OUTBREAK INVESTIGATION: MENTAL HEALTH IN THE TIME OF CORONAVIRUS (COVID-19)

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EDITORIAL
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Editorial: Outbreak Investigation: Mental Health in the Times of Coronavirus (COVID-19)

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Editorial on the Research Topic

Outbreak Investigation: Mental Health in the Times of Coronavirus (COVID-19)

Two years ago, on 20 January 2020, the World Health Organisation (WHO) declared the COVID-19 outbreak a public health emergency of international concern. At that time, it was unclear what lay ahead in terms of its impact on mental health of populations, although some lessons from previous epidemics and pandemics were already available. With all focus on physical survival, mental health was put on the back burner. However, concerns started building up rapidly. How would people without a history of mental health problems cope with the psychological fall-out from the COVID-19 pandemic? And how would those with already existing mental health problems cope? To monitor this unfolding mental health crisis, we embarked on our Research Topic on 3 April 2020. At that time, there were over one million COVID-19 cases recorded worldwide. The death toll had surpassed 50,000. Two years later, at the time of writing this editorial on 13 January 2022, there were over 300 million cases recorded world-wide. The death toll had surpassed 5.5 million people (1).

The recent Omicron variant has made it clear that COVID-19 is not going away. But this may not necessarily mean doom. The Omicron variant, albeit much more transmissible, seems much milder. Cases have surged globally, hospitalization and death rates have not. Preprint data from South Africa, where the Omicron variant was first reported, indicates 80% reduced odds for hospitalization and 70% reduced odds for severe disease (2). Still, due to the sheer numbers of infections, the death toll may rise. Concerns about hospital and intensive care capacities have led some countries to re-introduce lock-down measures. This has caused havoc in vulnerable industries, such as tourism and gastronomy. They had their hopes set on a strong rebound during the 2021 festive season, only to shut down again. However, even that situation is changing rapidly. The milder course of Omicron and a shorter incubation time [3 days (3)] suggest that self-isolation measures could be relaxed. On 27 December 2021, the US Centers for Disease Control and Prevention (CDC) shortened quarantine time from 10 to 5 days for people testing positive but asymptomatic (4). South Africa went even further, scrapping the need for isolation altogether in asymptomatic individuals. One day later though, after an intense flood of media, stakeholders and public enquiries, the new isolation and quarantine rules were recalled (5). Meanwhile, Germany discusses school closures (6).

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The most predictable thing about the pandemic in the new year is its utter unpredictability. Three factors may become game changers in 2022: vaccines, anti-COVID medicines and economic performance. Globally, more than 9 billion vaccine doses have been set (7), however, COVID-19 vaccine coverage remains patchy. In richer countries, anti-vax influencers, including conspiracy theorists, populists, and some vocal celebrities, continue to undermine the confidence in the vaccines, driving down vaccination rates. In poorer countries, vaccine supplies continue to be limited. Incomplete vaccination coverage, though, increases the likelihood of further mutations. Vaccine developers may not be able to keep up with the speed of mutations, unless they manage to predict mutations before they occur and decide to mass-produce vaccines based on their predictions. As with Omicron, future COVID-19 strains may turn out more transmissible but less virulent than previous ones. But this may not invariably be the case. For instance, a future mutation could cause the virus to replicate in people's airways at higher levels than the immune system could clear. This would also lengthen the time an infection persists (8). Antiviral medicines such as Paxlovid (nirmatrelvir tablets and ritonavir tablets, co-packaged for oral use) and Lagevrio (molnupiravir) may become the next movers in the equation. Approved for emergency use by the US Federal Drug Administration (FDA) on 22 and 23 December 2021 (9, 10), both medicines can be taken in the convenience of one's home. However, the tablets are not a substitute for vaccination (9). These anti-COVID medicines are expensive and most likely out of reach for many countries. Poorer countries may acquire supplies through donations and subsidies, often *ad hoc* and one-off. Under such circumstances, securing steady supplies may be economically unviable. Finally, how well the world fares in terms of mental health will depend on economic performance as well. Fiscal stimulus packages have been one way of taking people through the economic fallout of the pandemic. But fiscal stimuli together with labor and supply shortages have driven up inflation (11). Soaring energy prices add further inflationary pressure. Compensatory rises of interest rates may put pressure on indebted countries and households alike. The longer the pandemics persists, the more economies will become vulnerable. It is indeed difficult to predict where the world is heading in 2022. Much of the uncertainty we have experienced since the beginning of the pandemic will prevail. Other uncertainties will emerge. Uncertainty makes people anxious. Uncertainty that does not go away makes people depressed.

Mental health impact of pandemic can be seen as occurring due to anxiety, loneliness, and isolation but also grief due to loss of friends and family without likelihood of being able to attend funerals in early days and survivor guilt. Furthermore, long COVID brings with it certain mental health factors into play. Understanding and documenting the early impact of the COVID-19 pandemic on mental health can help us to manage the challenges lying ahead. Early experiences, frozen in time, provide a unique historical account of the unfolding pandemic. This Research Topic is an investigation into the early impact of the COVID-19 pandemic on mental health. It has covered nearly all aspects of mental health during the pandemic. Most of the studies came from China and Italy, two countries particularly hard-hit in the early days of the pandemic. Many of the studies published here were based on online surveys. The discussions of their strengths and limitations leave a vivid testimony of epidemiological research during the lockdown, replacing fieldwork on the ground with fieldwork in cyberspace.

Some findings were expected. Undoubtedly, the pandemic has precipitated psychological distress, trauma, anxiety and affected quality of life as depicted in several contributions in this collection (Akdeniz et al.; Bottaccioli et al.; Chen et al.; Cerami et al.; Ferreira dos Santos et al.; Ganesan et al.; Luo et al.; López Steinmetz et al.; Rondung et al.; Yan et al.). One study from Pakistan, however, did not find any increase of anxiety and obsession in the surveyed population. The authors speculated that might either be due to resilience or lack of understanding (Majeed et al.). It is also possible that in cultures where fatalism is a common response, people may deal with it in a different way. More research is on its way concerning the psychological impact of COVID-19 (Giallornardo et al.; Schimmenti et al.).

The evidence collated in this Research Topic also points toward a level of gender disparity. Men run a higher risk of an adverse clinical course and death of COVID-19 infection (12). But women seem to bear the psychological brunt of the pandemic (Dagnino et al.; Parlapani et al.; Rossi et al.; Thomas et al.; Torales et al.). Admittedly, women are more likely to participate in surveys. Thus, some selection bias may have been at play. Yet, this gender difference is not entirely unexpected. In many parts of the world, women carry a higher burden of caring for families. They tend to be more isolated and run a higher risk of economic hardship and insecure employment. Social and geographical isolation may promote intimate partner violence (Mojahed et al.). Alcohol use may rise during traumatic events, global disasters, and economic crisis, in part mediated by anxiety, depression and post-traumatic stress. Here, being male, young, or single may convey the highest risk (Gonçalves et al.). However, addiction was only covered in one contribution to this Research Topic, exploring gambling activity in Sweden. Rather unexpectedly, gambling activity declined during the first phase of the outbreak compared to a previous forecast (Lindner et al.).

Health care workers were another group of individuals identified to experience high levels of psychological distress at the beginning of the pandemic (Cao et al.; Liu et al.; Nguyen et al.; Zhang, Xie, et al.; Zhang, Wang, et al.). Unsurprisingly frontline medical staff may be most vulnerable (Zhang, Zhao, et al.). Professional self-identity, good psychological preparation, social support, and positive cognitions were protective (Mo et al.; Xie et al.). Two contributions gave examples of how support systems for hospital staff could work in practice (Geoffroy et al.; Rolling et al.). At the same time access to protection equipment including face masks proved essential to maintain psychological health (Lam et al.). The scarcity of protective equipment at the beginning of the pandemic is a testimony of unpreparedness of authorities all over the world for major disaster. For the individual health care worker, forced to work without protective equipment, this may have led to moral injury and subsequent post-traumatic stress. Moral injury has mainly been examined in the context of warfare and military service. It can present when there has been a betrayal of what is right, by someone who holds a legitimate authority, in a high-stake situation (13). But the beginnings of the pandemic did not only leave health care workers highly vulnerable. Patients, particularly when suffering from severe conditions such as cancer, may have been at an increased risk of post-traumatic stress, when resources were withdrawn and treatments were delayed (Bandinelli et al.; Cui et al.; Li et al.).

The beginnings of the pandemic may have been particularly difficult for people who already had mental health problems. As the focus on somatic health eclipsed mental health needs, people with mental health problems became less visible. Two studies in this Research Topic, describing a decreased use of psychiatric inpatient and emergency services in adults and adolescents, give testimony to this effect (Kim et al.; Díaz de Neira et al.). Patients, however, may have struggled in silence at home, as demonstrated by a interview studies of patients with eating disorders and obsessive compulsive disorders (McCombie et al.; Benatti et al.). Individuals with pre-existing mental health problems may also have run into more physical problems during the pandemic. A Swedish register study showed that the odds of COVID-19 associated death was double in people with psychotic or bipolar disorder (Maripuu et al.). Further work has shown that this increased mortality may not be specific to COVID-19; similarly increased odds arise with other lung infections (14). As judged by increased hospitalization rates (15), the higher mortality risk may be more likely linked to an increased risk of an adverse clinical course of a COVID-19 infection than to an increased risk of infection *per se*. Efforts to prioritize people with serious mental disorder for vaccination must continue.

Several observational studies in the Research Topic explored coping strategies. Positive thinking and reducing cognitive bias may be strategies worth trying (Baldacara et al.; Giusti et al.; Shudy et al.). Religiosity may also be protective (Saleem et al.). Physical exercise may reduce stress levels and build resilience (López-Bueno et al.; Bento Silva et al.; Van Der Feltz Cornelis et al.). Face masks seem to offer protection against COVID-19 infection, even if robust randomized controlled studies are still lacking (16, 17). Intriguingly, face masks may also have an impact on mental health. One study comparing the impact of face mask use in two countries showed that use of face mask was associated with less anxiety, depression, and stress (Wang et al.). Possibly, taking control by using a mask reduces feelings of stress, anxiety, and depression. Although this finding can at best be considered preliminary, it is still noteworthy. Finally, right from the beginning of the pandemic, there was a proliferation of COVID-19 related health apps, providing news and information, contact tracing, and self-assessment, or diagnosis (Zhang, Chow, et al.). Such apps may facilitate infection control and help to stay connected in periods of quarantine. However, there are caveats to the current "infodemic" (18). Civil liberties may become infringed when there is comprehensive control of movements. At the same time, a constant flow of information may increase stress, particularly in people who are intolerant to uncertainty. Besides, not all apps are equally reliable. They may be used to spread misinformation and conspiracy theories. The verdict is still out whether such apps do more harm than good. Virtual reality applications generating positive emotions to may take self-help to the next frontier. A randomized trial is planned to test whether such a virtual reality protocol can be used to improve wellbeing and preserve social connectedness through the beneficial social effects (Riva et al.).

The economic impact of the COVID-19 pandemic may play as much of an essential role as the infection itself in short, medium, and long-term. Strict lockdowns, implemented almost globally, have brought economic insecurity and poverty for many. Job and income loss, as well as the fear of it, add to anxiety and depression. A statistical modeling exercise based on longitudinal data from 38 countries showed that unemployment might increase suicide rates, particularly in middle-age. Loss of national income might even have a higher impact on suicide rates, particularly in the older age groups (Brenner and Bhugra). Currently, in many high-income countries, vaccination programmes are being implemented at an exponential rate. At the same time, our ability to effectively treat severe courses of COVID-19 infection has substantially improved. The subsequent reduction of mortality will invariably shift the focus to economic and social recovery, even if new outbreak waves and mutations lie ahead. Such may then precipitate further mental health problems in an already primed population. At present, it remains unclear whether the detrimental effect of COVID-19 on mental health is transitory or lasting. A global study estimated an additional 53.2 million cases of depression and an additional 76.2 million cases of anxiety due to COVID-19 for 2020 (19). But depending on data sources and circumstances, there is scope for over-reporting and observation bias. For instance, according to that study, Sweden should have experienced a 22–25% change in the prevalence of major depression after adjustment for COVID-19 (19). Data extrapolated from the Swedish Board for Health and Welfare suggest otherwise. Depression requiring specialist services and suicide rates have not gone up in 2020 (20). Prescribing for antidepressants has increased by little more than one percent (21). This is consistent with suicide trends observed in 21 countries or areas within a country during the beginning of the pandemic. Suicide numbers remained largely unchanged or even decreased in same countries or areas (22). However, it remains unclear whether these findings from high- and upper-middle-income countries can be generalized to lower-middle- and low-income countries.

The pandemic is not over yet. COVID-19 related mental health problems and their consequences are likely to be with us for a long time. Neither is the direct impact of long-term COVID-19 on mental health fully understood. Some survivors of COVID-19 are even at risk of psychiatric sequelae, which may either be caused by the virus itself or the immune response to it (23). Ultimately, it is early days. And it may not take another 100 years until the next pandemic. We hope that the lessons learnt in these early days of the COVID-19 pandemic and documented in this Research Topic can be used in preparation for the next one.

AUTHOR CONTRIBUTIONS

UW initially proposed and set up this Research Topic and led the editorial introduction. All authors acted as guest editors, managed the submissions, and worked collaboratively to decide which manuscripts were accepted or rejected. All authors contributed to the article and approved the submitted version.

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Psychological Support System for Hospital Workers During the Covid-19 Outbreak: Rapid Design and Implementation of the Covid-Psy Hotline

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Background: The worldwide coronavirus outbreak has put hospital workers under extreme stress with possible mental health problems. In this context, we decided to rapidly design and implement a psychological support system for all hospital workers in Paris during the Covid-19 outbreak.

Methods: We built a hotline in 3 days using the following steps: 1) official mandate, 2) request for the creation of hotline numbers, 3) formulation of psychological intervention materials and policies, 4) call for volunteer certified psychologists, 5) call for volunteer certified psychiatrists in case of psychiatric cases, 6) creation of an anonymous and protected database, and 7) communication and regular reminders about the existence of the hotline for hospital workers.

Results: After the first 26 days, we received 149 calls with a mean of 5.73 calls/day (SD=3.22). The average call duration was 18.5 min (min=1; max=65min; SD=14.7), and mostly women (86%) called. The mean age was 32.7 years old (SD=11.0). Calls from hospital workers were from all professions; though mostly represented by frontline healthcare workers, non-frontline departments also called (total of 44 departments). Reasons for calling were anxiety symptoms (n=73, 49%), request for hotline information (n=31, 20.8%), worries about Covid-19 (n=23, 15.44%), exhaustion (n=17, 11.41%), trauma reactivation (n=10, 6.11%), insomnia (n=9, 6.0%), anger (n=8, 5.37%), depressive (n=6, 4.02%), and psychotic symptoms (n=3, 2.01%). Regarding referrals, 105 (70.47%) of them were referred to psychosocial, Covid, and general support.

Conclusions: This psychological support system can be easily duplicated and seems to benefit all hospital professions that all appeared psychologically affected.

Keywords: healthcare workers, medical workers, psychological intervention, mental health, psychiatry, psychology

INTRODUCTION

The worldwide coronavirus outbreak of pneumonia emerged in December 2019 in Wuhan in the Hubei province of China (1). In January 2020, Chinese scientists isolated a novel coronavirus with the rapid development of RT-PCR diagnostic tests specific for this 2019 novel coronavirus (2019-nCoV; also more commonly named Covid-19) (1). Acute respiratory distress syndrome may occur for 42% of patients with Covid-19 with a mortality rate above 50% for those patients (2). France had the first individuals affected by January 24 and, to date, ranks seventh in terms of the number of confirmed cases of Covid-19 infection. A nationwide lockdown began on March 17 and was extended until May 11 to better contain the spread of the Covid-19 and help overwhelmed hospitals (3). This unprecedented situation has put healthcare workers under extreme stress with possible moral injuries or mental health problems (4). It very quickly became clear that we needed to develop a psychological support system for hospital workers, and this was requested by the direction of the Assistance Publique – Hôpitaux de Paris (AP-HP).

Indeed, experiences from China were that healthcare workers in Wuhan have been facing enormous pressure and overwork, thus leading to mental health problems, including stress, anxiety, depressive symptoms, insomnia, denial, anger, and fear (5). The observations of Chinese colleagues were that mental health problems affected both the professional functioning and overall well-being of healthcare workers (5). In addition, first observations also reported that frontline medical workers may present with vicarious traumatization (negative transformation in the helper with psychological abnormalities that are derived from sympathy for survivors of a trauma, which causes serious physical and mental distress—even mental breakdown), and there is an increased risk for non-frontline hospital workers (6). In a very recent cross-sectional survey in 1,257 healthcare workers, up to 71.5% of them reported distress, 50.4% symptoms of depression, 44.6% anxiety, and 34% insomnia (7). In this context, in order to prevent or early intervene in case of mental health problems, we decided to rapidly design and implement a psychological support system for all hospital workers during the Covid-19 outbreak in Paris. This paper aims to 1) present the methods for implementing such psychosocial support system we called the Covid-Psy hotline and 2) characterize first calls and reasons for the call.

METHODS

Implementing the Hotline

Table 1 summarizes the different steps for developing a psychosocial support system for healthcare workers.

These steps have been made in only three days, the hotline being opened and active the third day. The first step was to get an official mandate, which was granted from the direction of the Assistance Publique – Hôpitaux de Paris (AP-HP) who mandated ML to propose an anonymous and psychological support for all its workers, 24/7. This step was a major one because it guarantees the feasibility of the project, its successful promotion, and its unifying dimension. The second step was the creation of hotline numbers with possible transfer to psychologists' personal mobile phones. According to our experience, this step should be launched as soon as possible since it may take some time due to technical resources. In addition, we decided to ask for three numbers to be in capacity to respond to all calls (and so up to three calls at the same moment). The third step was the formulation of the psychological intervention materials and policies, which include a list with numbers and addresses of possible psychological and psychiatric referral locations. The fourth step was a call for certified psychologists to volunteer help on this hotline. VLG, who was the coordinating psychologist, created a list of volunteers with personal contact details and a messaging group to facilitate communications between volunteers. The fifth step was carried out by ML: certified psychiatrists were called upon to volunteer in case of psychiatric cases, and a list of volunteers and their personal contact details was created. Then, for the sixth step, PAG created an anonymous and protected database in order to be able to improve and assess the support (such as the change for 2 work schedules, 8am–7pm and 7pm–8am, to 3 work schedules, 8am–2pm, 2pm–8pm, and 8pm–8am; pairing during each work schedule except at night, as few calls have been made so far at night). The project was also submitted to the Research Ethics Board of our hospital. The last step is a large communication about this hotline (emails, posters, newsletters, Twitter, Facebook, etc.) and regular reminders of the existence of the hotline for hospital workers (and not only healthcare professionals since more indirect professionals are also dealing with difficulties).

TABLE 1 | Rapid design and implementation of a psychosocial support system for healthcare workers: Steps for implementing the Covid-Psy hotline in 3 days.

Step 1	Official mandate from the authorities to lead and develop the project (an essential step for its successful promotion and unifying dimension).
Step 2	Request for the creation of hotline numbers with possible transfer to psychologists' personal mobile phones (this step may take some time and may need several lines to be provided).
Step 3	Formulation of psychological intervention materials and policies (including a list with numbers and addresses of possible psychological and psychiatric referral locations)
Step 4	Call for volunteer certified psychologists to help on this hotline (creation of a list of volunteers with personal contact details, and a messaging group to facilitate communications between volunteers)
Step 5	Call for volunteer certified psychiatrists in case of psychiatric cases (creation of a list of volunteers with personal contact details)
Step 6	Creation of an anonymous and protected database (in order to be able to improve and evolve the support)
Step 7	Communication and regular reminders of the existence about the hotline for hospital workers

Interventions

Briefly, the psychological assistance hotline team was composed of certified psychologist volunteers. VLG was responsible for formulating psychological intervention materials and policies (guidelines for the intervention, hotline organization and technical functioning, and lists of volunteers and referrals). VLG certified volunteers through a 30-min session by phone on brief crisis intervention with rapid assessment and crisis resolution or referrals (see the types of assistance provided below). No specific crisis intervention models or algorithms were used (8). At the same time, to provide a secure base for this internal AP-HP teams, OS has built up a reserve of volunteer clinicians who can be mobilized. Psychologists can consult with a psychiatrist (ML or PG) to discuss the cases and then call the original caller back to propose a referral or to organize a further meeting or call with the psychiatrist. ML and PG provided supervision for situations requiring a psychiatric opinion. A case discussion was proposed twice a week by external psychologists.

The types of assistance provided by the hotline:

- The reason for the call expressed by the hospital worker for an average of about 20 minutes
- Identification of symptoms
- Proposal of responses according to guidelines and to symptoms identified:
• Short individual response, if sufficient, without particular referrals
• Referral to other psychosocial supports, including cognitive behavioral therapies or psychotherapies more focused on trauma
• Referral to medical specialized additional expertise, including psychiatric consultation

First-Line Intervention

First-line volunteers were certified psychologists from university hospitals at AP-HP with expansion of this recruitment on March 23 to external psychologists to reinforce the team, which now consists of about 30 volunteers. VG provided full-time work for three weeks to coordinate the hotline, and they were assisted by a colleague (GD) on a part-time basis. Over the following weeks, VG dedicated 80% of her time to assure the current functioning and to manage the technical problems. The extended list of 30 voluntary psychologists allowed the maintenance of their current clinical activities.

Second-Line Intervention

Second-line interventions available according to situation and as called by the volunteer include

- Possible call to the psychiatrist working 24/7 in each emergency room of each AP-HP hospitals
- A specialized trauma telephone platform at the Hôtel-Dieu (Help-line) available 9:30am–6 pm from Monday to Friday
- Links with the medical-psychological emergency cells (CUMP, Plan Blanc Psy, Dr Abgrall)
- Orientation towards other local psychological support
- Occupational health and safety department at each of the AP-HP sites with possible Covid-19 screening on appointments
- Infectious Disease department in case of a question directly related to the Covid involving a "medical" answer not provided by psychiatrists

Backup of Psychologists and Psychiatrists Includes

- Backup team made up of volunteer psychologists and psychiatrists in case of increased need

Data

The following data are collected and entered online or offline, using a predefined scoring grid to simplify statistical analysis, on an Excel file on a secure AP-HP workstation:

- Date of the call
- Gender
- Age
- Hospital
- Service
- Profession
- Call time
- Call duration
- Reasons for the call
- Psychiatric history
- Orientation
- Free text to detail the problem/concern

The Data Protection and Security Compliance Diagnostic Report was made by the AP-HP Data Protection Office under number BPD2018DIA008.

Population

This psychological support was accessible for all hospital workers (healthcare and non-healthcare workers) from the Assistance Publique – Hôpitaux de Paris (AP-HP), which is a regional group of 39 hospitals in Ile de France, France. The 39 hospitals are organized and united in six university hospital groups, as detailed in **Figure S1**. AP-HP employs more than 100,000 professionals, including nearly 1,300 doctors, 3,600 residents, and more than 52,000 nursing, paramedical, and socio-educational staff.

Statistics

Descriptive analyses were made using Excel and an R software package provided by the R Foundation for Statistical Computing. Qualitative variables were expressed as frequencies and percentages. Quantitative variables were expressed as means and standard deviation (SD) with min and max values.

RESULTS

Hotline Activity

After the first 26 days of the hotline activity, we received 149 calls. **Figure 1** summarizes the distribution of calls per day, showing a large variability of calls number per day ranging from minimum 1 to maximum 15 calls per day with a mean of 5.73 calls/day (SD=3.22).

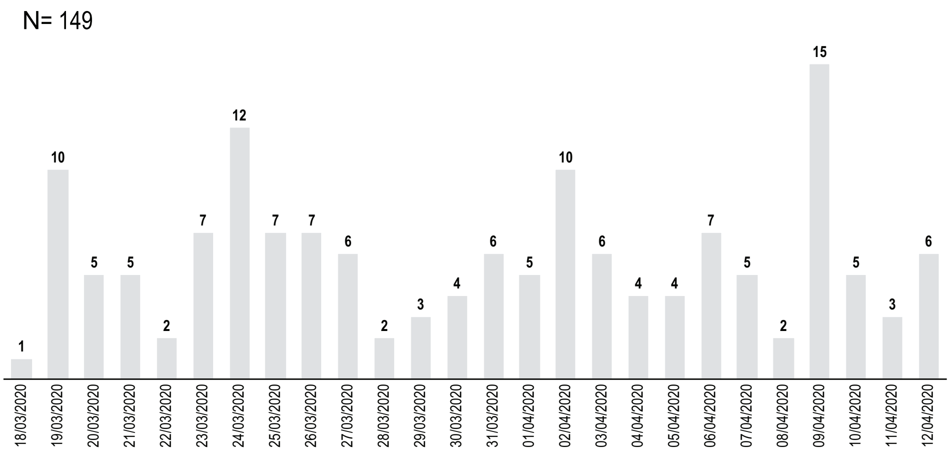

FIGURE 1 | Distribution of the daily calls [in number of calls] to the hotline Covid-Psy for a total of 149 calls in 26 days.

The average duration of a call to the hotline was 18.5 min (min=1; max=65min; SD=14.7). Calls were mainly during the morning (between 8am until 2pm) with 85 calls (57%), then during the afternoon (2pm-8pm) with 49 calls (33%), and lastly during the night (8pm-8am) with 15 (10%) of calls (**Figure 2**).

Population

Mostly women (86%) called the hotline. The mean age of callers was 32.7 years old (min=19; max=56min; SD=11.0).

Hospital workers calling were from all professions, including mostly registered nurses (n=25; 19%), personal support workers (PSW) (n=15; 11%), nursing students (n=14; 11%); psychologists (n=13; 10%), residents (n=10; 8%), senior doctors (n=8; 6%), head-nurses (n=7; 5%), Lab, X-Ray, or Information technology (n=6; 5%), senior head-nurses (n=3; 2%), administrative staff (n=3; 2%), communications (n=3; 2%), psychiatrists (n=3; 2%), and administrative officers (n=3; 2%). All professions are reported in **Figure 3**.

The analysis of the different departments who called the Covid-Psy hotline showed that 44 different hospital departments called the hotline Covid-Psy, highlighting that the most exposed and frontline departments called the most: emergency room (8% of total calls), nursing school (7%), intensive care units and Covid specialized units (6%), and the Infectious Disease department (6%). Interestingly, numerous

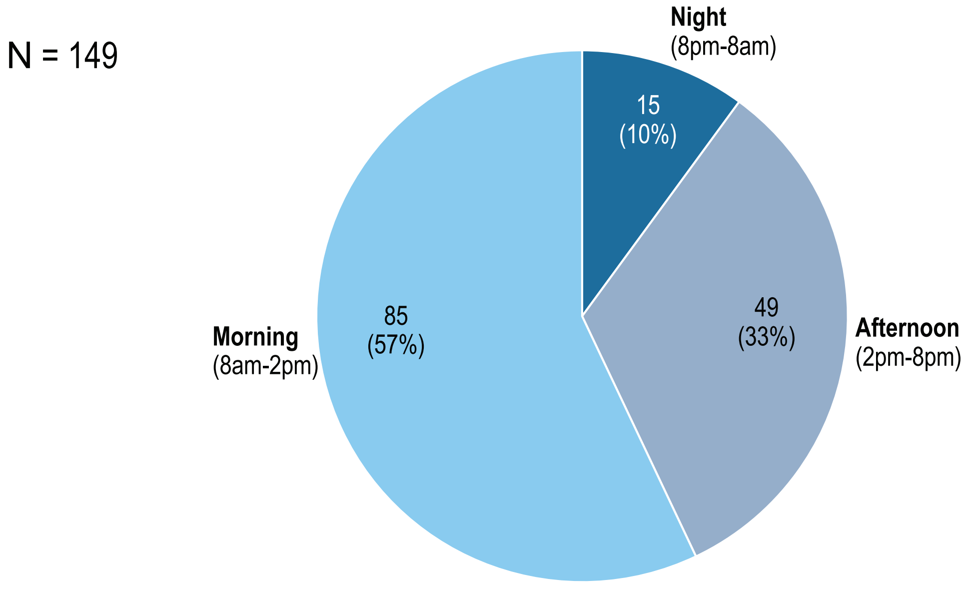

FIGURE 2 | Hours of call to the Covid-Psy hotline [number of calls and %].

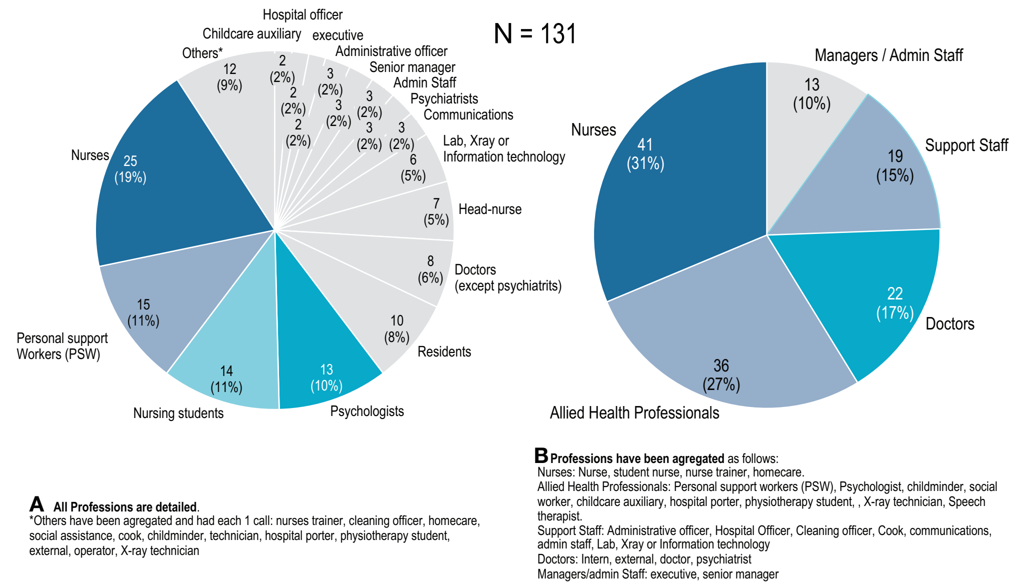

FIGURE 3 | Hospital professions calling to the hotline Covid-Psy [number of professions].

other non front-line departments appeared affected, including non-health-care workers, as summarized in **Table 2**. All hospitals from the AP-HP called the hotline, and dates are summarized in **Figure S1**.

Reasons for the Call

Anxiety symptoms were the first cause for hospital workers to call the hotline and affected 73 (49%) of them. Other reasons were requests for hotline information (n=31, 20.8%), worries about Covid-19 (n=23, 15.44%), exhaustion (n=17, 11.41%), trauma reactivation (n=10, 6.11%), insomnia (n=9, 6.0%), anger (n=8, 5.37%), depressive symptoms (n=6, 4.02%), and psychotic symptoms (n=3, 2.01%). **Figure 4** summarizes occurrences of all different reasons for calling the hotline Covid-Psy.

TABLE 2 | Hospital departments calling the hotline Covid-Psy [number of call and % of calls].

Hospital departments (N= 44)	Number of calls (N=100) (per department)	% of total calls
Emergency Room	8	8
Nursing school	7	7
intensive care units, Covid specialized units	6	6
Infectious disease department, Rehab, support services	5	5
Community doctors	4	4
Surgery, Geriatrics, Hepato-gastro, Cardiology, Presse department	3	3
Maternity, Radiology, Functional exploration, Outpatient care, Occupational health and safety department, Anesthesia, Oncology, Hematology, Administrative office	2	2
Lab, Addictions, Internal Medicine, Biochemistry, Physical medicine, Union Service, Neonatology, Crib, Nephrology, Finance department, Neurology, Immunology, Oto-rhino laryngology, Urology, Orthopedics, Operating, Pneumology, Kitchen, Back-up department, Staff service, Admissions	1	1

Referrals

Regarding referrals proposed to hospital workers who called the hotline (**Figure 5**), 105 (70.47%) of them were referred to psychosocial, Covid, and general support. Among them, 29.5% (31/105) were referred to a psychologist or psychiatrist, 16.2% (17/105) were referred to the psychiatry helpline, 13.3% (14/105) preferred calling the hotline back, 6.6% (7/105) were referred to an external/city psychiatrist, 6.6% (7/105) had their child referred to a child psychiatrist, and 2.9% (3/105) were referred to a social worker.

Regarding referrals to specialized Covid units, 12.4% (13/105) were referred to the Hygiene and Nosocomial Infections Unit, 9.5% (10/105) to the infectious department, and 12.4% (13/105) to the Call Center Information for Covid-19 (**Figure 5**).

Regarding referrals to hospital and general services, 12.4% (13/105) were referred to the occupational medicine, 4.8% (5/105) to the administrative office, and 4.8% (5/105) to a general practitioner (**Figure 5**).

DISCUSSION

At present, this is the first report of a psychological hotline design and implementation for the stress induced by the

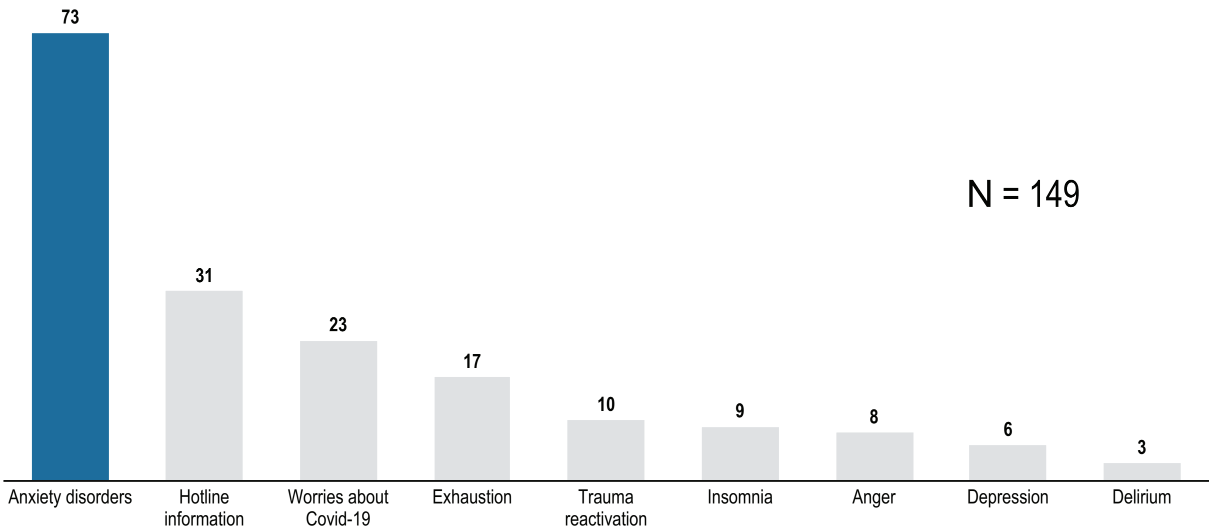

FIGURE 4 | Occurrences of the reason for calling the hotline Covid-Psy [number].

Covid-19, which can be replicated in only 3 days in other hospitals and countries. We found that all hospital professions and departments have workers who are experiencing psychological distress. We were surprised by the numerous non-frontline workers that were affected, leading us to intervene directly in these departments, including admissions, mortuary, informatics, radiology, hospital porter, technical, mail service, etc. Of note, we found a high prevalence of new psychiatric symptoms manifesting in hospital workers during this Covid-19 outbreak, which could have been underestimated because of the absence of standardized evaluation. This explains the high numbers of referrals, especially regarding psychosocial supports.

The stress reported by callers might be summarize in three main dimensions with 1) the "direct Covid-19 stress"—stress of being contaminated, of dying, and of contaminating loved ones;

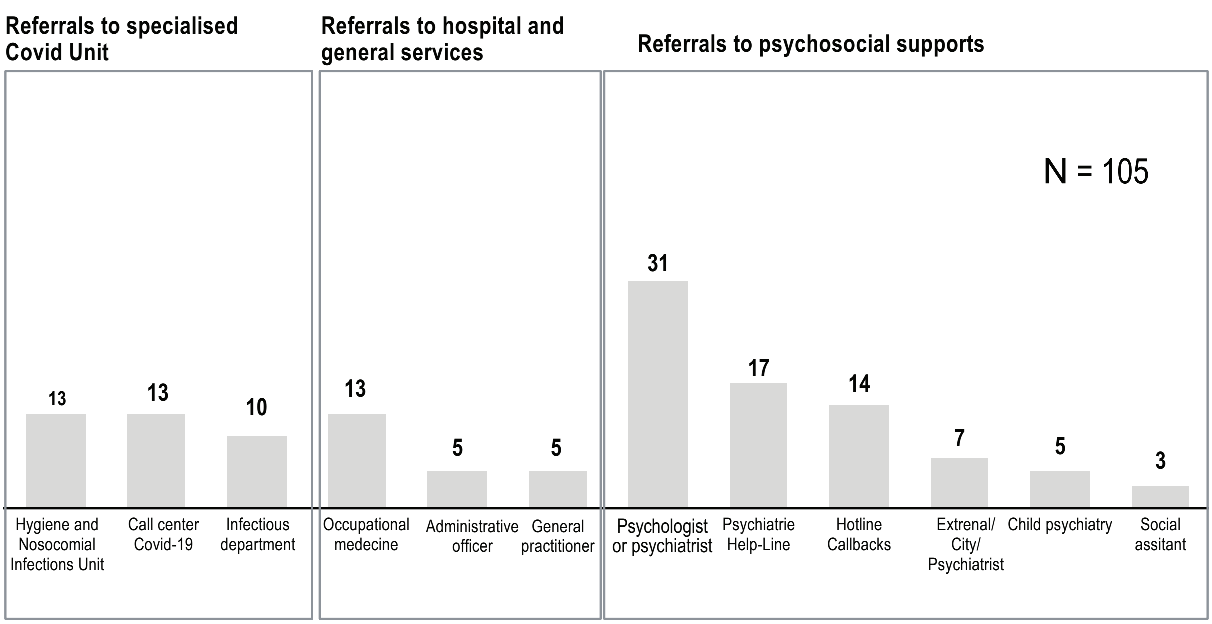

FIGURE 5 | Referrals for hospital workers calling the Covid-Psy hotline [number of referrals].

2) the "social stress"—numerous hospital workers met difficulties at home feeling either isolated, poorly understood, or suffering from intra-family tensions; and 3) the "work-related stress"—with numerous changes at work, loss of routines, and new procedures and materials. These psychological and occupational impacts are similar to those observed during the 2003 SARS Outbreak (9–11), and their understanding is important in planning for future outbreaks of emerging infectious diseases.

A post-hoc examination of the free text emphasized that profiles of calls changed over time with mostly mild symptoms at the beginning, such as anxiety, "stress," and worries about the Covid-19; the last week, we noticed an increase of more severe problems, such as anxiety and depressive symptoms, sleep disorders, exhaustion (or "burn-out"), and psychosis. We also observed an increase in reactivations of previous traumas. We also noted the marked fragility and difficulties of the new healthcare workers who arrived as reinforcements to already constituted teams. Difficulties met were the reorganization of care habits, the unfamiliarity of the department's functioning, the lack of training/information, and the social isolation, all this in spite of the welcoming the reinforcements received by the constituted team and the acquisition of new equipment.

This psychological support is complementary to other supports we have detailed in the methods and as observed in the referrals. As in Wuhan (5), hospitals in Paris benefited also from local psychological intervention teams with psychologists (face-to-face meetings and on-site outreach mobile team the week-end) and the psychiatry team, who are mainly psychiatrists, participating in clinical psychological intervention for healthcare workers and patients in the hospital. Lastly, other psychological assistance hotline teams exist, such as the specialized trauma telephone platform at the Hôtel-Dieu (Help-line), and this allowed to propose a complete and complementary support to hospital workers.

Some limitations should be acknowledged. Because the main objective of this hotline was the provision of anonymous psychological support with brief interventions, we have no feedback on caller satisfaction or the follow-up for the referrals. Moreover, it was not possible to estimate the prevalence of these disorders since other possible local supports may exist, and there were no questions made to the caller as to whether they had tried to reach their own local support team. In addition, the hotline cannot make a formal diagnosis. Finally, we should be aware of the opportunity cost of using staff working in other areas to set up the psychological support, which could be limited by recruiting many volunteers.

CONCLUSION

This psychological support system was rapidly designed and implemented in 3 days and can thus be easily duplicated. It seems to benefit to all hospital professions that all appeared psychologically affected. Significant psychological repercussions included psychiatric disorders like trauma reactivation, anxiety, depressive, insomnia, and psychotic symptoms. Mandatory factors for the implementation of the hotline include a clear mandate, the adequate and appropriate human resources (volunteers), a functional technology platform, ensuring anonymity, as well as a clear communication plan (sending regular reminders about the 24/7 hotline). Finally, these observations emphasize the need for Health Authorities to be informed of the psychological impact of a pandemic on the welfare of their employees and their workplace performance in order to offer the psychological support and the help needed.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by CEERB Paris Nord. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

PG, VG, and ML designed the study. VG coordinated the hotline and was responsible for formulating psychological intervention materials and rules. ML and PG provided supervision for situations requiring a psychiatric opinion. PG wrote the first draft of the manuscript. PG, VG, and OS made the statistics and figures. PG made the table. PG, VG, OS, CR, AW, GD, and ML participated in the writing and approved the submitted version of the work.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2020.00511/full#supplementary-material

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frontiers in Psychiatry

STUDY PROTOCOL
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The Impact of Quarantine and Physical Distancing Following COVID-19 on Mental Health: Study Protocol of a Multicentric Italian Population Trial

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The COVID-19 pandemic and its related containment measures—mainly physical distancing and isolation—are having detrimental consequences on the mental health of the general population worldwide. In particular, frustration, loneliness, and worries about the future are common reactions and represent well-known risk factors for several mental disorders, including anxiety, affective, and post-traumatic stress disorders. The vast majority of available studies have been conducted in China, where the pandemic started. Italy has been severely hit by the pandemic, and the socio-cultural context is completely different from Eastern countries. Therefore, there is the need for methodologically rigorous studies aiming to evaluate the impact of COVID-19 and quarantine measures on the mental health of the Italian population. In fact, our results will help us to develop appropriate interventions for managing the psychosocial consequences of pandemic. The "COVID-IT-mental health trial" is a no-profit, not-funded, national, multicentric, cross-sectional population-based trial which has the following aims: a) to evaluate the impact of COVID-19 pandemic and its containment measures on mental health of the Italian population; b) to identify the main areas to be targeted by supportive long-term interventions for the different categories of people exposed to the pandemic. Data will be collected through a web-platform using validated assessment tools. Participants will be subdivided into four groups: a) Group 1

—COVID-19 quarantine group. This group includes the general population which are quarantined but not isolated, i.e., those not directly exposed to contagion nor in contact with COVID-19+ individuals; b) Group 2—COVID-19+ group, which includes isolated people directly/indirectly exposed to the virus; c) Group 3—COVID-19 healthcare staff group, which includes first- and second-line healthcare professionals; d) Group 4—COVID-19 mental health, which includes users of mental health services and all those who had already been diagnosed with a mental disorder. Mental health services worldwide are not prepared yet to manage the short- and long-term consequences of the pandemic. It is necessary to have a clear picture of the impact that this new stressor will have on mental health and well-being in order to develop and disseminate appropriate interventions for the general population and for the other at-risk groups.

Keywords: pandemic, global mental health, post-traumatic stress disorder, burn-out, anxiety, depression, resilience

BACKGROUND

The ongoing COVID-19 pandemic represents an unprecedented event in terms of consequences for physical and mental health of individuals and for the society at large (1–4). In order to reduce the spread of the virus, national and international bodies and institutions have ordered quarantine, physical distancing, and isolation almost everywhere in the world. However, the psychological consequences of quarantine, such as frustration, loneliness, and worries about the future are well-known risk factors for several mental disorders, including anxiety, affective disorders, and psychoses (5–7).

From a medical and sociological viewpoint, the pandemic caused by COVID-19 represents a unique event, since it does not resemble any other previous traumatic event, such as earthquakes or tsunamis (8). In those cases, the traumatic factors are usually limited to a specific area and to a given time; affected people know that they can "escape" from the event. On the contrary, in the case of COVID-19 pandemic, the "threat" can be everywhere and can be carried by every person next to us (9–11). Therefore, people living in cities most severely impacted by the pandemic are experiencing extremely high levels of uncertainties, worries about the future and fear of being infected.

The only comparable studies are those carried out during the SARS outbreak (12–16). Those studies showed that people experienced fear of falling sick or dying, feelings of helplessness, increased levels of self-blame, fear, and depression (17–20). During quarantine and physical distancing, Internet and the social media can be useful in reducing isolation and increasing opportunities to keep in contact with family members, friends, and co-workers at any time (21, 22). However, Internet may also represent a risk factor for mental disorders, in particular Internet Gaming Disorder. Moreover, Internet can also have a negative impact on mental health of the most vulnerable people, such as those who live alone or the elderly, since it spreads an uncontrolled amount of information (a situation known as "infodemic").

In the current pandemic, the impact of quarantine and physical distancing on the mental health of the general population has been explored only in a few studies, mostly conducted in China, where the pandemic started (23–25). Qiu et al. (26) found that 35% of the population experienced psychological distress; in particular, those more vulnerable to stress and more likely to develop post-traumatic stress disorder were women and individuals aged between 18 and 30 years or older than 60 years. Moreover, people were more concerned about their own health and that of their family members, while less concerned about leisure activities and relationships with friends (24, 27).

After China, Italy has been the first country to face the contagion of COVID-19 and one of the countries with the highest number of deaths due to this coronavirus (http://www.salute.gov.it/portale/nuovocoronavirus/). On March 8, the lockdown status has been declared by the Italian government. This status included the definition of specific containment and quarantine measures, such as the interdiction of all public meetings and strict movement restrictions (i.e., possibility to go out only for working, serious health reasons, or other urgent needs). These containment measures have been prolonged until May 4.

Moreover, the expected psychosocial and emotional reactions to the pandemic observed in the general population may be significantly different in the Chinese and Italian populations due to their socio-cultural characteristics and historical contexts, which obviously impact on people's behaviors and attitudes. Furthermore, the organization of public health system is different in Italy compared to China and other Eastern Asian countries, also due to financial constraints. In fact, although in those countries the model of care has shifted in the last 20 years to become more similar to a Western model of care, it has to be acknowledged that 20 years is a relatively short period of time, and differences may still persist.

Methodologically rigorous studies are needed in order to evaluate the impact of COVID-19 and quarantine measures on the mental health of Italian population. These data will help us to develop appropriate interventions for managing the psychosocial consequences of the pandemic (28–30). The present study has been developed with the aims to: a) evaluate the impact of COVID-19 pandemic and its containment measures on mental health of the Italian population; b) to identify the main areas to be targeted by supportive long-term interventions for the different categories of people exposed to the pandemic.

METHODS

Design

The "COVID-IT-mental health trial" is a no-profit, not-funded, national, multicentric, cross-sectional population-based trial involving the following eleven sites: University of Campania "Luigi Vanvitelli" (Naples), Università Politecnica delle Marche (Ancona), Università Milano Bicocca, Università "Statale" (Milan), University of Perugia, University of Pisa, Sapienza University of Rome, "Cattolica" University of Rome, University of Trieste, University of Ferrara; the Center for Behavioral Sciences and Mental Health of the Istituto Superiore di Sanità (Rome). The Department of Psychiatry of the University of Campania "Luigi Vanvitelli" in Naples is the coordinating center, which has originally conceived the study idea and design.

Data Collection

Recruitment Procedure

An online survey has been set up through EUSurvey, a web platform launched in 2013 by the European Commission. The application, hosted at the Department for digital services (DG DIGIT) of the European Commission, is available to all EU citizens at https://ec.europa.eu/eusurvey. The survey will be online from March 30 to June 30, 2020 (https://ec.europa.eu/eusurvey/runner/COVIDSurvey2020). The survey takes approximately 15–30 min to be completed. Participants can stop the survey at any time and save their answers as "draft" on the web-platform. Furthermore, participants can interact with the principal investigator of the study and with all researchers through email messages at any time during and after study participation.

Participants will be subdivided into four groups: a) Group 1—COVID-19 quarantine group. This group includes the general population which are quarantined but not isolated, i.e., those not directly exposed to contagion nor in contact with COVID-19+ individuals; b) Group 2—COVID-19+ group, which includes isolated people directly/indirectly exposed to the virus; c) Group 3—COVID-19 healthcare staff group, which includes first- and second-line healthcare professionals; d) Group 4—COVID-19 mental health, which includes users of mental health services and all those who had already been diagnosed with a mental disorder.

The survey addresses the Italian population aged over 18 years through a multistep procedure: 1) email invitation to health professionals and their patients; 2) dissemination of the link through social media channels (Facebook, Twitter, Instagram) and the mailing lists of national psychiatric associations; 3) involvement of national associations of stakeholders (e.g., associations of users/carers); 4) official communication channels (e.g., university websites; websites of the hospitals directly involved in the management of the pandemic).

The invitation letter includes information on study purposes and confidentiality. The provision of the informed consent is mandatory in order to start the survey.

The snowball sampling procedure—without the definition of strict inclusion/exclusion criteria (except that of age limit)—will give us the opportunity to recruit a large sample of the Italian population and to evaluate the effect of the studied variables on the outcome measures.

Assessment Instruments

The survey includes the following self-reported questionnaires: the General Health Questionnaire - 12 items (GHQ-12) (31); the Depression, Anxiety and Stress Scale - 21 Items (DASS-21) (32); the Obsessive-Compulsive Inventory – Revised (OCI-R) (33); the Insomnia Severity Index (34); the Severity-of-Acute-Stress-Symptoms-Adult (35); the Suicidal Ideation Attributes Scale (SIDAS) (36); the Impact of Event Scale - 6 items (37); the UCLA loneliness scale - short version (38); the Brief COPE (39); the Post Traumatic Growth Inventory short form (40); the Connor-Davidson Resilience Scale – short form (41); the Multidimensional Scale of Perceived social support (42); the Pattern of Care Schedule (PCS)—modified version (43); the Maslach Burnout Inventory (only for health professionals) (44). Respondents' main socio-demographic characteristics, as well as data on their Internet use, will be collected through an *ad hoc* schedule. All assessment instruments used for the study are detailed in **Table 1**.

Outcomes

Primary Outcome

The primary outcome of the study is the global score at the DASS-21. This choice is due to the fact that this assessment measure has already been used in a large population study carried out in China, thus giving us the opportunity to compare the Italian situation with the Chinese one (45). Our study hypothesis is that the pandemic and the related containment measures are associated with higher levels of depressive and anxiety symptoms in the surveyed population compared to a community Italian sample not exposed to the pandemic (46). Furthermore, a significant difference between groups will be identified (COVID-19 quarantine group = COVID-19 healthcare professional second-line < COVID-19+ group = COVID-19 healthcare professional first-line group < COVID-19 mental health group).

Secondary Outcomes

In the COVID-19 quarantined group, the severity of obsessive-compulsive symptoms, evaluated through the OCI-R, the perceived loneliness and suicidal ideation will be considered as secondary outcome measures.

In the COVID-19+ patient group, the severity of post-traumatic symptoms at the Severity-of-Acute-Stress-Symptoms-Adult scale will be considered. The hypothesis is that post-traumatic symptoms are more severe in this group compared to the other ones.

In the COVID-19 health staff group, the presence of burn-out symptoms, in particular mental exhaustion, and suicidal ideation

TABLE 1 | Assessment tools used in the survey.

Assessment tool	Acronym	N. items	Description
General Health Questionnaire-12	GHQ-12	12	Each item assesses the severity of a mental problem on a 4-level Likert scale. The total score ranges from 0 to 36, with higher scores indicating worse conditions.
Depression, Anxiety and Stress Scale - 21	DASS-21	21	It consists of three subscales. The depression subscale assesses dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest/ involvement, anhedonia, and inertia. The anxiety scale assesses autonomic arousal, skeletal muscle effects, situational anxiety, and subjective experience of anxious affect. The stress scale assesses difficulty in relaxing, nervous arousal, and being easily upset/agitated, irritable/over-reactive and impatient.
Obsessive-Compulsive Inventory – Revised	OCI-R	18	Each item assesses the severity of obsession or compulsion on a 5-level Likert scale. The total score range from 0 to 72, with higher scores indicating worse conditions.
Insomnia Severity Index	ISI	7	Each item assesses the nature, severity, and impact of insomnia on a 5-level Likert scale. The aspects evaluated includes sleep onset, sleep maintenance, and early morning awakening problems, sleep dissatisfaction, interference of sleep difficulties with daytime functioning, noticeability of sleep problems by others, and distress caused by the sleep difficulties. The total score ranges from 0 to 28.
Severity-of-Acute-Stress-Symptoms-Adult	SASS	9	It assesses the severity of post-traumatic stress disorder in adult individuals. Each item assesses the severity of post-traumatic symptoms during the past seven days.
Suicidal Ideation Attributes Scale	SIDAS	5	It assesses all the attributes of suicidal thoughts: frequency, controllability, closeness to attempt, level of distress associated with the thoughts, and impact on daily functioning. Each item is assessed on 10-level Likert scale. When the score at the first item is zero, the remaining items are not compiled.
Impact of Event Scale-6	IES-6	6	It assesses the impact of the traumatic event, including three subscales that describe the three major symptoms of posttraumatic stress: intrusion, avoidance, and hyperarousal.
UCLA loneliness scale - short version	UCLA	8	It is an 8-item scale designed to measure one's subjective feelings of loneliness as well as feelings of social isolation.
Brief Coping Orientation to Problems Experienced	Brief-COPE	28	It includes 14 subscales designed for measuring effective and ineffective ways to cope with a stressful life event. The subscales include: self-distraction, active coping, denial, substance use, use of emotional support, use of instrumental support, behavioral disengagement, venting, positive reframing, planning, humor, acceptance, religion, and self-blame.
Post Traumatic Growth Inventory- short form	PTGI	10	It evaluates the construct of post-traumatic growth on a 6-level Likert scale.
Connor-Davidson Resilience Scale – short form	CD-RISC	10	It evaluates the levels of resilience and it includes the following five factors: personal competence, high standards, and tenacity; trust in one's instincts, tolerance of negative affect, and strengthening effects of stress; positive acceptance of change and secure relationships; control; spiritual influences. Each item is rated on a 6-level Likert scale.
Multidimensional Scale of Perceived Social Support	MSPSS	12	It evaluates the levels of perceived adequacy of social support from the family, friends, and significant others on a 5-level Likert scale
Pattern of Care Schedule - modified version	PCS	20	It is an *ad hoc* schedule evaluating the pharmacological and nonpharmacological treatments received by participants
Maslach Burnout Inventory (only for healthcare professionals)	MBI	22	It evaluates the three dimensions of burnout: emotional exhaustion, depersonalization, and personal accomplishment

will be considered. We anticipate that first-line professionals will report higher levels of mental exhaustion and suicidal ideation compared to second-lines staff members.

In the COVID-19 mental health group, the secondary outcome measures will include the adoption of maladaptive coping strategies (e.g., drinking alcohol) and a poor resilience style. Patients with pre-existing mental disorders are expected to adopt more maladaptive coping strategies and poorer resilience styles compared to the other three groups.

Exploratory Outcomes

The use of Internet and social media will be tested as possible moderator of the impact of pandemic and quarantine (**Figure 1**). Moreover, the exposure time to COVID-19 and to the related containment measures will be tested as possible mediators of the severity of the clinical symptomatology. Finally, the other exploratory outcomes will include the variety of coping strategies and resilience styles as well as the different levels of post-traumatic growth.

Data Analysis

Statistical analyses will be conducted according to a multistep plan. Missing data will be handled using the multiple imputation approach (47). Descriptive statistics will be calculated for the dependent and confounding variables. A bilateral alpha of 0.05 is considered, and error and confidence intervals are calculated at 95%.

The analytic plan will include: 1) data cleaning of the online dataset and replacement of missing values; 2) descriptive statistics of the general characteristics of the recruited sample, in terms of levels of depressive and anxiety symptoms, post-traumatic and stress-related symptoms, insomnia, satisfaction with life, suicidal ideation, hopelessness, post-traumatic growth, resilience, coping strategies, and social support; 3) sub-groups analyses based on the level of exposure to the pandemic (i.e.,

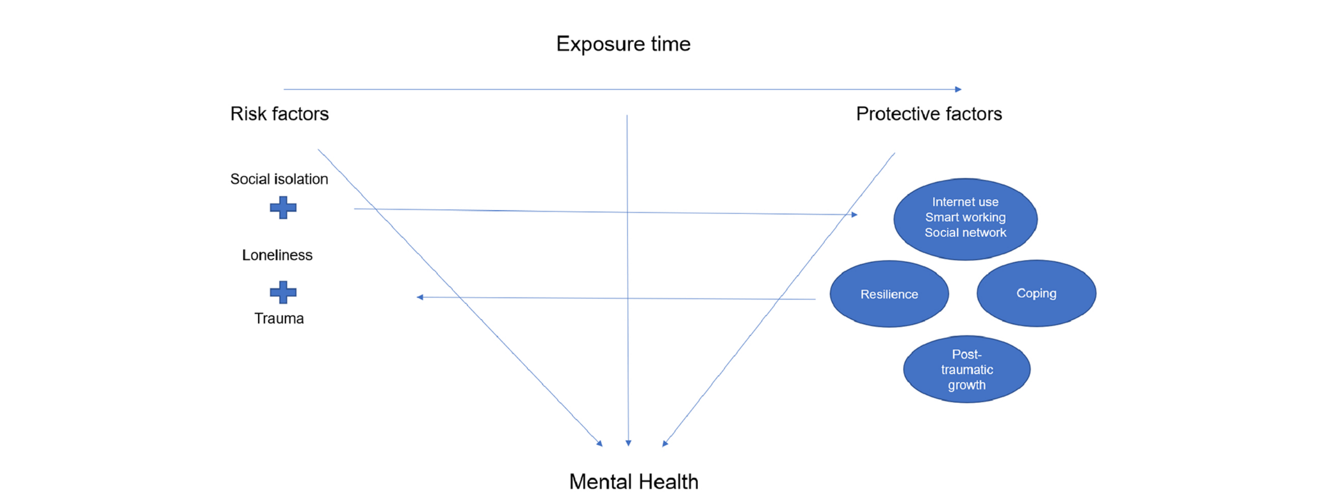

FIGURE 1 | Determinants of mental health during the COVID-19 pandemic.

COVID-19 quarantine group vs. COVID-19+ patients group vs. COVID-19 healthcare staff group vs. COVID-19 mental health group); 4) calculation of a propensity score, in order to adjust our findings for the likelihood of being exposed to the pandemic and to the quarantine (48, 49). This method is adopted since it produces a better adjustment for differences at baseline, rather than simply including potential confounders in the multivariable models. The independent variables used for calculating the propensity score will include gender, age, socio-economic status, and geographical region. The obtained propensity score will be used to weight the observations in the multivariable analyses. In the final regression model, the inverse probability weights, based on the propensity score, will be applied in order to model for the independence between exposure to the pandemic/quarantine and mental health outcomes and estimation of causal effects (48, 49); 5) development of a Structural Equation Model (SEM), in order to evaluate the possible role as mediators and moderators of coping strategies, post-traumatic growth and usage of social networks on the severity of depressive and anxiety symptoms, post-traumatic and stress-related symptoms, suicidal ideation, and hopelessness.

In order to improve the external validity and generalizability of our findings, all analyses will be controlled for the impact of confounding variables, such as age, gender, and geographical region.

Data will be stored in an online dataset by the coordinating center. For safety reasons, the dataset will be protected by a two-step password. It will be possible to export data in compatible formats with common calculation software (e.g., Microsoft Access and Excel) and in specific softwares (e.g., SPSS and STATA) for the statistical analyses.

Ethics and Dissemination

This study is being conducted in accordance with globally accepted standards of good practice, in agreement with the Declaration of Helsinki and with local regulations. The study protocol has been approved by the Ethical Review Board of the University of Campania "L. Vanvitelli" (Protocol number: 0007593/i).

DISCUSSION

Our survey will give us the opportunity to describe the impact of the pandemic on the mental health of different subgroups of the Italian population.

In fact, the analyses will be run according to the four subgroups of respondents: the general population not directly affected by the virus (COVID-19 quarantine group); people who have had a direct or indirect contact with the virus (COVID-19+ patients group); those working in health care units as first or second-line staff (COVID-19 healthcare staff group); people with mental health problems, independently from the contact with the virus (COVID-19 mental health). This choice is due to the evidence that stress and traumas have a different impact on different target groups (7, 50–52).

In the COVID-19-quarantine group, we anticipate that the pandemic and the related containment measures will increase the levels of stress, anxiety and depression, as well as other stress-related symptoms. In particular, physical distancing has obviously changed the patterns of daily routine in order to mitigate the spread of the disease, with serious consequences on mental health and well-being in both the short- and long-term (53). Similar consequences would require immediate efforts for developing preventive strategies as well as direct interventions aiming to mitigate the impact of the outbreak on individual and population mental health. The longer the pandemic will last the most the ordinary life of the general population will be seriously affected. In particular, Zhang et al. (23) have highlighted the need to pay attention to the mental health of people who have not been directly infected by the virus though have been forced to stop all their activities during the outbreak. These people represent the most susceptible group to the detrimental impact of quarantine and physical distancing measures adopted during the lockdown. Moreover, during the current pandemic, it is reasonable to expect that the incidence of severe mental disorders will increase, but also that of other mental health disturbances not reaching the threshold for a full-blown diagnosis (3). However, currently available data are based on studies carried out in China and the different socio-cultural context may limit the generalizability of findings to the Italian and Western contexts. Therefore, we consider essential to collect Italian data in order to develop data-driven guidelines for an adequate management of mental health problems during the emergency and the post-emergency phases. In fact, this survey will represent the starting point for developing, validating, and implementing psychosocial supportive interventions (53, 54), as discussed later in this paper.

We hypothesized that Internet and social media can play a buffering role in the development of psychiatric symptoms (25, 55). It may be that online contacts and interactions will limit the detrimental effects of social isolation (56). Moreover, Internet can represent the ideal setting for providing supportive interventions through tele-mental health applications (57–60). However, the positive effect of Internet and social media has to be confirmed yet, since it is only speculative at this stage.

In the COVID-19+ patient group (i.e., those with a direct or indirect contagion), the impact on mental health has been mostly neglected during the acute emergency phase. Of course, this has been due to the fact that the infection is a potentially life-threatening condition, as confirmed by the need for hospitalization in intensive care units for many patients (61). In particular, the experience of being isolated in the hospital, the perceived danger, uncertainty about own physical conditions and the fear of dying alone can be considered risk factors for the development of post-traumatic, anxiety, and depressive symptoms (62, 63). The only study conducted in China so far has documented that over 90% of COVID+ patients admitted to the hospital reported significant post-traumatic stress symptoms (62, 64, 65). Furthermore, the authors found that providing patients with psychoeducational intervention is well received and perceived as helpful and useful by users.

As regards the effects on mental health of those working in health care units as first-line or second-line staff (COVID-19 healthcare staff group), we expect that many health professionals will experience symptoms of burn-out, including mental exhaustion, irritability, detachment from reality, and insomnia. In a survey involving medical and non-medical health workers, Zhang et al. (23) found a higher prevalence of insomnia, anxiety, depressive symptoms, somatization, and obsessive-compulsive symptoms in mental health staff. Moreover, front-line medical staff working in close contact with infected patients (e.g., staff professionals working in the departments of respiratory, emergency, infectious disease, and intensive care unit) showed higher scores on depressive/anxiety symptoms and had a twofold increase in risk to develop a mental health problem (66–69). However, the effect on suicidal ideation of health professionals has not been investigated yet and will be the focus of one of our work-packages.

Finally, the pandemic will affect the mental health status of people who already suffer from mental health problems, independently from the contact with the virus (COVID-19 mental health group). Although the effects of the coronavirus on mental health have not been systematically studied, it is likely that the COVID-19 will have detrimental effects on patients with pre-existing mental health problems. Many patients with severe mental disorders have been overlooked during the pandemic, although they can have a higher risk of contracting the virus and of death considering the higher prevalence of somatic comorbidities compared to general population and the difficulties in accessing health services (70).

However, if protracted, social isolation may increase the risk of recurrences of episodes of mental disorders, beyond triggering the onset of new mental disorders in most vulnerable people. Moreover, objective social isolation and subjective feelings of loneliness are associated with a higher risk of suicidal ideation and suicide attempts (71). For many persons with mental disorders, being alone is a heavy burden, far beyond that experienced by many other persons (72).

In patients with pre-existing anxiety disorders or obsessive-compulsive disorder, we expect an exacerbation or worsening of their clinical symptoms. Moreover, the fact that there is not (yet) a definitive treatment for the COVID infection represents another potential stressor, further increasing the levels of anticipatory anxiety and reducing personal functioning. In our study, both obsessive-compulsive and anxiety symptom clusters will be evaluated through reliable and validated questionnaires.

We believe that our study has several strengths, which should be highlighted. First, this is the first national multicentric, no-profit study carried out in Italy with a rigorous methodology for evaluating the impact of pandemic and quarantine on mental health. Second, the development of a web-based platform for data collection will give us the opportunity to recruit a high number of participants. Based on previous population surveys carried out in Italy, an ideal target would have been 10,000 participants, but this target has been reached in only 7 days. Therefore, we expect to reach more than 20,000 people within the study period. A third relevant strength of our study is the selection of validated and reliable assessment instruments, which are available and validated in several languages. The next step of the project will be to adapt our survey to the European level, by involving several countries. Fourth, several psychopathological dimensions will be evaluated, not only those usually assessed following natural disasters, such as the post-traumatic and depressive-anxious dimensions. In this study, we will also evaluate the obsessive-compulsive spectrum, the suicidal ideation, the maladaptive use of Internet, among the others, which represent novel targets for psychiatrists (73, 74).

Our study has obviously also some limitations. In particular, the study sample includes the adult population only, due to existing restrictions related to the provision of informed consent of children and adolescents in Italy. However, it is likely that the pandemic will have a detrimental impact on the mental health of adolescents as well (75, 76). Moreover, being exposed to a traumatic event during early life is associated with alterations in the social, emotional, and cognitive development and could determine a variety of impairment in the adulthood. The effects of the pandemic on children and adolescents will be evaluated in an *ad hoc* study, in which we will explore the relationship between parents and their underage children during the pandemic. Another limitation is related to the recruitment process, which might partially bias our findings, since only persons interested in the topic of the survey may have voluntarily participated. However, we expect that most people are interested in participating in the survey given the global magnitude of the current traumatic threat with collective psychological and social reactions.

Another possible limitation of our study is the choice to use a web-based online survey, which may have limited the participation of people not having access to the Internet or not familiar with online tools, particularly the elderly. The cross-sectional design of the study does not allow an evaluation of changes over time as regards the levels of severity of symptoms. However, in order to overcome this possible bias, we will compare our findings with those already available from the Italian population (46) and will adopt a propensity score approach in order to understand the impact of the duration of exposure to the pandemic on the risk of developing psychiatric symptoms. With this methodology, we will be able to evaluate the levels of post-traumatic growth and the type of resilience styles in the study population in order to identify possible critical areas to be targeted in the post-acute phase. However, these psychological constructs are slow to change, and this is why we will promote a second wave of the survey, which will start six months after the end of the "lockdown phase" in Italy. Finally, the survey link can be used multiple times in order to allow sharing and re-posting it. This methodological choice could bias the findings, since the same person can potentially compile the survey several times. However, this methodological choice was due to the adoption of the "snowball" sampling, and it is rather unlikely that someone can compile the same long survey more than once.

Next Steps

Based on the findings of this study and on our previous work in the development of psychosocial interventions (77–79), we aim to develop a psychosocial intervention which will include elements of classic psychoeducation, cognitive-behavioral therapy, and motivational intervention (80–84). In particular, we are developing an experimental intervention which includes information on the mental health consequences of the pandemic and on strategies to prevent them; practical advices for promoting healthy lifestyle behaviors (e.g., healthy eating, regular sleeping patterns, physical activity, etc.); stress-management techniques; communication strategies; problem-solving skills. Based on participants' needs, additional sessions on suicide prevention, burn-out, and Internet dependence may be provided.

The intervention will include face-to-face sessions and tele-mental health sessions (85, 86). Information will be provided through instant messages (e.g., Chatbot), email contacts, and the development of an *ad hoc* app.

The modules of the intervention will be adapted according to the characteristics and the needs of the four above-mentioned target groups. In particular, in the COVID-19 quarantine group, the main focus of the intervention will be the improvement of healthy lifestyle behaviors; for the COVID-19+ patients group, the intervention will include a specific focus on post-traumatic symptoms and on the risk of being socially stigmatized; for the COVID-19 healthcare staff group, specific sessions will be dedicated to the burn-out syndrome and the management of stressful situations; for the COVID-19 mental health group, sessions on resilience, coping strategies, and the detection of early warning signs of relapses will be included.

The proposed experimental intervention will be tested in a randomized controlled trial which will start when the acute phase of the pandemic will be over, and the control group will be represented by an informative group intervention on the effects of the pandemic on mental health.

Moreover, our survey is going to be translated into different languages in order to assess the impact of the pandemic in other European countries.

CONCLUSIONS

The pandemic and the quarantine may have a detrimental impact on mental health. An increase of psychiatric symptoms and of mental health problems in the general population is expected. Most health professionals working in isolation units and resuscitation departments very often do not receive any training or support for their mental health care. Mental health services worldwide are not prepared to manage the short- and long-term consequences of pandemic. It is necessary to have a clear picture of the impact that these new stressors are having on mental health and well-being in order to develop and disseminate appropriate preventive interventions for the general population as well as for the different at-risk groups.

ETHICS STATEMENT

This study is being conducted in accordance with globally accepted standards of good practice, in agreement with the Declaration of Helsinki and with local regulations. The study protocol has been approved by the Ethical Review Board of the University of Campania "L. Vanvitelli" (Protocol number: 0007593/i).

AUTHOR CONTRIBUTIONS

VG, GaiS, ML, VV, and AF designed the study and wrote the protocol. UA, GC, CC, FC, BDO, MN, MP, GabS, AT, and UV revised the draft of the paper. All authors contributed to the article and approved the submitted version.

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Covid-19 Outbreak In Italy: Are We Ready for the Psychosocial and the Economic Crisis? Baseline Findings From the PsyCovid Study

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The Covid-19 pandemic is burning all over the world. National healthcare systems are facing the contagion with incredible strength, but concern regarding the psychosocial and economic effects is growing quickly. The PsyCovid Study assessed the influence of psychosocial variables on individual differences from the perceived impact of the Covid-19 outbreak on the issues of health and economy in the Italian population. Italian volunteers from different regions completed an online anonymous survey. The main outcomes were the perceived impact of the Covid-19 outbreak on health and the economy. A two-way MANOVA evaluated differences in the main outcomes, with geographical area (northern, central, and southern regions) and professional status (healthcare workers or not) as factors. We then tested the relationship linking psychosocial variables (i.e. perceived distress and social isolation, empathy, and coping style) to the main outcomes through two different mediation models. 1163 responders completed the survey (835 females; mean age: 42 ± 13.5 y.o.; age range: 18-81 y.o.) between March 14 and 21, 2020. Healthcare workers and people living in northern Italy reported a significantly worse outbreak impact on health, but not on the economy. In the whole sample, distress and loneliness were key variables influencing the perceived impact of the Covid-19 outbreak on health, while empathy and coping style affected the perceived impact on the economy. The Covid-19 pandemic is a worldwide emergency in terms of psychological, social, and economic consequences. Our data suggests that in the Italian population, actual differences in individual perception of the Covid-19 outbreak severity for health are dramatically modulated by psychosocial frailty (i.e., distress and loneliness). At the same time, problem-oriented coping strategies and enhanced empathic abilities increase people's awareness of the severity of the impact of the Covid-19 emergency on economics. There is an immediate need for consensus guidelines and healthcare policies to support interventions aimed to manage psychosocial distress and increase population resilience towards the imminent crisis.

Keywords: Covid-19 outbreak, perceived impact on health, economic crisis, psychosocial frailty, loneliness, empathy, distress, coping abilities

INTRODUCTION

In late 2019, pneumonia cases of an unknown etiology, then proven to be caused by a new coronavirus (2019-nCOV or SARS-CoV2), appeared in Wuhan, Hubei Province of China. The first clusters of patients were epidemiologically linked to human-animal transmission in the Huanan Seafood Wholesale Market of Wuhan. At the end of December 2019, the World Health Organization (WHO) was alerted of the novel viral illness that caused respiratory symptomatology which sometimes resulted in severe acute respiratory syndrome (SARS) (1, 2). The first two cases in Italy, a couple of Chinese tourists, were registered in Rome (3) at the end of January 2020. Later they were proved to be infected prior to their arrival in Italy (4). Specific algorithms and protocols were then applied, and specialized teams were instituted, in order to control the contagion spread (5). However, a dramatic increase of positive cases and hospitalizations quickly followed, especially in Northern Italy. After the confirmation of 2019-nCov positivity of the two Chinese tourists admitted at the Spallanzani Hospital in Rome on February 21, 2020, the Italian government declared a state of emergency (6). Extraordinary measures to prevent the virus spread were instituted only on March 9, 2020 (DCPM #iorestoacasa – I stay at home), and further hardened on March 13, 20, and 22, 2020. At that time, social distancing became extreme and unprecedented (**Figure 1**). A daily press release system was established and educational campaigns were launched, in order to sensitize and encourage people to undertake contact precautions and avoid the contagion. The Covid-19 outbreak disruptively changed habits, routines, and lifestyles, affecting human relationships and the productivity of the entire country. Roads and streets were deserted and the suspicion of infection from others is high. At the time of the last revision of this manuscript (May 13, 2020) in Italy there were 222.104 confirmed case and 31.106 deaths.

A few days after March 9, 2020, we started the PsyCOVID longitudinal study. We designed this psychosocial research study, taking into account three key requirements to test the impact of infectious diseases (7): i) a systemic perspective, directed to the general public, designed to be as inclusive as possible; ii) a prospective outlook, including a baseline assessment during the social restrictive measures and two follow-ups (the first a month after the abolition of these measures, and the second six months after the first follow-up); iii) measurable outcomes of psychosocial variables, suitable to detect fragile sub-populations who would benefit from specific interventions at the end of the outbreak.

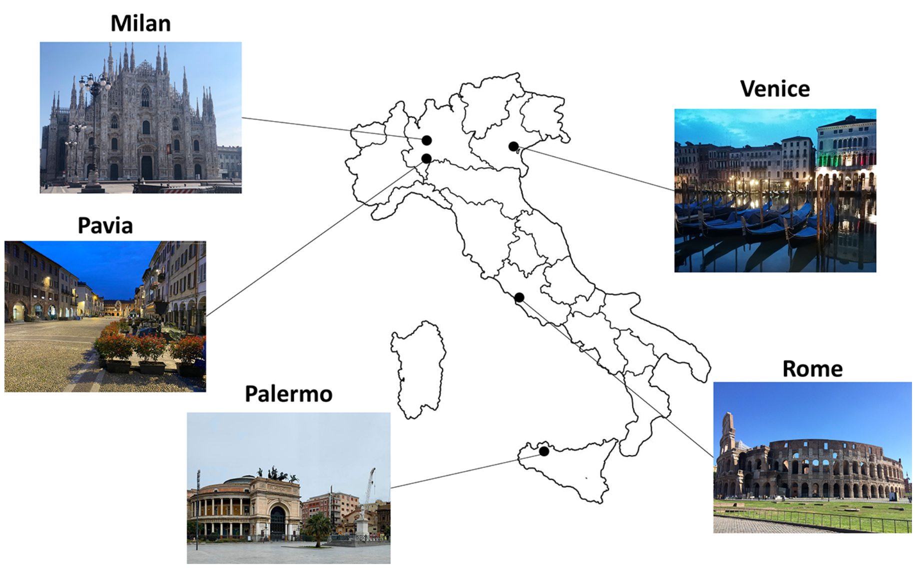

FIGURE 1 | Italian ghost towns. The figure illustrates the effect of social distance measures in the Italian cities of Milan, Pavia, Venice, Rome, and Palermo.

Indeed, extreme social restrictions like social distancing, as well as emergency situations and settings that healthcare professionals have to face every day, require individuals to allocate enormous resources to the process of psychosocial adjustment to such a novel and catastrophic situation, which in the long-term may exert a critical impact on individuals' well-being, mental health, and quality of life. In such a context, increased distress and loneliness, possibly emerging as a result of social isolation, can profoundly affect our perception of events and, importantly, may exacerbate the risk of negative mental health outcomes, including the emergence or the worsening of anxious and depressive symptoms, addictive behaviors, thought disorders, as well as the increase of the risk of suicide (8).

At the same time, effective coping strategies and empathic abilities can help individuals to enhance their awareness of the problem, build resilience, and increase social responsibility, and thus face such a complex situation in a more constructive way.

In this paper, we report findings on the baseline assessment of the PsyCOVID study aiming at evaluating differences in the perceived impact of the Covid-19 outbreak on health and economy in the Italian population during the very first days of the extreme social distancing measures, specifically taking into account the impact of demographic variables, regional differences (Northern, Central, and Southern regions), and professional status (healthcare workers or not).

PARTICIPANTS AND METHODS

Participants

Between Mar 14 and 21, 2020, we conducted an anonymous online survey among adult Italian residents. Study protocol was approved by the University Ethics Committee (IUSS—University of Pavia). We selected convenience sampling, selecting participants based on their accessibility and proximity to the research group. We created the survey using Google Forms and distributed it through a link, accessible to anyone (https://forms.gle/5f3yH3aTNJYEuJ7B9). We distributed the survey link *via* written invitations through e-mails, Whatsapp, and social network messaging (Facebook, Instagram, and Linkedin). Then, we asked initial participants to diffuse the questionnaire through their social networks. The eligibility criteria were age (18 years of age or older), ability to provide an informed consent, and place of residence (Italy). At the beginning of the survey, we presented the study objective and timeline, the commitment required of participants, and information about the research team. We asked potential participants to read and provide their informed consent by clicking a box. After providing informed consent, participants were directed to the survey. We first invited all participants to provide a reference in order to be contacted for the following phases. Participants did not receive any incentive to take part in the study. The response rate was 98%. We calculated the rate response as the ratio of the number of complete responders to the total number of potential participants who had the chance to access the first page of the study. Non-responders were persons who did not provide their informed consent to participate or who declared an age < 18 years old.

A total of 1,163 adult Italian residents completed the survey (72% females; mean age: 42 ± 13.5 y.o.; age range: 18–81 y.o.). The majority (65.6%) of participants were residents in Northern Italy, 9.6% in Central Italy, and 24.8% in Southern Italy. Of all responders, 14.3% were healthcare professionals. **Table 1** provides details about the socio-demographic characteristics of the sample.

Measures

The questionnaire collected data on socio-demographic characteristics (**Table 1**), an assessment about the perceived impact of the Covid-19 outbreak on health and the economy (main outcome measures), and psychosocial factors.

Outcome Measures: Assessment of the Perceived Impact of Covid-19 Outbreak

We assessed the perceived impact of the Covid-19 outbreak with 4 items for health (*average interitem covariance*=0.34; *Cronbach's alpha or* $\alpha = 0.74$) and 4 items for the economy (*average interitem covariance*=0.31; $\alpha = 0.81$). Items on both the health and economy scales required participants to rate the perceived severity of the Covid-19 outbreak at the local (item 1: city or town), regional (item 2), and global (item 3: national; item 4: international) levels, on a 5-point Likert scale (0=not serious at all; 4=extremely serious). Finally, for each scale we created an index (range 0-16), obtained by summing up the item ratings within each scale. We used the resulting measures as outcome variables in our subsequent analyses.

Psychosocial Predictors

In the PsyCOVID study we decided to evaluate a set of specific psychosocial dimensions related to emergency settings and situations, including perceived global distress (9, 10), loneliness (10), empathic skills (11, 12), and coping strategies (13). To collect information about these psychosocial dimensions we used a battery of validated questionnaires in the Italian language. In particular, we assessed the different facets of global distress with the Italian version of the Depression Anxiety Stress Scales-21 (14), allowing participants to obtain specific sub-scores of depression, anxiety, and stress. We used the Empathic Concern and Perspective Taking sub-scales of the Interpersonal Reactivity Index [IRI (15)] to capture emotional and cognitive facets of empathic abilities. Loneliness was assessed with the Italian Loneliness Scale (16), including the three sub-scales (Emotional, Social, and General Loneliness). Finally, coping strategies were investigated with the short version of the Italian version of the Coping Orientation to the Problems Experienced [COPE-NVI-25 (17)], measuring different coping behaviors or styles towards problems and stressful events, reflected in 5 scale sub-scores (Positive attitude, Problem orientation, Transcendence orientation, Social support, Avoidance strategies).

Statistical Analysis

Since fewer than 2% of cases were missing in any analysis, we dropped cases with missing values *via* list-wise deletion. We set

TABLE 1 | Demographic information.

Characteristics	No. (and %) of respondents
Sex	
Male	326 (28.0)
Female	837 (72.0)
Age	
Youth age (18-24 y)	61 (5.2)
Young adults (25-39 y)	528 (45.4)
Adults (40-64 y)	475 (40.9)
Elderly (>65 y)	99 (8.5)
Education	
Secondary school (8 y)	26 (2.2)
High school (13 y)	323 (27.8)
Graduate school (16-18 y)	549 (47.2)
Postgraduate school (>18 y)	265 (22.8)
Occupation	
Student	84 (7.2)
Housewife	31 (2.7)
Unemployed	48 (4.1)
Employee	558 (47.9)
Manager	96 (8.3)
Freelance	211 (18.1)
Professor or Researcher	32 (2.8)
Retired	103 (8.9)
Job field	
Industry	106 (9.1)
Financial and Economy	109 (9.4)
Communication Industry	57 (4.9)
Art and Manufacturing	55 (4.7)
Humanistic	188 (16.2)
Non-profit	90 (7.7)
Construction	22 (1.9)
Trade	58 (5.0)
Healthcare	165 (14.3)
Education and University	56 (4.8)
Public Services	54 (4.6)
Others	203 (17.4)
Geographic Area (place of birth)	
Norther Italy	646 (55.5)
Centre Italy	111 (9.5)
Southern Italy	375 (32.3)
Abroad	31 (2.7)
Geographic Area (place of residence)	
Norther Italy	763 (65.6)
Centre Italy	112 (9.6)
Southern Italy	288 (24.8)
Size of place of residence	
Rural area (<1k people)	11 (0.9)
Small-size town (1-10k people)	202 (17.4)
Medium-size town (10-50k people)	314 (26.9)
Small-size city (50-250k people)	243 (20.9)
Medium-size city (250-500k people)	46 (4.0)
Big-size city (500k-1mln people)	142 (12.2)
Metropolis (>1 mln people)	205 (17.7)

The table reports demographic features of the PsyCOVID study baseline sample (N=1,163) collected within the first week after the start of the study (March 14–21, 2020).

statistical significance at p <0.05 for all statistical tests we performed. We calculated descriptive statistics including frequencies and percentages for categorical variables, and mean and standard deviation for pseudo-continuous variables. We estimated group differences in the perceived impact of the Covid-19 outbreak on health and the economy dimensions with a two-way MANOVA, considering geographical area (northern, central, and southern regions) and professional status (healthcare professionals vs. non-healthcare professionals) as factors. We additionally described between-group differences on psychosocial variables, with geographical area (one-way ANOVA) and professional status (Student's t-test) as grouping variables in separate analyses. We then explored the correlations (Pearson's r coefficient) between psychosocial variables and main outcomes.

Finally, based on correlation results, we tested two mediation models. The first (*Model 1*) tested the indirect effect of perceived distress (Stress subscale of the DASS-21) on the relationship between loneliness (General Loneliness subscale of the ILS) and the perceived impact of Covid-19 outbreak on health. The second mediation model (*Model 2*) assessed the indirect effect of coping style (Problem orientation sub-score) on the relationship between empathic skills (Composite score of Empathic Concern and Perspective taking sub-scales of the IRI) and the perceived impact of the Covid-19 outbreak on the economy.

We carried out sample description and statistical group analyses using SPSS (https://www.spss.it/), and tested mediation models using STATA (https://www.stata.com/).

RESULTS

Descriptive statistics are illustrated in **Tables 1** and **2** and in **Figure 2**.

The two-way MANOVA showed a significant multivariate effect of both geographic area (Λ=0.955 F(4, 2308)=13.582, p<0.001) and professional status (Λ=0.991 F(2, 1154)=5.042, p=0.007) on the perceived severity of the Covid-19 outbreak. However, the interaction between geographic area and professional status was not significant (Λ=0.996; F(4, 2308)=1.031, p=0.390). Univariate results revealed that both geographic area and professional status had a significant effect on the perceived severity for health (*geographic area:* F(2, 1161)=19.391, p<0.001; *professional status*: F (2,1161)=30.920, p=0.035), but not for the economy (*geographic area:* F(2, 1161)=0.231, p=0.794; *professional status*: F(2,1161)= 0.874, p=0.350).

Post hoc tests (Tukey HSD) on geographical area showed the perceived severity for health in northern Italy was significantly different from that of central (p<0.001) and southern regions (p<0.001). The perceived outbreak impact on health was significantly higher (i.e., more serious) in healthcare workers and in people living in northern Italy, compared to non-healthcare workers and people living in central-southern Italian regions.

Group comparisons on all psychosocial variables by professional status did not show significant results (**Table 2**). The same was true for group comparisons based on geographical area, with the exception of coping strategies reflecting transcendence orientation, which characterize southern regions more than central (Tukey HSD, p=0.001) and northern ones (Tukey HSD, p<0.001).

Correlation analyses assessing the relationship between main outcomes and psychosocial variables are reported in **Table 3**. Several variables were significantly related to one or both study outcomes. On this basis, we selected a small set of variables to test two mediation models. In *Model 1* (**Figure 2A**), we tested the mediation effect of perceived distress – positively correlated to the dependent variable and negatively with the independent variable – on the positive relationship linking general loneliness (independent variable) and the perceived impact of the Covid-19 outbreak for health (dependent variable) (direct effect: Z=-4.32, p<0.001). Results highlighted a significant indirect effect of perceived distress (Z=4.50 p<0.001), mediating approximately 48% of the total effect of loneliness on the perceived impact of the Covid-19 outbreak for health. In *Model* 2 (**Figure 2B**), we tested the mediation effect of problem-oriented coping strategies – positively correlated with both the dependent and the independent variables – on the positive relationship linking empathic skills (independent variable) and the perceived impact of the Covid-19 outbreak on the economy (dependent variable) (direct effect: Z=2.37, p=0.02). Results highlighted a significant indirect effect of problem-oriented coping (Z=2.81, p=0.005), making up approximately 34% of the total effect of perceived social isolation on the perceived impact of the Covid-19 outbreak for health.

DISCUSSION

The Covid-19 pandemic seems at present to be unstoppable, effecting countries all over the world. Although Italy is facing this extremely stressful situation with all the available weapons and tools, severe concern has arisen regarding the Italian national health system's capacity to take the brunt of any subsequent psychosocial and economic implications. To this purpose, recent data highlighted that a significant proportion of the Italian general population may have moderate-to-severe psychological distress during the early phases of the Covid-19 emergency (18).

In line with this evidence, baseline findings of the PsyCOVID study suggest that Covid-19 will represent a psychosocial catastrophe. On the one side, healthcare workers face the emergency not only at the physical level, as they are continuously exposed to the contagion and engaged in patient assistance and care, but they have to cope with a huge psychosocial burden. This requires healthcare professionals to put into play enormous resources to adapt themselves to the new dystopic situation, managing the increasing distress while trying to bring out the most effective coping strategy. On the other side, quarantine and other social distancing measures imposed by Italian authorities to the majority of the population can exacerbate feelings of loneliness and lack of connectedness in socially fragile individuals, as well as enhance the risk of negative mental health outcomes (8).

As with the SARS outbreak (19, 20), persistent psychological symptoms will affect healthcare personnel and outbreak survivors, families of affected patients, quarantined fragile individuals, and socially disadvantaged sub-populations (i.e., subjects affected by chronic disease, elderly population with mild cognitive impairments, aged people without close relatives). However, literature reports only a few studies investigating psychological variables related to the Covid-19 spread. Wang and co-workers (21) provided evidence of a moderate to severe psychological impact of the outbreak in more than half of Chinese respondents, with 16.5% of interviewed individuals having moderate to severe depressive symptoms, 28.8% moderate to severe anxiety symptoms, and 8.1% moderate to severe stress levels. Li et al. (22) reported self-control as a resilience factor potentially mitigating the perceived severity of the Covid-19 outbreak and mental health problems. Moccia and colleagues reported that the mental health burden due to the Covid-19 outbreak may be predicted by temperament and adult attachment style (8).

Here we provided a first look at the psychosocial effects that the Covid-19 outbreak is having in Italy, in the very first days after the Italian Government Decree #iorestoacasa of March 9, 2020. Our results about the perceived impact of the Covid-19

TABLE 2 | Group comparisons on psychosocial variables.

	A. Professional status		B. Geographic area		
	Healthcare	***Non-healthcare***	***Northern Italy***	***Central Italy***	***Southern Italy***
DASS-21 Depression	3,55 ± 3,65	3,52 ± 3,87	3,44 ± 3,65	3,75 ± 4,33	3,64 ± 4,11
DASS-21 Anxiety	1,84 ± 2,46	2,07 ± 2,87	1,94 ± 2,64	2,01 ± 3,20	2,27 ± 3,09
DASS-21 Stress	6,21 ± 4,23	5,32 ± 4,31	5,60 ± 4,15	5,21 ± 4,66	5,09 ± 4,55
ILS Emotional	7,66 ± 4,38	7,61 ± 4,35	7,54 ± 4,31	8,12 ± 4,42	7,64 ± 4,44
ILS Social	13,55 ± 4,22	13,44 ± 4,39	13,38 ± 4,40	13,67 ± 4,08	13,59 ± 4,37
ILS General	8,48 ± 5,11	8,40 ± 5,07	8,31 ± 5,07	8,66 ± 5,04	8,63 ± 5,15
IRI Empathic Concern	20,57 ± 3,82	20,39 ± 4,10	20,35 ± 4,09	20,63 ± 3,94	20,47 ± 4,06
IRI Perspective Taking	18,80 ± 4,31	18,23 ± 4,57	18,12 ± 4,55	18,54 ± 4,33	18,72 ± 4,56
COPE-NVI-25 Positive attitude	24,32 ± 5,38	23,74 ± 5,48	23,79 ± 5,31	23,13 ± 5,25	24,16 ± 5,97
COPE-NVI-25 Social support	20,51 ± 5,03	19,10 ± 5,33	19,44 ± 5,16	18,74 ± 5,55	19,09 ± 5,59
COPE-NVI-25 Problem orientation	21,72 ± 4,42	20,66 ± 4,75	20,83 ± 4,53	19,96 ± 4,20	21,05 ± 5,35
COPE-NVI-25 Transcendence orientation§	8,82 ± 5,95	9,39 ± 6,33	8,56 ± 5,93	8,87 ± 5,82	11,42 ± 6,87
COPE-NVI-25 Avoidance strategies	9,40 ± 3,65	10,25 ± 3,85	9,96 ± 3,61	10,48 ± 3,93	10,44 ± 4,31

*The table illustrates group comparisons on psychosocial variables assessed, taking into account professional status **(A)** and geographic area **(B)**. For each group we report mean and standard deviation. Statistical significance at p < 0.05 is indicated with (*) for group comparisons based on professional status and with (§) for group comparisons based on geographic area.*

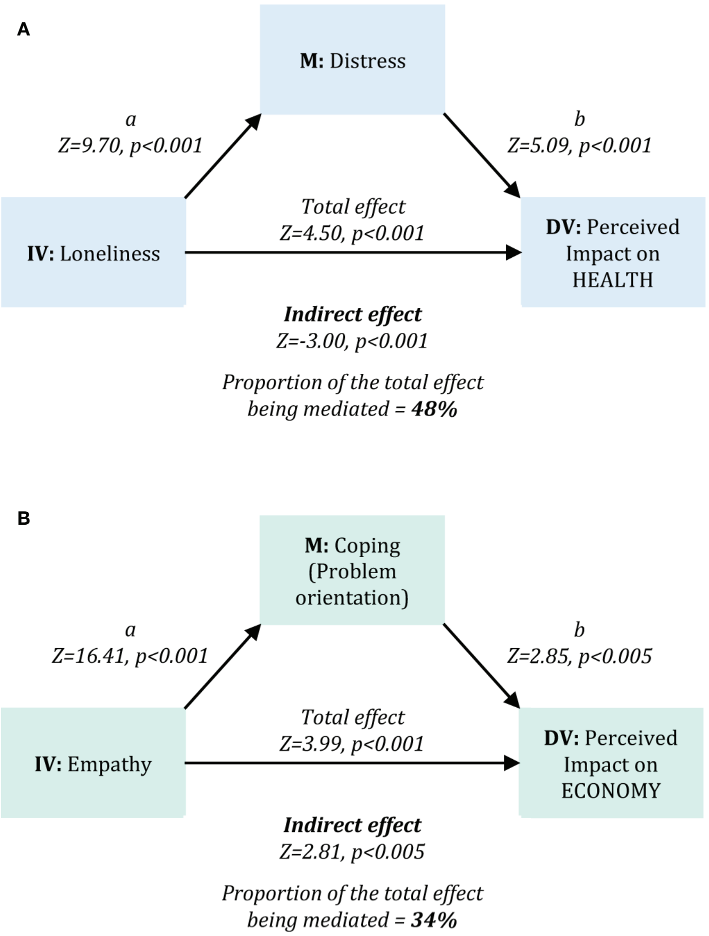

FIGURE 2 | Mediation analyses. The figure illustrates the two mediation models tested for the main outcomes related to the perceived impact of the COVID-19 outbreak for Health (*Model 1*, Panel **A**) and for Economy (*Model 2*, Panel **B**). *Model 1* assessed the mediation effect of perceived distress (DASS-21 Stress sub-scale) on the relationship between perceived loneliness (ILS General Loneliness sub-scale) and the perceived impact of the COVID-19 outbreak on health. *Model 2* assessed the mediation effect of problem-oriented coping strategies (COPE-NVI-25 Problem orientation sub-scale) on the relationship between empathy (IRI Empathic concern and Perspective Taking sub-scales) and the perceived impact of the COVID-19 outbreak on the economy. *Figure acronyms: IV, Independent variable; DV, Dependent variable; M, mediator.*

outbreak suggest that while the economy emergency is viewed as equally serious in all Italian regions and in both healthcare and non-healthcare workers, the health emergency is tightly linked to the professional status and the geographical spread of the Covid-19 outbreak. As expected, healthcare workers who have to deal with suffering and deaths day by day judged the health emergency as more serious than people not involved in Covid-19 patients assistance and care. At the same time, individuals living in Northern Italy—who are dramatically facing illness and suffering of close relatives and friends—felt the health emergency as more urgent than what individuals living in Central and Southern regions did.

Notably, we provided evidence that the severity of perception of the Covid-19 emergency reflected the individuals' psychosocial vulnerability. First, increased perceived social support (i.e., a low degree of loneliness) was significantly correlated to the increased perception of the Covid-19 impact on health. This suggests that the greater an individual's support network, is the worse (i.e., more serious) his/her judgment about the Covid-19 consequences for health will be. In other terms, having more people in our own social network increases the probability to have examples of positive or probable cases in mind [feeding the so-called representativeness heuristic (23)] and, thus, to consider the current emergency as more serious. This is particularly true for healthcare professionals who are continuously and physically in touch with patients and colleagues. However, such a relationship is mediated by perceived distress, contributing to nearly half of the total effect of loneliness on the perception of the Covid-19 impact on health.

Model 2 highlighted that better empathic skills (i.e., how much better I can understand others' emotions and point of view) are related to a more serious perception of the Covid-19 impact on the economy. Such a result indicates that a profound understanding of what the restrictive measures mean for Italian

TABLE 3 | Correlation analyses.

		Outcomes		*Global distress (DASS-21)*			*Loneliness (ILS)*			*Empathy (IRI)*		*Coping (COPE-NVI-25)*				
		H	***E***	***D***	***A***	***S***	***EL***	***SL***	***GL***	***EC***	***PT***	***PA***	***SS***	***PO***	***TO***	***AS***
Outcomes	*H*	–	0,502***	0,072*	0,154***	0,118***	-0,060*	-0,007	-0,88**	0,180***	0,059*	0,043	0,116***	0,0124***	0,099**	-0,29
	E		–	0,091***	0,068*	0,38	-0,015	0,009	-0,019	0,125***	0,079**	0,08**	0,096***	0,125***	0,093***	0,017
Global distress (DASS-21)	*D*			–	0,606***	0,738***	0,324***	-0,181***	0,352***	-0,025	-0,055	-0,110***	0,001	-0,125***	-0,010	0,261***
	A				–	0,656***	0,232***	-0,132***	0,227***	0,49	-0,005	0,066*	0,069*	-0,035	0,071*	0,219***
	S					–	0,291***	-0,124***	0,274***	0,024	-0,047	-0,085**	0,095***	-0,044	-0,008	0,180***
Loneliness (ILS)	*EL*						–	0,258***	0,837***	-0,27	-0,20	0,001	0,038	-0,061*	-0,063*	0,196***
	SL							–	-0,154***	0,241***	0,246***	0,272***	0,367***	0,293***	0,036	-0,122***
	GL								–	-0,096***	-0,065*	-0,021	-0,068*	-0,099**	-0,057	0,252***
Empathy (IRI)	*EC*									–	0,495***	0,318***	0,333***	0,346***	0,177***	-0,127***
	PT										–	0,424***	0,325***	0,402***	0,064*	-0,105***
Coping (COPE-NVI-25)	*PA*											–	0,440***	0,650***	0,178***	0,071*
	SS												–	0,571***	0,184***	0,049
	PO													–	0,177***	-0,097***
	TO														–	0,153***
	AS															–

*The table reports correlation coefficients (Pearson's r) and statistical significance (*p<0.05; **p<0.0; ***p<0.005).* Variable acronyms: H, Perceived impact of COVID-19 on Health; E, Perceived impact of COVID-19 on Economy; D, Depression; A, Anxiety; S, Stress; EL, Emotional loneliness; SL, Social loneliness; GL, General loneliness; EC, Empathic concern; PT, Perspective taking; PA, Positive attitude; SS, Social support; PO, Problem orientation; TO, Transcendence orientation; AS, Avoidance strategies.

entrepreneurs and organizations generates a more serious judgment of the impact of Covid-19 on the Italian economy. Interestingly, we observed that a third of the effect is mediated by problem-oriented coping strategies. This indicates that a way of facing problems based on active strategies, planning, and focused efforts towards problem resolution makes people more aware of the imminent crisis and gets them prepared to face the economic disaster (e.g. industrial conversion of activities to produce goods currently in high demand). Interestingly, a previous report on the psychosocial impact of global infection outbreaks, including the SARS and the West Nile Virus, showed that the perceived threat of these diseases were related with different coping strategies, also including empathic responding (24). In particular, the authors underlined that empathic responding is associated to an individual engagement in recommended health precautions and in the avoidance of behaviors entailing detrimental social and economical consequences. In this light, more empathic individuals may also display a higher adherence to the imposed measures, in order to prevent the contagion spread.

Crucially, psychosocial variables here investigated represent modifiable factors. The scientific literature provides a large range of intervention strategies and programs for each single domain (25–30). Of course, the day-by-day accurate reporting of the status of the epidemic and experts' opinion guidance on prevention and infection control play important roles in stabilizing people and overcoming the epidemic-related crisis. Actively mobilizing the population to participate in epidemic prevention and control can help to alleviate social anxiety and the feeling of helplessness and strengthen the sense of membership to a large community despite the physical distance and isolation due to restrictive measures. However, real-time updates of information on outbreak effects without more hopeful news to counteract this could be detrimental in the long time. This is the reason why, in such a catastrophic context, there is an urgent need to develop evidence-driven and multi-faceted intervention strategies to reduce adverse psychological impacts and psychosocial distress during, and especially after, the Covid-19 outbreak. Comparably, consensus guidelines to orient physicians, psychologists, and other mental care professionals toward an effective unified approach are urgent. The present work provides important suggestions that may help in defining new intervention programs. Our data, indeed, might help the government and health authorities to evaluate how and where to allocate resources in the future, including personnel, services, care facilities, and interventions, to manage the situation in the coming months and years.

Some criticisms in this report have to be underlined. First, we collected data *via* a self-administered survey, and thus possible issues might be related to recall bias and the intrinsic limitations of self-report measures. Secondly, the convenience sampling might have affected the generalizability of the present findings, as the sample cannot be considered actually representative of the Italian population. Another limitation is related to the cross-sectional nature of our report, which prevents the observation of changes of participants' perceptions of the Covid-19 impact over time. However, we are going to overcome such an issue by reporting longitudinal data after the planned follow-up assessment, once all the socially restrictive measures in Italy will definitively end. Moreover, we have to underline that, despite having confirmed our initial predictions by showing that the perceived impact of Covid-19 on health and the economy is affected by different psychosocial predictors, including distress and loneliness as well as empathic and coping abilities, there was the possibility that the opposite is also true. Further studies can address such a specific issue. Finally, future analyses will also benefit from taking into account the socio-economic status of participants, a variable that may be crucial to better understand individual differences in perceptions and psychosocial profiles.

In conclusion, only time will tell us whether Italian quarantine measures have prevented a historical disaster. However, the costs of the outbreak are not limited to medical aspects, as the virus has led to significant social, psychological, and economic effects globally. Our data teaches us the need to invest in preparedness to prevent, rapidly identify, and contain mid- and long-term consequences of global health emergency outbreaks such as Covid-19. Although reacting with travel bans and quarantines costs effort and economic resources and impacts on the well-being of millions of individuals cordoned off in a zone of contagion, it is reasonably necessary to contain further disasters. The psychological weight of thousands of suspected and confirmed Covid-19 cases and of huge numbers of deaths is difficult to bear without a known successful scenario. People are suffering from the weight of having a limited access to social or psychological support, as well as from not seeing a future constructive outlook.

In this view, big data analyses should analyze public health risks in the future in order to adjust health care strategies that could be implemented for any future crisis. We all need to move in this direction in order to understand and control the disease now and its effects later. Memories of the numbers of affected and diseased people will probably wane but psychosocial consequences will last. This modern war has just begun.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the University of Pavia and IUSS Pavia Ethics Committee. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

CCe, GS, CG, CCr: conception and design of the work. CCe, GS, CG, AD, CCr: acquisition, analysis of data. CCe, AD, SC, TV, CCr: interpretation of data. CCe, CCr: drafting the work. CCe, GS, CG, AD, SC, TV, CCr: revising and providing the final approval of the work.

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Predictors of Health-Related Quality of Life and Influencing Factors for COVID-19 Patients, a Follow-Up at One Month

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Objective: To survey the health-related quality of life (HRQoL) and its influencing factors among patients with COVID-19 in their first medical follow up.

Methods: All patients diagnosed with COVID-19 were discharged from 12 hospitals in Wenzhou, Zhejiang from Jan 17, 2020 to Mar 20, 2020. Prospectively collected and analyzed data included demographics, clinical symptoms, comorbidity, and chest CT imaging features at the first follow up, 1 month after discharge. All patients underwent the HRQoL evaluation with the Chinese version of Short-Form 36-item questionnaire (SF-36) as well as a general condition questionnaire. Factors associated with SF-36 were constructed using linear regression. Predictors of impaired physical component summary (PCS) and a mental component summary (MCS) were identified by logistic regression.

Results: SF-36 demonstrated a significant difference in HRQoL in patients with COVID-19, except in physical function (PF), when compared to the general Chinese population (p<0.05). The multiple linear regressions demonstrated that age was negatively associated with PF, role physical (RP), but positively associated with vitality (VT) (p<0.05). PF, bodily pain (BP), and role-emotional (RE) were negatively associated with the female sex (p<0.05). For mental health, the clinical subtypes were significant associated factors (p < 0.05). Length of stay (LOS) was strongly negatively associated with RE and RP, and positively associated with VT (p< 0.05). Logistical regression revealed that non-obese overweight (OR 3.71) and obesity (OR 3.94) were risk factors for a low PCS and female sex (OR 2.22) was a risk factor for a low MCS.

Conclusions: Health-related quality of life was poor among COVID-19 patients at the 1 month follow-up. Patients suffered from significant physical and psychological impairment. Therefore, prospective monitoring of individuals exposed to SARS-CoV-2 is needed in order to fully understand the long-term impact of COVID-19, as well as to inform prompt and efficient interventions to alleviate suffering.

Keywords: COVID-19, health-related quality of life, SF-36, follow-up, influencing factors

INTRODUCTION

The coronavirus disease 19 (COVID-19) is an infectious disease caused by the relentless spread of the severe acute respiratory coronavirus 2 (SARS-CoV-2) from human to human, all across the world (1). In the early stages of this disease, severe acute respiratory infection symptoms frequently occur (2). Some patients rapidly develop acute respiratory distress syndrome (3), and other serious complications. In addition to the pulmonary system, COVID-19 can impact multiple other organ systems, including neurological (4), cardiovascular (5), hematopoietic (6), and psychological (7). Our understanding is evolving regarding the threats COVID-19 poses to patient quality of life, mental health and life expectancy (8).

Along with social progress and the transformation of medical care and service systems, interest in health-related quality of life (HRQoL) is increasing (9). HRQoL is defined as the subjective feeling by patients of the multifaceted effect of a disease (10). The Short-Form 36-item questionnaire (SF-36) is a popular instrument for evaluating HRQoL (11). However, no study to date has explored the psychometric performance and applicability of a Chinese version of SF-36 in assessing HRQoL in COVID-19 patients at first month follow up.

Wenzhou is located in the southeastern coast of China, which has a population of 9.3 million. Wenzhou was initially one of the worst hit cities out of Hubei Province with 504 confirmed cases due to the highest volume of mobility with Wuhan (12, 13). The objective of this study was to provide theoretical basis for the targeted development of measures to improve quality of life of patients with COVID-19, as well as to guide relevant governmental departments and to improve medical and health care service strategy in the future.

METHODS

Study Design and Participants

This is a multicenter and cross-sectional study of patients with COVID-19 who were discharged from Jan 17, 2020 to Mar 20, 2020 at first month follow up from twelve hospital isolation wards in Wenzhou City, Zhejiang Province, China. The diagnosis of COVID-19 was based on the Chinese standard at the time (14). All patients had subsequent laboratory confirmation of SARS-CoV-2. Patients with SARS-CoV-2 infection were clinically divided into four types: mild, moderate, severe, and critical, according to a WHO–China Joint Mission report on COVID-19.

Questionnaire Development

The questionnaire contains questions with defined response categories. A few questions asked participants to provide descriptive information. Participants were informed of the purpose, the agency conducting the research, and the privacy protection of survey. The study was approved by the Institutional Review Board of Wenzhou Medical University. Written informed consent was obtained from all participants.

SF-36 Scores on the Evaluation of HRQoL

The Chinese version of the SF-36 was translated from the International Quality of Life Assessment (IQOLA) SF-36 Standard UK Version 1.0 (15), composed of a single item of health transition (HT) and 35 items, which can be divided into 8 subscales: (1) physical function (PF), limitations due to physical health problems (role physical, RP), (3) bodily pain (BP), (4) general health (GH), (5) vitality (VT), (6) social functioning (SF), (7) limitations due to emotional health problems (role-emotional, RE), and (8) mental health. The scores of SF-36 between 0 and 100 were assigned to each domain, with higher scores indicating more favorable functional status. The eight subdomain scores were aggregated into two summary measures: physical component summary (PCS) scores and mental component summary (MCS) scores, while a low MCS or PCS (< 50) is indicative of a poor HRQoL (16).

Chinese Population Norm

The Chinese population norm was based on the study done by He and colleagues (17). A random sample of Chinese adults in mainland China was collected and analyzed.

Statistical Analysis

Descriptive statistics for demographic information were calculated. The results were expressed as either the mean ± standard deviation (SD) or the categorical data were summarized as percentage of the total group. Differences in quantitative data distributions between patient subgroups were tested by Student's t-test for normally distributed data and by Wilcoxon rank-sum test or Kruskal-Wallis test for non-normally distributed data. Linear regression analysis was performed to explore the correlation between two variables. Logistic regression analysis was used to determine factors associated with decreased PCS score and MCS score. A p-value threshold of <0.05 was considered statistically significant. All statistical analyses were performed using SPSS software (SPSS Inc, USA).

RESULTS

Demographic and Clinical Characteristics of the Patients

Five hundred and four COVID-19 patients were enrolled in this cohort study. Among the 503 survivors, 131 did not follow up and 11 provided incomplete data. A total of 361 participants were available for analysis. Baseline characteristics of the participants were collected (**Table 1**). The study participants included 186 men (51.5%) and 175 women (48.5%), with 327 mild cases and 34 severe cases. The mean age (SD) was 47.22 years (13.03) and more than half of these patients were age 40 to 60 years. The mean body mass index (BMI) was 23.64 (3.31) and the mean LOS (SD) in hospital was 19.13 days (7.60).

Abbreviations: BP, bodily pain; GH, general health; HT, health transition; MCS, mental component summary; MH, mental health; PCS, physical component summary; PF, physical function; RE, role-emotional; RP, role physical; SF, social functioning; VT, vitality.

TABLE 1 | Socio-demographic characteristics and health situation of the study sample.

Characteristics	Subtype	Number	Percentage (%)
Sex	Male	186	51.5
	Female	175	48.5
Subgroup	Mild	327	90.6
	Severe	34	9.4
Age, years; mean (SD)	47.22(13.03)		
BMI	23.64(3.31)		
Heart rate, (bpm)	86.63 ± 12.8		
Systolic blood pressure, (mmHg)	130.91 ± 17.17		
Diastolic blood pressure, (mmHg)	82.97 ± 11.14		
Length of stay (LOS)	19.13 (7.60)		
Age	10–19	6	1.7
	20–29	29	8.0
	30–39	67	18.6
	40–49	106	29.3
	50–59	93	25.8
	60–69	44	12.2
	70–79	13	3.6
	80–89	3	0.8
Smoking	Yes	17	4.7
	No	344	95.3
Drinking	Yes	15	4.2
	No	346	95.8
Chronic diseases history	Yes	115	31.9
	No	246	68.1

Scores of SF-36 in the Study

The SF-36 mean score for eight specific dimensions was measured (**Figure 1**). In these eight dimensions, RP, SF, and RE subgroup scores were significantly lower in patients than the Chinese population norm (p<0.05). However, the scores of BP, GH, VT, and MH were higher than the norm group (p<0.05). Furthermore, there was no difference between two groups in PF score (p=0.75). At baseline, the mean scores were 55.96 ± 7.24 points for the PCSs and 48.92 ± 10.81 points for the MCSs, respectively. Comparison of HRQoL outcomes between COVID-19 patients and subjects with normal health of the different sexes was performed (**Table 2**). Compared with normative group, RP, SF, and RE subgroup scores were lower in the male group than the female group (p<0.01). In contrast, the scores of BP, MH, GH, and VT were higher than the normal group (p<0.01). However, no significant differences were observed between the two groups in PF (p=0.43, p=0.41).

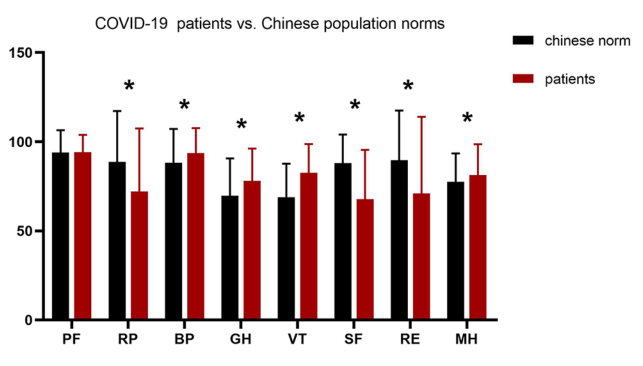

FIGURE 1 | Mean scores in SF-36 for COVID-19 patients vs. Chinese population norms. PF, physical functioning; SF, social functioning; RP, role limitation due to physical problems; RE, role limitation due to emotional problems; MH, mental health; BP, bodily pain; VT, vitality; GH, general health. *p < 0.05.

Factors Associated With SF-36 Among Patients in the Multivariate Linear Regression

Multivariate linear regression analysis was used to identify factors related to HRQoL of the follow-up cohort (**Table 3**). Age was negatively associated with PF, RP, but positively associated with VT (p < 0.05). PF, BP, and RE were negatively associated with the female sex (p< 0.05). The severity of the clinical subtype was significantly negatively associated with the PF, GH, RE, and MH (p < 0.05). Length of stay (LOS) was negatively associated with RE and RP, and positively associated with VT (p < 0.05). In addition, there were significant negative association between lung function parameters (Forced vital capacity, FVC) and MH (P < 0.05).

TABLE 2 | Comparison of health-related quality of life (HRQoL) outcomes between COVID-19 patients and subjects with normal health in different sex.

Scale	Sample	Mean± SD	P
PF	Male(n=186)	95.13(9.11)	0.43
	Norm	95.60(10.43)	
	Female(n=175)	93.17(10.26)	0.41
	Norm	92.57(13.88)	
RP	Male(n=186)	71.37(34.73)	<0.001
	Norm	90.76(26.09)	
	Female(n=175)	72.29(36.40)	<0.001
	Norm	86.99(30.41)	
BP	Male(n=186)	95.59(10.36)	<0.001
	Norm	89.77(17.95)	
	Female(n=175)	91.95(16.49)	<0.001
	Norm	86.73(19.84)	
GH	Male(n=186)	78.31(17.37)	<0.001
	Norm	71.20(20.03)	
	Female(n=175)	77.80(19.01)	<0.001
	Norm	68.41(21.68)	
VT	Male(n=186)	83.25(16.13)	<0.001
	Norm	70.69(17.97)	
	Female(n=175)	81.80(16.32)	<0.001
	Norm	67.30(19.36)	
SF	Male(n=186)	70.44(27.68)	<0.001
	Norm	88.39(16.20)	
	Female(n=175)	64.66(27.16)	<0.001
	Norm	87.71(15.82)	
RE	Male(n=186)	74.53(40.54)	<0.001
	Norm	91.12(26.06)	
	Female(n=175)	66.64(45.62)	<0.001
	Norm	88.15(29.52)	
MH	Male(n=186)	81.27(17.46)	<0.001
	Norm	77.80(15.78)	
	Female(n=175)	81.24(17.37)	<0.001
	Norm	77.43(17.42)	

TABLE 3 | Factors associated with Short-Form 36-item questionnaire (SF-36) among patients in the multivariate analysis.

Dependent Variable	Independent Variable	*P*	Beta	95%*CI*
PF	Age	<0.001	–0.231	–0.250, –0.097
	Female	0.033	–0.107	–3.999, –0.174
	Clinical subtype	0.001	–0.175	–9.198, –2.442
RP	Chronic kidney disease	0.005	–0.147	–118.331, –21.661
	Length of stay (LOS)	0.004	–0.149	–1.167, –0.221
	Age	0.038	–0.107	–0.571, –0.016
BP	Female	0.013	–0.131	–6.454, –0.773
GH	Clinical subtype	0.042	–0.107	–13.067, –0.233
VT	Age	0.004	0.128	0.032,0.289
	Length of stay (LOS)	0.040	0.113	0.023,0.461
SF	NA	NA	NA	NA
RE	Length of stay (LOS)	0.002	–0.163	–1.515, –0.357
	Clinical subtype	0.014	–0.128	–33.852, –3.920
	Female	0.043	–0.105	–17.774, –0.282
	Smoking history	0.022	–0.119	–1.515, –0.357
MH	Clinical subtype	0.022	–0.120	–13.045, –1.012
	FVC	<0.001	–0.223	–0.052, –0.019

Risk Factors for Low Health-Related Quality of Life

We stratified patients into two groups according to the PCS and MCS with a cutoff point of 50 and then explored the relationship between the PCS, MCS, and potential risk factors (**Tables 4** and **5**). Logistic regression analysis demonstrated that being overweight (OR 3.71, 95% CI 1.42–9.70) or obese (OR 3.94, 95% CI 1.47–10.52) were significant factors associated with a poor PCS score. Female sex (OR 2.22, 95% CI 1.30–3.81) was a significant determinant associated with an MCS < 50 in COVID-19 patients.

TABLE 4 | Logistic regression analysis of COVID-19 patients with a physical component summary (PCS) < 50.

		Multivariate logistic regression results	
		OR [95% CI]	**p value**
Age	<45	1	
	45~60	2.22 [0.68, 7.17]	0.184
	>60	0.87 [0.34, 2.27]	0.780
Sex	Male	1	
	Female	1.84 [0.87, 1.91]	0.110
BMI	Normal	0.70 [0.16,2.99].	0.625
	Overweight	3.71 [1.42, 9.70]	0.008
	Obesity	3.94 [1.47,10.52]	0.006
Clinical subtype	Mild	1	
	Server	1.49 [0.55,4.00]	0.434
LOS		1.00 [0.96,1.04]	0.911
FEV1		0.68 [0.36,1.29]	0.235
FVC		1.00 [0.94,1.08]	0.925
FEV1/FVC		1.03 [0.99,1.06]	0.132
Smoking	No	1	
	Yes	0.37 [0.05,2.60]	0.319
Drinking	No	1	
	Yes	3.25 [0.74,14.28]	0.118
Hypertension	No	1	
	Yes	1.08 [0.48,2.45]	0.851
Diabetes	No	1	
	Yes	1.92[0.68,5.42]	0.217

TABLE 5 | Logistic regression analysis of COVID-19 patients with a mental component summary (MCS) < 50.

		Multivariate logistic regression results	
		OR [95% CI]	**p value**
Age	<45	1	
	45~60	0.98 [0.44,2.20]	0.957
	>60	1.18 [0.58,2.41]	0.641
Sex	Male	1	
	Female	2.22 [1.30,3.81]	0.005
BMI	Normal	1	
	Overweight	1.14 [0.51,2.55]	0.751
	Obesity	1.26 [0.56,2.87]	0.579
Clinical subtype	Mild	1	
	Severe	1.70 [0.76,3.78]	0.225
Length of stay (LOS)		0.61 [0.27,1.36].	0.125
FEV1		0.79 [0.53,1.27].	0.364
FVC		1.00 [0.96,1.04]	0.860
FEV1/FVC		1.02 [0.99,1.05]	0.276
Smoking	No	1	
	Yes	2.16 [0.67,6.89]	0.195
Drinking	No	1	
	Yes	0.54 [0.16,1.85]	0.329

DISCUSSION

The COVID-19 pandemic is a significant psychological and physiological stressor for individuals, as well as organizations across social and economic communities worldwide. This study is the first to perform a comprehensive analysis of HRQoL in Chinese COVID-19 patients in a 1-month follow-up cohort.

In this study, we examined the absolute difference between COVID-19 patients and a normal Chinese population in SF-36 scores, including male and female subsets. Patients had higher body pain and vitality scores, but lower physiological function, social function, and role-physical scores. To our knowledge, the COVID-19 patients had uncommon symptoms, including headache, abdominal pain, and chest pain, especially in the severe/critical group (18). Therefore, the physical pain caused by the COVID-19 may last for 1 month. Furthermore, during the acute phase of the disease, patients were quarantined in hospital wards and followed strict control measures (19). They had to reduce their connection with the community. Meanwhile, they focused more on themselves and less on the individuals around them, as well as social affairs, leading to lower SF scores. These findings could be applicable to infectious disease outbreaks for informing psychosocial factors important to long-term recovery.

Multivariate analysis demonstrated that the clinical subtype was negatively correlated with PF, GH, RE, and MH. This phenomenon demonstrated that the more severe the condition of patients, the more severe the impact on physical health, as well as emotional and mental health, after hospital discharge. The results are not surprising as—in addition to the physical and psychological impairment—the long period of isolation, fear of illness, and extreme uncertainty during the COVID-19 illness had tremendous psychological and mood disturbances, such as insomnia, irritability, and anger. Recent studies observed that during the early stage of the COVID-19 outbreak, patients were at higher risk for mental health issues than the general population (20, 21). Nevertheless, the neuropsychiatric mechanism of this pandemic is currently unknown. In the brain, contiguous spread from the nasopharyngeal mucosa or a hematogenous route are two major entry pathways of SARS-CoV-2 into the CNS (22), as upper airway epithelium and vascular endothelium express Angiotensin Converting Enzyme 2 receptor (23). In addition, viruses undergo retrograde axonal transport to reach the neuron cell bodies or infecting endothelial cells of the blood-brain-barrier, epithelial cells of the blood-cerebrospinal fluid barrier in the choroid plexus (24). The breadth of this pandemic will likely require closer examination of the mechanisms underlying post-viral neuropsychiatric sequelae. Physical activity and exercise have been proven to be an effective method for directly improving both mental and physical health in general (25). Thus, COVID-19 patients with chronic diseases could also benefit from exercise.

Further subgroup analysis helped us identify patients with decreased quality of life. The PCS and MCS have been reported using norm-based scoring (mean 50 and SD 50) in nearly every published study to date (26). In our study, we found 15.5% of patients displayed poor physical health and 48.5% demonstrated poor mental health (scores <50). Multivariate logistical regression was performed to examine whether some factors were possible predictors of decreased PCS or MCS scores in SF-36. Overweight and obesity were predictors of PCSs lower than 50, indicating an association between BMI and impaired physical function. Early studies have demonstrated a similar association between increasing BMI and worse PCS scores (27, 28). BMI may influence HRQoL independent of related diseases (29). Therefore, BMI management is also crucial for the long-term rehabilitation of COVID-19. Moreover, female sex was a predictor of MCSs lower than 50, suggesting that female sex is a risk factor for the mental health quality of life in Chinese COVID-19 patients. Males and females have unique social roles and pressures, with different impacts on their disease course. Females take more care of family than males and need more energy to face stress, which results in a substantial emotional harm (30). Consequently, we argue that women are a concern in COVID-19 and should be considered for potential need for longer rehabilitation times. These findings could be applicable to infectious disease outbreaks for informing psychosocial factors important to long-term recovery. Psychotherapy such as cognitive behavior therapy and mindfulness therapy may improve the mental health of COVID-19 patients.

This study has several limitations. (1) This study may be biased due to relatively mild disease. Milder illness may correlate with higher quality of life and cause an overestimate of HRQoL. (2) Another limitation is that the study population did not include children, which should be investigated further in future research. (3) Furthermore, investigation of the physical and mental health of COVID-19 patients should include more specific, comprehensive evaluation tools, such as the Quality of Life Enjoyment and Satisfaction Questionnaire, Hamilton Anxiety Scale, and Hamilton Depression Scale, which may add to the accuracy of assessment of mental health status. (4) Finally, the cross-sectional nature of the data precludes making causal inferences.

CONCLUSION

Our study provides a database for the physical profile, psychological profile, and HRQoL status of patients with COVID-19 at first month follow up. The HRQoL impairment of Chinese COVID-19 patients was significant. We propose early measures should be taken to prevent mental health problems, as well as initiation of a comprehensive program to assist COVID-19 patients in recovering basic function. Furthermore, we encourage the biomedical research community to pursue longitudinal monitoring of neuropsychiatric symptoms and status. Further follow-up is needed to assess the HRQoL of COVID-19 patients.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Wenzhou Medical University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

K-YC, J-SZ, and X-KL conceived the study. K-YC, TL, and F-HG collected and analyzed the data. K-YC, J-SZ, and X-KL wrote the paper. All authors contributed to the article and approved the submitted version.

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A Survey of Attitudes, Anxiety Status, and Protective Behaviors of the University Students During the COVID-19 Outbreak in Turkey

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A new coronavirus disease began on 31 December 2019 in Wuhan/China and has caused a global outbreak in only a few months resulting in millions being infected. In conjunction with its' physical side effects, this outbreak also has a tremendous impact on psychology health. This study aims to assess the spread and frequency of protective behaviors, emotional and anxiety status among the Turkish population using a rapid survey during the COVID-19 outbreak. An online questionnaire was administered to 3,040 respondents between the ages of 18–30. This cross-sectional study was conducted from Apr 2 to Apr 8, 2020. While questions related to the outbreak were created by members of our neuroscience department, the Turkish version of the Abbreviated Beck Anxiety Inventory was included in our survey to measure anxiety status. Pearson correlation coefficient was used for statistical analysis. We found that 90% of respondents report washing hands more frequently since the outbreak while %50 wear protective gloves. Respondents were more fearful of their relatives catching the coronavirus disease than they were of themselves catching it. In response to the question, "What are your emotions about the coronavirus?", 38% responded with "worried". There was a significant correlation between anxiety status and consumption information from the media about COVID-19. Individual early protection behaviors might slow transmission of the outbreak. Our results showed that the behavior of the participants has changed in predictable ways during the COVID-19 outbreak. Understanding how emotional responses such as fear and anxiety status vary and the specific factors that mediate it may help with the design of outbreak control strategies.

Keywords: COVID-19, coronavirus disease, behavioral, outbreak, anxiety, survey

INTRODUCTION

Novel coronavirus disease (COVID-19) began in Wuhan, China in December 2019 and has spread worldwide since then. This new coronavirus disease turned into an outbreak reaching around the world in as little as three months showing the serious threat of this outbreak. The first patient with coronavirus disease was identified in Turkey on March 10, 2020 (The Republic of Turkey, Ministry of Health, 02/04/2020).

People display awareness of protective behaviors against diseases and develop health-protective attitudes during a health crisis, such as an outbreak. Timely and accurate information plays a critical role in controlling the spread of illness and managing fear and uncertainty during an outbreak. Furthermore, society's perception of risk and anxiety of being ill have an impact on prevention behaviors and measures to be taken. Knowing what to do helps people feel safer and enhances the belief that they can take meaningful steps to protect themselves (1). In outbreaks, anxiety is one of the psychological problems that can be seen in humans because pandemics can be seen as events that can raise concerns. The use of a face mask (2) and protective measures during the workplace are protective factors for mental health (3). Anxiety and related disorders (such as posttraumatic stress disorder, and obsessive-compulsive disorder) can be seen due to stressful life events, and they are prevalent, debilitating, and costly (4, 5). The outbreak of COVID-19 has been reported to cause mental health problems among the people in China (6), Japan (7), and Wuhan (8).

Due to the sudden nature of the outbreak and the infectious power of the coronavirus, people may show psychological and stress-related reactions. Some prohibitions and precautions were taken against the coronavirus disease outbreak such as social isolation, quarantine, travel restrictions, contact avoidance. These measures affect people's social life, emotional status, and psychological well-being. It is necessary to investigate and understand the publics' mental states during this tumultuous time (6). Accordingly, psychological and behavioural measurement and evaluation are essential. Psychological tests contribute to the identification of certain disorders, monitoring of disease, and make predictions in a way that reflects the variability in human behaviors (9). Furthermore, psychological tests such as web-based surveys offer a rapid and efficient method of identifying problems, planning and monitoring a course of treatment, and assessing the outcomes of interventions (10). Particularly in the severe COVID-19 pandemic, the data obtained through these methods provide information about people's attitudes, emotions, and behaviors while providing a contemporary perspective to researchers. However, what type of psychological disorders are prevalent and how they distribute among the population are not know. Therefore, a rapid assessment of outbreak-associated psychological disorders for the public is needed (11). So, the current study aims to determine the prevalence and distribution of anxiety and emotional status and protective behaviors among the young Turkish population and examine their associations with media exposure with a rapid assessment during the COVID-19 outbreak.

MATERIALS AND METHODS

Participants and Design

This cross-sectional study was conducted online over a span of seven days from April 2 to April 8, 2020. Participants were 3040 university students living in Turkey. Google documents were used as a platform to design online surveys that were automatically hosted *via* a unique URL. The survey was created by the Department of Neuroscience at Ankara Yildirim Beyazit University. Respondents were asked about about (i) demographic and epidemiological information, (ii) protective behaviors to prevent catching the coronavirus, (iii) different emotions and thoughts caused by the COVID-19 outbreak, (iv) anxiety status during the COVID-19 outbreak, and (v) exposure to COVID-19 Outbreak on TV. Respondents had to answer a yes-no question to confirm their willingness to participate voluntarily. After confirmation of the question, the participant was directed to complete the self-report survey. Respondents were found from internet social media tools such as Facebook and Twitter.

Measures

Respondents gave free-text responses to questions about their name-surname, current age, and city.

Protective Behaviors in Response to COVID-19

To measure the response of epidemiologically relevant behavior to information on the coronavirus disease outbreak, we asked seven yes/no questions about precaution actions taken by the respondents. In the survey, we asked: "washing hands more often with soap for 20 seconds", "wearing protective gloves", "wearing a mask", "avoiding contact with hands, face, and eyes", "washing clothes at a minimum of 60 degrees", "personal and social isolation", and "frequent ventilation of the room". All of these actions are recommended as protective measures by doctors.

Emotional and Anxiety Status With COVID-19 Outbreak

An important epidemiological question is how people's affective states and anxiety have undertaken change with progression of the outbreak. To measure this, we asked participants two critical questions:

"How scared are you of catching the coronavirus disease (COVID-19)?"

"How scared are you that a relative will catch the coronavirus disease (COVID-19)?"

These questions were asked using a five-point ordinal scale with anchors at all points: "never", "somewhat", "moderate", "very", and "extremely". The two questions were compared to each other for the frequency distribution of perceived risk and fear of the new coronavirus disease outbreak.

To assess emotional status in the survey, we asked: "What are your emotions about the coronavirus?". The respondents were asked to choose from five different emotions. The choices were: "afraid", "sad", "worried", "indifferent", and "temporary".

Respondents were also asked about anxiety status during the coronavirus disease outbreak. We used eight-items from the Turkish version of Abbreviated Beck Anxiety Inventory: "fear of death", "scared", "difficulty in breathing", "fear of losing control", "feeling of choking", "nervous", "terrified or afraid", and "fear of the worst happening" (12, 13). Additionally, we added the following anxiety statuses: "Fear of losing your relative", "sad", "future anxiety". A self-report measure of anxiety severity experienced in the last 15 days was also included. These statements were asked using a five-point ordinal scale with anchors at all points.: "never", "somewhat", "moderate", "serious", and "very serious".

For our analysis of participants' responses to the threat of the coronavirus disease (COVID-19), we used a variable called "survey day". April 2nd represents the first day of the survey and April 8th represents the last day. This survey was joined one time by each participant. We investigated the change in respondents' protective behavior status and emotional status for each day in the survey.

Exposure to COVID-19 Outbreak on TV

Media exposure was evaluated by asking how often respondents were exposed to news and information about COVID-19 on TV over the past fifteen days. Response options were "never", "1–3 hours", "3–5 hours", "5–7 hours", and "7 or more hours". The correlation between protection behavior, sleep status, emotional status and information about COVID-19 from the TV was investigated.

Statistical Analysis

Statistical analyses were performed with the Statistical Package for the Social Sciences (SPSS 22.0, SPSS Inc., Chicago, IL) software. The Pearson correlation coefficient (PCC) was used to evaluate a possible correlation between information about COVID-19 on TV and protection behavior after determining the normal distribution of data. To assess the normality of a set of data, researchers usually report the Skewness and Kurtosis of such data. Normality is tested according to the common rule-of-thumb, which is to run descriptive statistics to determine both Skewness and Kurtosis. PCC was used to assess the relationship between information about COVID-19 on the TV and emotional status. PCC was also used to analyze the relationship between information about COVID-19 on TV and sleep status. Statistical tests were carried out with a level of significance at p=0.05.

RESULTS

A total of 3,040 Turkish university students (77,5% female, 22,5% male) ages 18–30 (20,7 ± 2,2) filled out the online survey named "Web-based Behavioral Measurement Related to COVID-19". **Figure 1** shows the distribution of the survey date and the number of respondents. **Table 1** displays the epidemiological and demographic data of the respondents.

TABLE 1 | Demographic data of the study population.

Variable	Respondents
Total	3040
Gender	
Female	2355 (77.5%)
Male	685 (22.5%)
Age (years)	
18-20	1370 (45.1%)
21-23	1321 (43.5%)
24-30	349 (11.4%)
Smoking Status	
Smokers	639 (21%)
Non-smokers	2401 (79%)
Chronic disease	
Yes	258 (8.5%)
No	2782 (91.5%)
Physical activity	
Yes	1570 (51.6%)
No	1470 (48.4%)

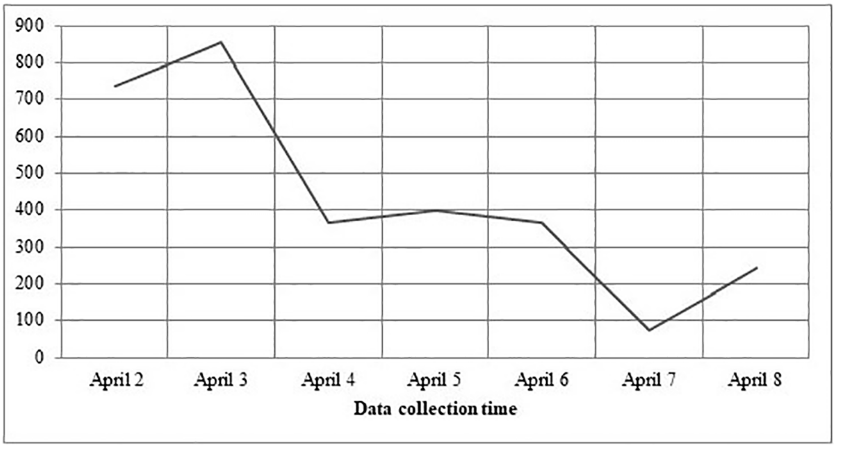


FIGURE 1 | Presents the daily distribution respondents to the survey.

Figure 2 shows the frequency distribution of protective behavior. Respondents paid attention to hand washing (90%), social isolation (97%), and room ventilation (95%). The rate of wearing protective gloves and masks is notably lower (50%).

Figures 3A, B reveal the frequency distribution of perceived COVID-19 risk and fear for respondents and their relatives. Respondents had to moderate fear of catching constituted 44% while 9% stated that they did not have this fear. Respondents' fear of their relatives being infected with the disease was much higher with 80% of them reporting their fear as high and extreme.

Figure 4 includes responses to the question "What are your emotions about the coronavirus?". While 38% of the respondents stated that they were worried about the new coronavirus, there was a 2% portion that reported they were indifferent. In addition, 20% of the respondents' perceived this virus as temporary.

According to Tabachnick, data may be assumed to be normal if both Skewness and Kurtosis are within a value range of ±1.5. **Tables 2** and **3** present the results of Skewness and Kurtosis analysis on each of the items that measure the constructs of our study (14). There was a significant correlation between being exposed to information about COVID-19 on TV, hand washing, and clothes (**Table 2**). However, as shown in **Table 3** no significant correlation was found between being exposed to information about COVID-19 on TV and other precautions. The correlations are summarized in **Tables 2** and **3**.

In **Figure 5**, we show the distribution of anxiety status during the COVID-19 outbreak. "Serious" and "very serious" options were high among the responses given to "future anxiety" and "fear of losing relatives". In addition, the "never" option was high in response to the questions about "difficulty in breathing" and "feeling of choking".

In **Figures 6** and **7**, we plot the change in respondents' protective behavior and emotional status over the survey days. On the third (April 4th) and sixth day (April 7th) of the study, we see that the number of people reporting a calm emotional state is very high, and the number of people reporting the high values of the protective behaviors is significantly reduced.

So, the current study aimed to determine the prevalence and distribution of anxiety and emotional status and protective behaviors among the young Turkish population and examine their associations with media exposure using a rapid assessment during the COVID-19 outbreak.

DISCUSSION

Our study is the first study to date that demonstrates the behavioral results of during the COVID-19 outbreak in Turkey. We preferred a web-based survey for assessment of behavioral responses because it is a faster. We found that respondents' behavior varies regularly with covariates from demographic, epidemiological, media, and emotional status. We determined the protective behaviors and anxiety of people in our country were excessive at the beginning of the survey. Respondents' fear of their relatives catching the virus was more than the fear they had for catching the virus themselves.

According to the results of our study, among the protective behaviors investigated, social isolation was very high at 97%. As a matter of fact, a study by Filder Smith and Do Freedman also stated that social distances would reduce transmission, as such outbreak diseases require a certain intimacy of people (15). Another surprising point in this study was that use of masks and gloves was higher than we expected because there was no legal obligation to do so. Although some studies (16) emphasize that only individuals with respiratory symptoms should wear a mask, we think that this protection behavior positively reflects the decrease in the number of cases in our country. Another study emphasized that it is very important to wash hands with soap and water before putting on the face mask as well as wearing a face mask (17). In regards to the results we obtained, the handwashing rate of the respondents' was quite high, and it was higher than the mask-wearing rate.

In response to the question, "What are your emotions about the COVID-19?", 38% of respondents said "worried". According to this result, it must be considered normal for respondents to

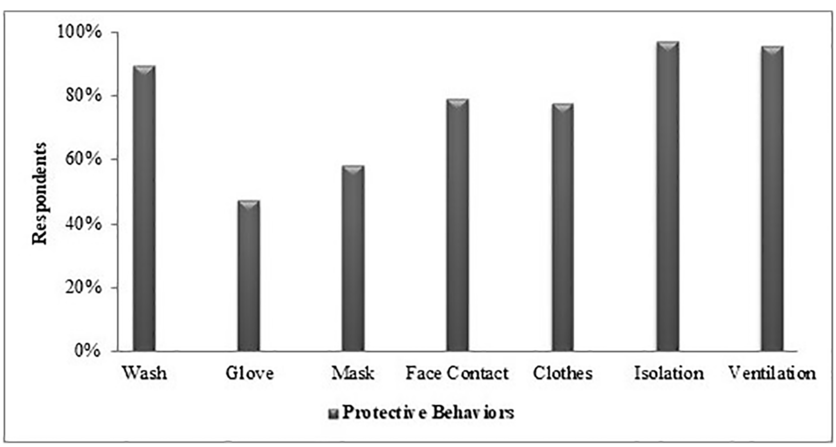
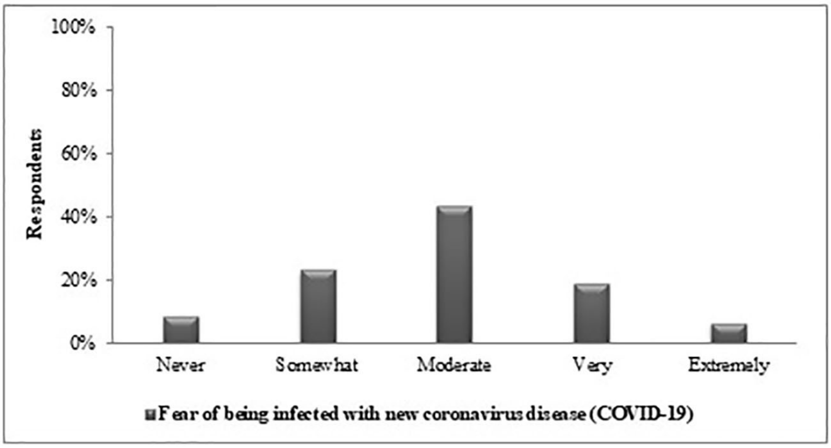
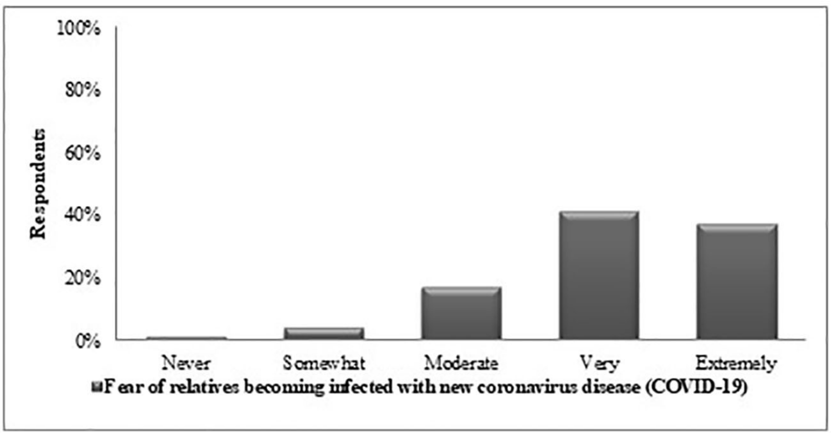


FIGURE 2 | Frequency of the protection behavior undertaken by the respondents, %. Wash, washing hands frequently with soap for 20 s; glove, wear protective gloves when going out; mask, wear protective mask when going out; face contact, avoid touch with hands face and eyes; cloth, washing clothes at least 60 degrees; isolation, personal and social isolation; ventilation, frequent ventilation of the room.



A



B

FIGURE 3 | Frequency distribution of fear of relatives infected with new coronavirus disease (COVID-19) **(A)** Oneself cathing **(B)** Relative cathing the disease.

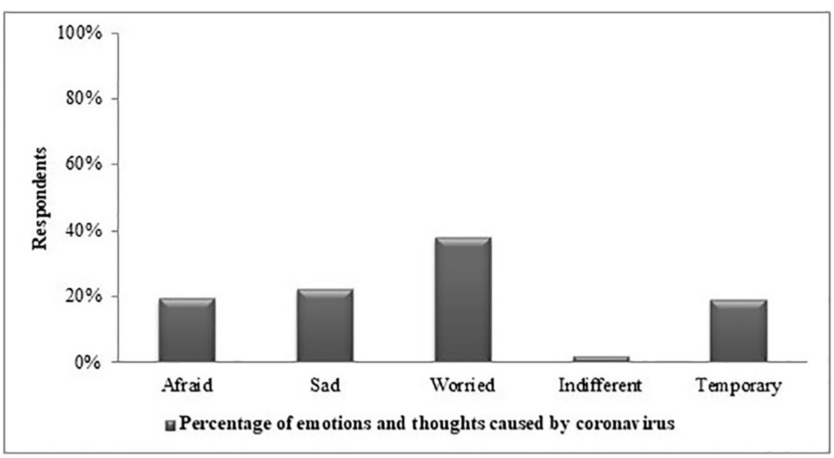


FIGURE 4 | Frequency distribution of emotional status about COVID-19 by respondents.

TABLE 2 | Correlation between information about COVID-19 on the TV and protection behaviors.

	Wash	Mask	Gloves	Clothes	Ventilation	Face contact	Isolation
Information							
PCC	0.042*	0.014	0.005	0.039*	0.030	0.029	0.015
p-value	0.020	0.450	0.784	0.031	0.102	0.108	0.424
Skewness	1.328	0.842	0.735	0.933	0.620	0.542	0.723
Kurtosis	-0.237	-0.611	-1.371	-1.134	-1.003	-0.463	-0.691

*PCC, Pearson correlation coefficent; Information, Being exposed to information about COVID-19 on TV; p < 0.05. *, statistically significant.*

TABLE 3 | (A) Correlation between sleep status and exposure to information (TV, social media); **(B)** Correlation between information about COVID-19 on the TV and emotional status.

A	Information	Watch TV	PC	MP
Sleep status				
PCC	0.017	0.005	0.066*	0.043*
p-value	0.335	0.425	0.000	0.018
Skewness	0.817	0.737	0.821	0.309
Kurtosis	-0.733	-1.464	-0.337	-1.020
B	**Fear**	**Fear of death**	**Fear of losing your relative**	**Future anxiety**
Information				
PCC	0.157*	0.179*	0.107*	0.146*
p-value	0.0	0.0	0.0	0.0
Skewness	0.517	0.716	0.101	0.128
Kurtosis	-0.406	-0.176	-0.138	-1.005

*PCC, Pearson correlation coefficent; Information, Being exposed to information about COVID-19 on TV; PC, Spending time on the computer; MP, Spending time on a mobile phone; p < 0.05. *, statistically significant.*

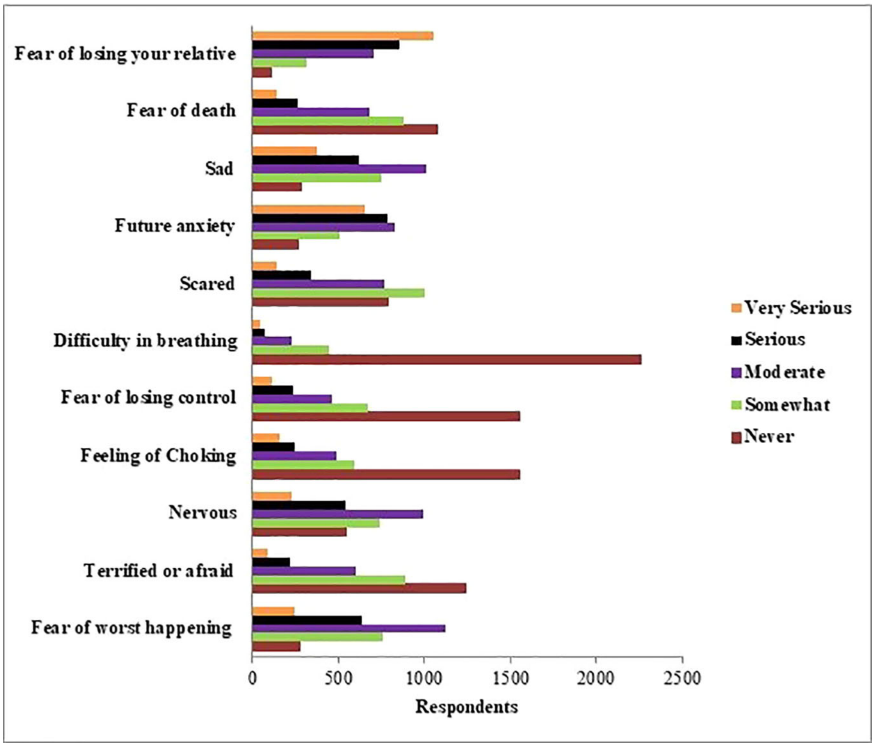


FIGURE 5 | Distribution of anxiety status during the COVID-19 outbreak.

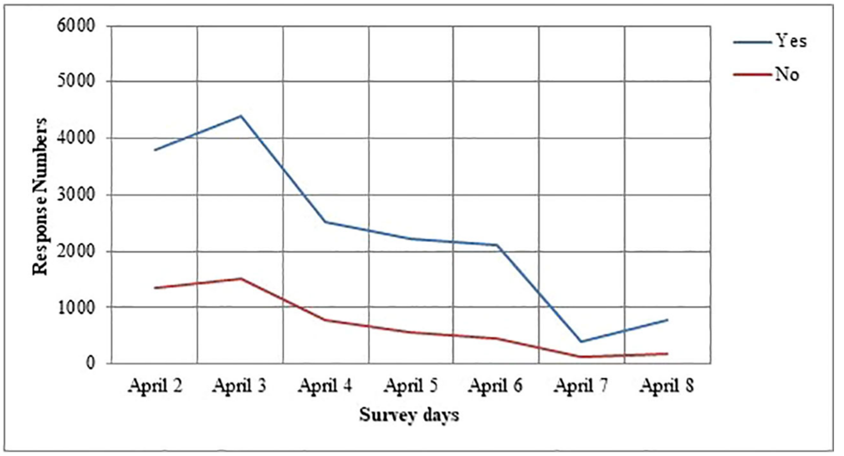


FIGURE 6 | Changes in response numbers of the protection behavior of the survey days.

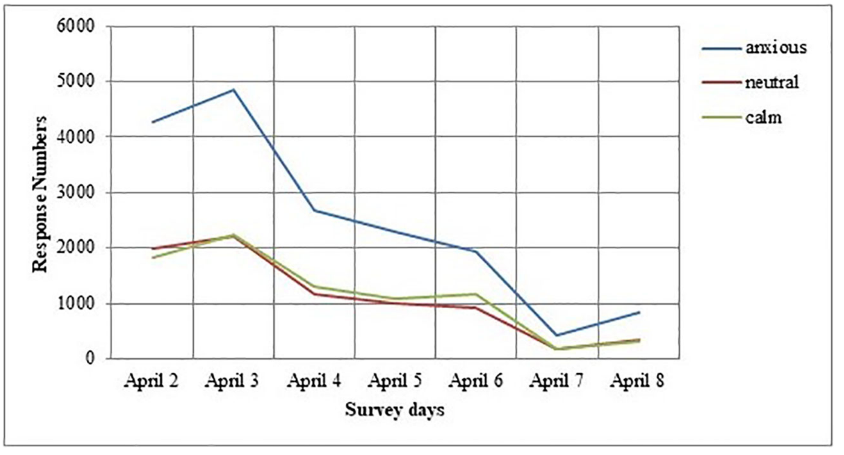


FIGURE 7 | Changes in response numbers of the emotional status of the survey days.

worry about their health. We interpreted this as a positive result that young people have supportive messages and encouraging information. Worry could be increased by misperception in society (18). As evidence from prior outbreaks such as SARS and Ebola showed (19–21) moderate amounts of worrying is effective for controlling the outbreak, but may lead to negative consequences of coronavirus disease control, if it is excessive.

In response to the question, "How scared are you of getting the coronavirus disease (COVID-19)?", 44% of the respondents stated that they have a moderate level of fear. Strikingly, in response to "How scared are you that a relative will catch the coronavirus disease (COVID-19)?" 80% of respondents said "extremely". The scare is directly associated with the COVID-19's rapid and invisible transmission rate, as well as its morbidity and mortality rates (22). It appears that humans perceive it as their moral duty to protect relatives and may exhibit irrational behaviors to do so. Consequently, elevated fears and misconceptions about COVID-19 may result in a disorder of excessive emotional status.

Our study has some public health implications. Our results demonstrate that respondents' protective behaviors vary consistently with media. Because of strict social isolation precautions, people are maintaining connectivity now more than before using social media and networks, to facilitate human interaction and information sharing about COVID-19. The highest responses to protective behaviors during the COVID-19 outbreak was for social isolation. Previous research shows that respondents did not know that COVID-19 could be transmitted by droplets, which might reduce certain precautionary measures (6). Incompatible with this work were our results showing that respondents use of protective behaviors was high. Effective visual videos, some with famous people, have been shared on social media in our country since the outbreak. Hence it has increased accurate knowledge and positive attitudes of the public about coronavirus disease outbreak. We suggest that providing simple and repeated health education *via* social media is important for encouraging protective behaviors. Our results have revealed that there was a significant correlation between using a computer or mobile phones and sleep patterns. Previous studies support our conclusion that social media, computer games, and the internet cause poor sleep quality (23–27).

When we pay attention to the anxieties caused by COVID-19, the most serious level of responses was fear of losing relatives and future anxiety. Anxiety responses to the feeling of nervousness, sadness, and fear of the worst happening are moderate in our study. The anxiety of the respondents might be result in switching to online education, working from home as much as possible in business life, reducing working hours, social distancing, and other social measures taken across the country. Recent research has indicated that the delay in academic activities was related to the emergence of anxiety symptoms with university students in China (28). Another study has demonstrated that college students' anxiety about COVID-19 might have been related to the effect of the coronavirus disease on their studies (29) and future employment (6). Prolonged lockdown had several adverse impacts on mental health, especially among young respondents who demonstrated a higher psychological impact of COVID-19 in China (6). Although COVID-19 treatment and vaccine finding studies (30–32) continue around the world, a cure has not yet been found. Consequently, because coronavirus disease does not have an effective treatment, it results in high anxiety responses.

We noted the change throughout the survey in respondent's protective behavior and emotional status. We observed that respondents' deployment of protective behavior is affected by their level of the outbreak and current information. We predict that the level of protection and anxious tendencies of people, the adaptation process, and protective behaviors may have been affected by this outbreak. In the study of Jones and Salathe, considering the progress of protection behaviors over time, an increase is observed on the first day, then a sharp decrease, and then a more stable progression is observed (33). Our results showing a linear trend in the perception of outbreak dispersion is associated with a significant decrease in the level of protective behavior and anxiety status in our respondents' compared to the first survey days. In addition, the behavior and anxiety situation of respondents may be decreased due to the government's precautions such as the closure of restaurants and intercity restrictions on transportation in our country. In the last of the survey days, we think that the increase in respondents' anxiety status and protective behavior tendency is a result of the increase in cases in countries such as Italy and Spain. Our research is scientifically important for the study of the spread of knowledge and its relationship to anxiety levels and behavioral change during the most uncertain time of an outbreak.

Several limitations should be noted in the present study. Exposure to news about the COVID-19 outbreak on the internet is not investigated. Meng et al. reported that gender is a biological variable to be considered in the prevention and treatment of COVID-19 (34). In another study, men were emphasized to have worse outcomes and risk of death than women, independent of age, with COVID-19 (35). Considering these studies, an important limitation of this study is that more than half of the participants are female participants. Our participants consisted only of young adults. We did not evaluate the economic status of the participants. Economic vulnerabilities may be the reason for people to seek medical assessment when they present with COVID-19 symptoms (36).

In conclusion, psychological and behavioral researches like this study could help to make progress in building a compassionate person and caring society which would be more effective in preventing and overcoming outbreaks. Our findings to be obtained may shed light on future processes that seem ambiguous for now. Although our study is web-based and has partial limitations for the general population, its rapid implementation, uncovering of unique and critical scientific data may increase the level of public awareness and perhaps lead to life-saving consequences. Public health education programs purposed at improving COVID-19 knowledge can useful encouraging optimistic attitudes towards COVID-19. In addition, cognitive-behavioral therapy can reduce stress and coherent copings (37). University students with good COVID-19 knowledge may reduce negative emotions and deal with the risks from an infection outbreak with a more positive attitude. Our study may have implications for young adult public health provision during outbreaks of infectious disease, including improvements in protective behavior. After the COVID-19 outbreak, studies on the psychological and behavioral effects of the pandemic can also be conducted. The information we have obtained in behavioral dimensions will be an essential scientific reference for other COVID-19 researchers in this vital and critical process and beyond.

DATA AVAILABILITY STATEMENT

All datasets presented in this study are included in the article.

ETHICS STATEMENT

Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article. According to the World Health Organization Guidelines on Ethical Issues in Public Health Surveillance, a surveillance study in emergency outbreak situations is clearly exempted from ethical review and oversight (HO guidelines on ethical issues in public health surveillance. Geneva: World Health Organization; 2017. Licence: CC BY-NC-SA 3.0 IGO.). Our online survey was applied in April when the lockdown of Ankara City/Turkey was officially announced. Respondents had to answer a yes-no question to confirm their willingness to participate voluntarily. After confirmation of the question, the participant was directed to complete the self-report survey.

AUTHOR CONTRIBUTIONS

GA, MK, and SY conceived and designed the study. SY and MG organized the database. SY, AK, BS, MG, and MK conceived the statistical approach. GA performed the statistical analysis and wrote the manuscript. All authors contributed to the article and approved the submitted version.

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Perceived Risk and Protection From Infection and Depressive Symptoms Among Healthcare Workers in Mainland China and Hong Kong During COVID-19

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Psychological health among healthcare workers (HCWs) has become a major concern since the COVID-19 outbreak. HCWs perceived risks of contracting COVID-19, in relation to depression were investigated. It was hypothesized that perceived high risk of contracting COVID-19 (close contact with cases, inadequate provision of personal protective equipment, insufficient infection control training, and presence of symptoms) would be significant predictors of depression. Our cross-sectional survey was completed by HCWs across three regions (Hubei, Guangdong, Hong Kong) between March 9 to April 9 2020 using convenience sampling. Depression was assessed using the 9-item Patient Health Questionnaire (PHQ-9). Prevalence of depression was 50.4% (95% CI: 44.5-56.2), 15.1% (10.1-21.9) and 12.9% (10.3-16.2) for HCWs in Hong Kong, Hubei and Guangdong, respectively. The strongest significant risk factors for depression, after adjustment, were HCWs who reported the greatest extent of feeling susceptible to contracting COVID-19 and those who reported the greatest difficulty obtaining face masks. HCWs whose family/peers greatly encouraged face mask use had lower prevalence of depression. Access to adequate supplies of personal protective equipment is essential for the psychological health of HCWs working in stressful environments, through potentially easing their perceptions of vulnerability to COVID-19.

Keywords: COVID-19, depression, healthcare workers, perceived vulnerability, personal protective equipment

INTRODUCTION

In the immediate aftermath of the outbreak of COVID-19 in Wuhan, Hubei Province, China, a number of tertiary hospitals in adjacent regions moved quickly to establish psychological intervention programs to support healthcare workers (HCWs) working with infected, and potentially infected patients (1, 2). This reflects the recognition of the centrality of maintaining optimal psychological functioning among HCWs for effective healthcare service delivery, and an implicit recognition that HCWs are adversely affected by both physical and psychological stresses (3). While the effectiveness of these programs, which include the provision of online courses on dealing with common psychological problems, hotlines to provide psychological assistance, and group-based activities designed to reduce stress,(1) has yet to be evaluated, it has been reported that staff are reluctant to engage with such services (1).

The question remains as to how it can be best achieved to support the psychological well-being of HCWs working in high-risk environments under high-pressure and anti-pandemic situations (4). Identification of specific psychological difficulties and their risk factors are required for a multi-faceted and nuanced approach to developing effective evidence-based support (5, 6). Individual responses may vary as a function of intrapersonal risk perception and resilience, and workplace environmental and organizational factors including training, availability and use of personal protective equipment (PPE) (e.g., protective face wear, gloves, aprons, gowns), (7) all of which may explain the psychological effects frontline HCWs experience during COVID-19 (3).

The majority of HCWs report the protection of one's own physical health as a primary concern in pandemic situations (6). Indeed, HCWs are expected to have adequate workplace protection measures (7). The limited availability of PPE due to global shortage and perceived risk of contracting the disease when exposed to infected patients may potentially underscore the onset of mental health symptoms. Confidence in infection-control measures, such as the effectiveness of face masks may reduce risk perception and may also mitigate and facilitate an adaptive stress response. However, what remains largely absent from the literature to date, is an examination of actual pandemic situations and if perceived risk (vulnerability and fear of contracting) and mitigations (effectiveness of face masks and knowledge of COVID-19) are associated with mental health difficulties, such as depression, in physicians and nurses. Here we report findings from an online survey of HCWs across three regions of China.

METHODS

Study Design and Population

We conducted an internet-based survey among HCWs in Hubei (mainly Wuhan), Guangdong (from the cities of Foshan, Shenzhen, Zhongshan, Zhuhai) provinces of Mainland China, and Hong Kong between March 9, 2020, and April 9, 2020, using a convenience sampling method. HCWs from a variety of practice settings, including hospitals and clinics were invited using various online platforms (e.g., discussion boards of societies of healthcare professionals, Facebook, Instagram, WeChat). For HCWs who accessed the link from the online platforms, study-related information was presented and respondents were then asked to indicate their consent preference ("agree" or "not agree"). Those who provided consent were then presented with the survey questionnaire (described below). Participation was voluntary and anonymous. Of the 1566 HCWs who accessed the link, 42.5% (146/343) in Hubei, 65.4% (510/780) in Guangdong and 62.3% (276/443) in Hong Kong agreed to participate. There were no exclusion criteria for the study and data from all participants who provided positive consent were included. The study was approved by the Human Subjects Ethics Sub-committee of the Special Geriatric Committee of Zhongshan Medical Association (SGCZSMA20200306) and was carried out in accordance with the Declaration of Helsinki.

Questionnaire

The 35-item questionnaire, administered in Chinese, was comprised of four sections (see **Supplementary Material**). Section 1 enquired about demographics and their profession. Section 2 enquired about the provision of training and face masks/respirators in their hospital/clinic for the COVID-19 epidemic. Section 3 explored the factors leading to or associated with face mask/respirator use, using the Health Belief Model framework, modified from previous studies (8). Section 4 was the nine-item Patient Health Questionnaire-9 (PHQ-9), used for screening and measuring the severity of depressive symptoms (9).

Depressive Symptoms

The outcome of interest was the presence of depressive symptoms, as measured by the PHQ-9, which scores each of the nine diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) for depression from 0 (not at all) to 3 (nearly every day) over the previous two weeks (10). With a cut-off score of 9, PHQ-9 had a sensitivity of 80% and a specificity of 92% for diagnosing major depression in the Hong Kong Chinese population (11). For this study, those who had scores of 15-27 were considered to have moderate/severe depression.

Exposure

Due to the ongoing nature of the COVID-19 outbreak, we considered four exposures associated with COVID-19, *a priori*, as potential risk factors for depression among HCWs over the previous two weeks. These included: (i) close contact with confirmed or suspected COVID-19 cases; (ii) inadequate provision of personal protective equipment; (iii) insufficient infection control training; and (iv) having symptoms recently similar to those manifested in a COVID-19 infection.

Participants also rated on a four-point scale (not at all/to a small extent/to a moderate extent/to a very great extent) the degree (i) they felt susceptible to COVID-19 infection; (ii) the fear of contracting coronavirus; (iii) face masks could prevent them from contracting coronavirus; (iv) difficulty obtaining face masks; (v) family/peers encouraged them to wear face masks; and (vi) if their knowledge about COVID-19 was adequate.

Statistical Analysis

We computed the mean PHQ-9 scores and the prevalence of PHQ-9-positive depressive symptoms, both with 95% confidence interval (CI) and compared them across the regions (Hong Kong versus Guangdong and Hong Kong versus Hubei) using

Cohen's d (for PHQ-9 scores) and Cohen's w (for the prevalence). We estimated the prevalence of depressive symptoms according to the number of risk factors they were exposed to (0, 1, 2, ≥3), and the health belief related to face mask use. We investigated the association between health belief and depression by building two logistic models, which yielded adjusted odds ratios (ORs) and 95% CI. In model 1, we entered the six health belief variables separately, each adjusting for sex, educational level, marital status, location, profession, ward/unit, year of hospital work experience (continuous), and the presence of *a priori* risk factors (0, 1, 2, ≥3). In model 2 all health belief variables were mutually adjusted for, in addition to those already entered in model 1. Because of the small number of responses in the "not at all" category, we combined them with "to a small extent" in all variables and considered the new group as the reference category. Based on the regression output, we estimated the prevalence of depression according to health belief variables, stratifying for location.

All statistical analyses were performed using Stata version 13.0 (StataCorp LP). P-values were 2-tailed and those <0.05 were considered statistically significant.

RESULTS

The sample characteristics of 932 HCWs are presented in **Table 1**, stratified by region. There were more females than males across each location. The percentage of HCWs in Hong Kong reporting inadequate provision of PPE was high (77.5%), and the majority of these HCWs also reported insufficient infection-control training (72.1%). Furthermore, 15.2% of HCWs in Hong Kong claimed they were experiencing COVID-like symptoms, greater than those in Hubei (4.1%) and Guangdong (3.3%).

On average, Hong Kong HCWs had a higher PHQ-9 score (*mean [SD]:* 10.5 [6.4]) compared to those in Hubei (5.4 [4.6]; Cohen's d=0.86; p<0.001) and Guangdong (4.6 [4.8]; Cohen's d=1.09; p<0.001). The differences in PHQ-9 scores across regions were smaller when controlling for demographic and organizational factors (**Table 2**). There was no meaningful difference in the PHQ-9 scores between nurses and physicians within each region (see **Supplementary Table 1**). More than half of the respondents in Hong Kong met the criteria for depression (50.4%), which was considerably higher than those in Hubei (15.1%; Cohen's w=0.35; p<0.001) and Guangdong (12.9%; Cohen's w=0.41; p<0.001). After adjusting for the demographic and organizational factors, the prevalence of depression among HCWs in Hong Kong was still considerably higher (30.0%, 95% CI: 21.1%-38.9%) than that in Guangdong (15.9%, 12.0%-19.9%; p=0.008) and Hubei (16.5%, 8.0%-25.0%; p=0.051) (**Table 2**). There was a dose-response relationship between the number of *a priori* risk factors (close contact with COVID-19 cases; inadequate PPE provision; insufficient infection control training; and having COVID-19-like symptoms) and prevalence of depression. For example, in Hong Kong, 64% of the HCWs with 3 or 4 risk factors had PHQ-9-positive depression compared to 8.3% among those none of the risk factors (see **Supplementary Table 2**).

Data surrounding health beliefs and personal views of face mask use during COVID-19 in relation to depression, by location, are presented in **Table 3**. Of note, 80% of those in Hong Kong who felt susceptible to COVID-19 to a very great extent met the criteria for depression. In the same group, 64.7% of those who felt very fearful of contracting COVID-19 screened positive for depression. The prevalence of depression appeared to higher with the increasing the level of perceived vulnerability and fear and frustration of not being able to obtain face masks (see **Supplementary Table 3**).

After adjustment for a range of potential confounding factors, those with *a priori* risk factors had 2 to 4 times the odds of screen-detected depressive symptoms compared to those without (*OR*=2.24, *95% CI*: 1.29-3.92 for 1 risk factor; 2.36, 1.25-4.42 for 2 risk factors; and 3.61, 1.65-7.91 for 3 or 4 risk factors). Among the health beliefs, feeling susceptible and fearful of contracting COVID-19, as well as difficulty obtaining face masks are associated with higher risk of depression (**Table 4**). Those having the strongest feeling of vulnerability and fear of contracting COVID-19 and those who found it extremely difficult to obtain face masks had approximately three times the odds of being screened positive for depressive symptoms, compared to those who did not have such feeling or problem. Interestingly, a strong belief that face mask could be protective was not associated with depression (*OR*=1.00, *95% CI:* 0.42-2.36)

TABLE 1 | Characteristics of 932 healthcare workers from Mainland China and Hong Kong.

	Guangdong (n=510)	Hubei (n=146)	Hong Kong (n=276)
Sex			
Male	129 (25.3)	54 (37.0)	48 (17.4)
Female	381 (74.7)	92 (63.0)	228 (82.6)
Married	390 (76.5)	88 (60.3)	96 (35.3)
Educational level			
College or below	106 (20.8)	32 (21.9)	106 (38.8)
Undergraduate or above	404 (79.2)	114 (78.1)	167 (61.2)
Profession			
Nurses	233 (45.7)	89 (61.0)	258 (93.5)
Physicians	208 (40.8)	52 (35.6)	3 (1.1)
Other	69 (13.5)	5 (3.4)	15 (5.4)
Ward/Unit			
COVID	1 (0.2)	9 (6.2)	0 (0.0)
Accident and emergency	30 (5.9)	13 (8.9)	18 (6.5)
Intensive care	25 (4.9)	63 (43.2)	8 (2.9)
Isolation ward	3 (0.6)	0 (0.0)	10 (3.6)
Infection control	3 (0.6)	12 (8.2)	4 (1.5)
Respiratory	21 (4.1)	11 (7.5)	4 (1.5)
Medical	67 (13.1)	16 (11.0)	64 (23.2)
Surgical	49 (9.6)	4 (2.7)	48 (17.4)
Maternity and pediatric	95 (18.6)	2 (1.4)	26 (9.4)
Community and out-patient clinic	48 (9.4)	4 (2.7)	17 (6.2)
Other	168 (32.9)	12 (8.2)	77 (27.9)
Work experience in hospital; years	12 (6-20)	10 (6-15)	5 (2-10)
Risk factors			
Close contact with confirmed or suspected COVID-19 cases	112 (22.0)	112 (76.7)	135 (48.9)
Inadequate provision of personal protective equipment	168 (32.9)	35 (24.0)	214 (77.5)
Insufficient infection control training	28 (5.5)	4 (2.7)	199 (72.1)
Presence of COVID-19-like symptoms	17 (3.3)	6 (4.1)	42 (15.2)

TABLE 2 | PHQ-9 score and screen-detected positive depression among 932 Chinese healthcare workers during COVID-19.

	Guangdong (n=510)	Hubei (n=146)	Hong Kong (n=276)
PHQ-9 score			
Mean (SD)	4.6 (4.8)	5.4 (4.6)	10.5 (6.4)
Effect size[#]	1.09	0.86	Reference
p-value	<0.001	<0.001	
Adjusted* mean (95% CI)	4.9 (4.2-5.5)	5.7 (4.5-6.9)	7.5 (6.6-8.5)
Difference; mean (95% CI)	2.7 (1.3-4.0)	1.8 (0.2-3.5)	Reference
p-value	<0.001	0.029	
PHQ-9 positive (score ≥9)			
n	66	22	139
Prevalence; % (95% CI)	12.9 (10.3-16.2)	15.1 (10.1-21.9)	50.4 (44.5-56.2)
Effect size^	0.41	0.35	Reference
p-value	<0.001	<0.001	
Adjusted* prevalence; % (95% CI)	15.9 (12.0-19.9)	16.5 (8.0-25.0)	30.0 (21.1-38.9)
Difference; % (95% CI)	14.1 (0.4-24.5)	13.5 (-0.01-27.1)	Reference
p-value	0.008	0.051	
Moderately severe/severe depression (score ≥15)			
n	23	7	74
Prevalence; %	4.5 (3.0-6.7)	4.8 (2.3-9.7)	26.8 (21.9-32.4)
Effect size^	0.32	0.27	
p-value	<0.001	<0.001	
Adjusted* prevalence; % (95% CI)	5.7 (3.1-8.3)	4.8 (-0.1-9.7)	8.0 (3.3-12.7)
Difference; % (95% CI)	3.2 (-3.7-10.2)	2.3 (-3.0-7.6)	Reference
p-value	0.402	0.364	

*Adjusted for sex, educational level, marital status, location, profession, ward/unit, work experience, close contact with confirmed or suspected COVID-19 cases, personal protective equipment provision, infection control training, and presence of COVID-19-like symptoms.
[#]Cohen's d.
^Cohen's w.

while encouragement by family and peers to wear a face mask to a great extent appeared to be a protective factor against depression, after adjustment (*OR*=0.45, *95% CI:* 0.23-0.88). The estimated prevalence of depression according to the various health beliefs are presented in **Supplementary Table 3**.

DISCUSSION

To our knowledge, we are the first group to report the mental health status, specifically depression, among a large sample of HCWs across both the pandemic and non-pandemic regions of China as well as Hong Kong and to examine the relevance of perceived risk and protection from infection in relation to depression. We found that the prevalence of self-reported depression was considerably higher among HCWs in Hong Kong, compared to Guangdong and Hubei (where COVID-19 was first discovered). The observations in Guangdong and Hubei are similar to those in other surrounding Asian countries during the COVID-19 outbreak (12). More than a quarter of HCWs in Hong Kong reported symptoms indicative of moderately severe

TABLE 3 | Prevalence of depression according to health beliefs among 932 Chinese healthcare workers during COVID-19.

	Guangdong	Hubei	Hong Kong
Feeling susceptible to COVID-19 infection			
Not at all/to a small extent			
n	32/363	12/106	34/103
PHQ-9 positive; % (95% CI)	8.8 (6.3-12.2)	11.3 (6.5-19.0)	33.0 (24.6-42.7)
To a very great extent			
n	11/48	1/15	36/45
PHQ-9 positive; % (95% CI)	22.9 (13.1-37.0)	6.7 (0.9-37.3)	80.0 (65.6-89.4)
Fearful of contracting COVID-19			
Not at all/to a small extent			
n	31/340	15/104	15/61
PHQ-9 positive; % (95% CI)	9.1 (6.5-12.7)	14.4 (8.8-22.7)	24.6 (15.3-37.0)
To a very great extent			
n	14/65	2/10	66/102
PHQ-9 positive; % (95% CI)	21.5 (13.1-33.3)	20.0 (4.6-56.5)	64.7 (54.9-73.4)
Wearing face mask could prevent contracting COVID-19			
Not at all/to a small extent			
n	5/34	1/9	7/17
PHQ-9 positive; % (95% CI)	14.7 (6.2-31.2)	11.1 (1.3-53.6)	41.2 (20.5-65.6)
To a very great extent			
n	32/280	8/95	89/180
PHQ-9 positive; % (95% CI)	11.4 (8.2-15.7)	8.4 (4.2-16.1)	49.4 (42.2-56.8)
Difficult to get face masks			
Not at all/to a small extent			
n	31/308	14/121	31/98
PHQ-9 positive; % (95% CI)	10.1 (7.2-14.0)	11.6 (6.9-18.7)	31.6 (23.1-41.6)
To a very great extent			
n	14/76	2/5	53/76
PHQ-9 positive; % (95% CI)	18.4 (11.2-28.8)	40.0 (8.1-83.4)	69.7 (58.4-79.1)
Encouraged by family and peers to wear face mask			
Not at all/to a small extent			
n	4/27	3/12	13/18
PHQ-9 positive; % (95% CI)	14.8 (5.6-34.0)	25.0 (7.8-56.9)	72.2 (47.2-88.3)
To a very great extent			
n	40/351	12/107	100/201
PHQ-9 positive; % (95% CI)	11.4 (8.5-15.2)	11.2 (6.4-18.8)	49.8 (42.8-56.7)
Having adequate knowledge about COVID-19			
Not at all/to a small extent			
n	4/30	1/5	32/56
PHQ-9 positive; % (95% CI)	3.3 (0.4-20.8)	20.0 (2.1-74.7)	57.1 (43.8-69.5)
To a very great extent			
n	25/213	7/79	30/65
PHQ-9 positive; % (95% CI)	11.7 (8.0-16.8)	8.9 (4.2-17.6)	46.2 (34.3-58.4)

TABLE 4 | Logistic regression analysis of health beliefs as predictors of PHQ-9 screened positive depression among 932 Chinese healthcare workers.

	Model 1*		Model 2#	
	OR (95% CI)	P-trend	OR (95% CI)	P-trend
Feeling susceptible to COVID-19 infection				
Not at all/to a small extent	1.00	<0.001	1.00	<0.001
To a moderate extent	2.20 (1.45-3.34)		1.64 (1.03-2.59)	
To a very great extent	3.51 (2.14-5.74)		2.65 (1.55-4.54)	
Fearful of contracting COVID-19				
Not at all/to a small extent	1.00	<0.001	1.00	0.006
To a moderate extent	1.95 (1.27-3.00)		1.68 (1.04-2.72)	
To a very great extent	2.94 (1.84-4.70)		1.98 (1.19-3.29)	
Wearing face mask could prevent contracting COVID-19				
Not at all/to a small extent	1.00	0.049	1.00	0.221
To a moderate extent	1.50 (0.68-3.29)		1.50 (0.63-3.56)	
To a very great extent	0.89 (0.41-1.91)		1.00 (0.42-2.36)	
Difficult to get face masks				
Not at all/to a small extent	1.00	<0.001	1.00	<0.001
To a moderate extent	2.06 (1.35-3.14)		1.90 (1.22-1.98)	
To a very great extent	2.67 (1.66-4.28)		2.27 (1.39-3.71)	
Encouraged by family and peers to wear face mask				
Not at all/to a small extent	1.00	0.027	1.00	0.030
To a moderate extent	0.57 (0.29-1.13)		0.56 (0.27-1.14)	
To a very great extent	0.48 (0.26-0.87)		0.45 (0.23-0.88)	
Having adequate knowledge about COVID-19				
Not at all/to a small extent	1.00	0.085	1.00	0.367
To a moderate extent	1.09 (0.66-1.81)		1.23 (0.72-2.10)	
To a very great extent	0.71 (0.40-1.26)		0.88 (0.44-1.62)	

**Adjusted for sex, educational level, marital status, location, profession, ward/unit, work experience, and number of risk factors.*

[#]Model 1 plus mutual adjustment of health belief variables.

or severe depression. It is important to note that before the COVID-19 outbreak in Hong Kong, the prevalence of depression among general population in October 2019, during social crisis, was between 11.2% (13). However, findings from a cross-sectional study that were reported in a local newspaper, stated that depression was 18.5% (14). Social unrest is therefore likely to have influenced the prevalence of depression during the COVID-19 outbreak among HCWs in our study. Not surprisingly, among these 932 HCWs the feeling of susceptible to and being fearful of contracting the virus were strongly associated with depression. However, what was emerged as a significant predictor among respondents was reporting great difficulty in obtaining face masks in particular. In line with his, our findings also highlighted the encouragement of face mask use from family and peers as inversely related to depression.

While on first inspection, it may appear paradoxical that HCWs in Hubei had low rates of depression compared to other regions, this pattern of differences in depressive symptoms according to location may be attributable to the timing of survey distribution. It is important to note that the pandemic in Hubei, where the virus started in late 2019, authorities had almost gained control of the outbreak at the time of survey administration, which may explain the lower levels of depressive symptoms observed in Mainland China, including Hubei. However, by this time, the number of diagnosed COVID-19 cases rose sharply in Hong Kong (from 116 on March 9 to 974 on April 9), which may explain the higher prevalence of depressive symptoms among its HCWs. Although the majority of the responders in Hong Kong were nurses (93.5%), previous research has identified that rates of both depression and anxiety are typically higher in nurses compared to other healthcare workers (3). This observation may be reflected in the current study, thereby contributing to this increased prevalence. Perhaps of greater concern is the higher levels of concern expressed by Hong Kong HCWs expressing in relation to the inadequate provision of PPE (77.5% in Hong Kong versus 24.0% in Hubei and 32.9% in Guangdong), which we will now discuss.

COVID-19 is transmitted by person-to-person contact or droplet transmission of large respiratory particles that can travel approximately one-meter from the infected individual (15). The importance of adequate availability of PPE for staff in hospital settings amidst the COVID-19 outbreak has been documented (16). PPE, which was once ubiquitous in clinical settings, is now sparse across multiple locations due to the influx of hospitalized COVID-19 patients and also a rapid uptake of their use among the general population (17, 18). If HCWs are not suitably protected with PPE, or have inadequate supplies, then this unequivocally jeopardizes the physical health by increasing the actual and perceived level of subsequent risk of infection among HCWs who work with confirmed or suspected cases (19).

While the focus of previous research since the COVID-19 outbreak has been on PPE in relation to the physical health of HCWs (contracting the virus), our findings suggest that adequate availability of PPE may influence risk perception, as highlighted by previous research that risk perceptions of susceptibility and severity of infection could predict preventative behaviors such as face mask purchase and use during infectious disease pandemics (20, 21). Thus, limited availability of face masks is likely to have heightened perceived risk and the fear of becoming infected with COVID-19 in our sample, particularly if the HCWs were in direct, close contact with COVID-19 patients. This increased perception of risk and susceptibility may be further heightened by the number of dependents (children, elderly) associated with the HCWs, though we did not obtain this data in our study.

There is a reciprocal relationship between state anxiety and increased threat perception (22). Specifically, cognitive biases, when applied to the processing of threat, increase the level of state anxiety. Elevated state anxiety, in turn, amplifies or exaggerates cognitive biases. As a result, cognitive behavior therapy (CBT) may be helpful for improving mental health outcomes during the COVID-19 pandemic, given that it is a well-evidenced treatment for psychological disorders (23). However, the evidence for CBT as an intervention in HCWs remains preliminary (24). Larger trials that are specifically tailored to the COVID-19 scenario are therefore needed. As such, pre-existing cognitive vulnerabilities, combined with insufficient PPE (exemplified by the difficulty in obtaining face masks), may result in elevated symptomatology in some HCWs. This may partially why only a proportion of HCWs manifest with symptoms of depression and anxiety (25). In addition, one of the driving factors behind the heightened risk of depression which we observed beyond inadequate PPE, was perceived susceptibility and fear of contracting COVID-19. This latter finding resonates strongly with a cognitive bias model of understanding psychopathology (22). In line with our findings, another recently conducted survey among HCWs in Hong Kong revealed that 45.2% reported being concerned about adequate PPE and that 19.6% were worried about contracting COVID-19 (2). Although the authors did not link the two factors, they did report a total of 49.3% who met the criteria for depression (34.8% with mild and 14.5% with moderate) based on the PHQ-9, the same tool that we employed in our study.

The only protective factor that we observed in relation to depressive symptoms across our total sample was that of family and peer encouragement for the application of face masks. This may be seen as an act of solidarity, as the encouragement could imply the help to procure of face masks even though they had been not been provided in sufficient quantities in the hospital and were very difficult to be obtained from the market. Our observation is consistent with another study that demonstrated significantly lower depression prevalence among those practicing good personal hygiene techniques such as face mask use and regular hand washing (26). This is further consistent with previous research that shows how an individual's social support networks is a key factor for mental health and wellbeing (27). In particular, social support networks have been specifically linked to depression levels rather than other psychological outcomes. Thus, meaningful social relationships and support are likely to play a pivotal role in the mental health and wellbeing of HCWs working in high risk environments during pandemics such as COVID-19.

We acknowledge some study limitations. First, our study relied on a convenience sample thus non-response bias is highly likely and may not be inferred to the whole HCW population. It is possible that the a considerable proportion of the HCWs who participated in this survey might want to use the opportunity to express their discontent towards the authority as there continued to be a chronic short supply of PPE in hospitals. Nevertheless, the same pattern emerged from all three regions suggesting this was not unique in Hong Kong. Second, all data are subjective but it is important to note that beliefs cannot be objectively ascertained, although these may be subject to biases including social desirability and recall, with the latter being a particularly important consideration in cognitively vulnerable individuals. Third, we did not obtain any data pertaining to age of our participants, which may be a potential confounding factor of the relationships assessed, although we have used number of years of experience as proxy. Fourth, due to the cross-sectional study design, we are unable to determine cause-effect relationships. Finally, the focus of our study was depression but we acknowledge that other psychological outcomes are also important although we did not obtain data on aspects such as anxiety and stress.

In conclusion, it is possible that waves of depressive symptoms may be observed in HCWs across COVID-19-affected countries when cases are peaking. It is essential that PPE demand is met to minimize and protect the mental and physical health of those who are working tirelessly to control the pandemic. The adverse consequences of insufficient physical protection (such as PPE provision and training on infection control) while having close contact with patients are likely to leave HCWs with higher perceived levels of risk in terms of fear and susceptibility of COVID-19, which manifest in depression. Psychological services should be provided to all HCWs, and social support from family members and peers are also fundamental to the psychological health of HCWs.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because restrictions imposed by the regulatory authorities. Requests to access the datasets should be directed to SL, simon.c.lam@polyu.edu.hk.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Human Subjects Ethics Sub-committee of the Special Geriatric Committee of Zhongshan Medical Association. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

SL: Conceptualization, Methodology, Investigation, Data curation, Writing—review and editing; TA: Writing original draft as well as review and editing; IG: Writing original draft as well as review and editing; LS: Conceptualization, Methodology, Writing—review and editing; EH: Conceptualization, Methodology, Investigation, Writing—review and editing; DL: Conceptualization, Methodology, Investigation, writing—review and editing; KL: Software, Formal analysis, Writing original draft as well as review and editing, Visualization.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2020.00686/full#supplementary-material

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BRIEF RESEARCH REPORT
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What Happened to Patients With Obsessive Compulsive Disorder During the COVID-19 Pandemic? A Multicentre Report From Tertiary Clinics in Northern Italy

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After the outbreak of Coronavirus disease was declared a pandemic by the World Health Organization, this resulted in extraordinary public health measures to control the infection, such as entire countries being placed under quarantine. The psychopathological consequences of the pandemic and quarantine were anticipated to be of particular relevance, especially in patients with psychiatric disorders such as Obsessive Compulsive Disorder (OCD). Aim of the present report was to describe the impact of COVID-19 pandemics within a sample of Italian patients affected by OCD. Sociodemographic and clinical variables of a sample of 123 OCD outpatients, currently attending three OCD tertiary clinics in Northern Italy, were assessed through telephone and in-person interviews. Patients showing a clinical worsening of OCD represented more than one third of the sample and reported a significant emergence of new obsessions and compulsions phenotypes along with a significant exacerbation of past ones. Moreover, they were more frequently found to experience suicidal ideation, increased Internet checking, sleep disturbances, avoidance behaviors, and work difficulties. A significantly increased need of therapy adjustment and family accommodation was also observed. Further research is warranted to clarify the potential risk and related consequences of the current COVID-19 pandemic on OCD patients.

Keywords: obsessive compulsive disorder, COVID-19, Internet-checking, avoidance, suicidal ideation

INTRODUCTION

On 11 March 2020, the COVID-19 worldwide outbreak has been classified as a pandemic by the World Health Organization (1). In order to limit the spread of the SARS-CoV-2 virus, many countries around the world have taken dramatic measures, such as to place entire cities under mass quarantine, with thousands of people living under lockdown (2).

Pandemics are known to have an impact not only on the biological and social context, but also on the psychological one. Thus, the potential usefulness of imposed mass quarantine needs to be watchfully evaluated against the possible psychological consequences (3, 4). A reduction in the availability of routine psychological or psychiatric counselling and timely intervention was observed in some countries. This led, in some places, to the lack of follow-up and medication prescription with potential discontinuation of therapy in psychiatric patients (5, 6).

To date, the recent literature on mental health consequences of COVID-19 has been mainly focused on the effect of social distancing, self-isolation and quarantining on mental health vulnerability (7). Among the several psycho-social consequences of COVID-19 pandemics, the possible worsening of obsessive-compulsive symptoms has been largely overlooked by health service providers, although empirically-based expert guidance for clinicians has recently been published (8). Obsessive compulsive disorder (OCD) is characterized by recurrent and intrusive thoughts or images (i.e., obsessions) associated to behavioural efforts aimed at neutralizing the anxiety caused by obsessions (i.e., compulsions) (9). Given the high impact of OCD on patients' quality of life and the high rates of psychiatric comorbidities (10, 11), the current COVID-19 outbreak represents a unique challenge both for OCD patients, given the higher disability due to a potential increase in frequency of obsessions and compulsions, and for psychiatrists, since the assessment of "reasonable behaviors" compared to excessive anxiety could be challenging. Since hand washing is considered one of the main precautions against infection, the demand for disinfectants, soaps and gloves has increased, together with insistence on the importance of hygiene, washing and contamination prevention standards. What apparently seem easy rules to follow, may be difficult for patients with OCD, who already have their insecurities about hygienic measures or compulsive cleaning need. Moreover, among the different symptom domains of OCD, obsessions about hygiene and contamination and washing/cleaning compulsions are the most common (12). Besides, although these obsessive and compulsive phenotypes respond better than others to therapy, there could be a higher tendency to recurrence in case of stressful events. In this respect, a recent study by Prestia and colleagues reported that in a sample of OCD patients, the presence of contamination symptoms before the pandemic was associated with a more elevated worsening measured using the Yale-Brown Obsessive Compulsive Scale (13).

The aim of the present report was therefore to assess the impact of COVID pandemic, through a brief cross-sectional interview, on a multicentre sample of OCD outpatients attending three OCD tertiary clinics in Northern Italy, which has been particularly hit by the outbreak.

In this regard, we hypothesize that OCD patients may experience a global OCD worsening (OW), with an increase of pre-existing obsessions or compulsions and the development of new obsessions and compulsions or the switch to different phenotypes. Moreover, we expect that patients with OW may experience a worsening of clinical and behavioural features.

METHODS

Patients affected by OCD of either gender and any age, attending three different OCD tertiary clinics based respectively in Milan, Lombardia region (ASST Fatebenefratelli Sacco, Ospedale Sacco-Polo Universitario), in Torino, Piemonte region (AOU San Luigi Gonzaga) and in Trieste, Friuli Venezia Giulia region (Azienda Sanitaria Universitaria Giuliano-Isontina) were interviewed in-person or by telephone. To limit the transmission of COVID-19 in healthcare settings for patients at higher risk for COVID-19 complications, most of the interviews were conducted by phone, also in consideration of the additional stress related to an in-person interview for OCD patients with contamination fears. In case of patients with specific needs, the interviews were conducted in-person following each hospital's safety protocols. The three centers previously agreed on each investigated variable and a common database was created. Main questions regarded: gender, age, presence and type of psychiatric comorbidity, obsessions and compulsions main phenotypes, OCD worsening (defined as a clinical worsening assessed during the clinical interview and referred to the last 3 months of pandemic), onset of new obsessions or compulsions, past obsessions or compulsions recurrence, presence of features of inflated responsibility, tic development, pharmacological stability defined as no change in the therapeutic regimens in the three months preceding the pandemics, pharmacological adjustment defined as a change in the therapeutic regimen in the last three months, occurrence of suicidal ideation, increased Internet checking for reassurance, increased family accommodation, increased avoidance behaviors, new sleep disturbances onset, working status and presence of job difficulties. Patients involved in the study had previously provided a written informed consent for research purposes.

In order to compare OCD patients with or without worsening of their OCD and to identify the main features in terms of symptoms and quality of life associated to the clinical worsening, an exploratory analysis was performed, Pearson Chi-squared and ANOVA tests were used, as appropriate, using SPSS 24 for Windows software. The level of statistical significance was set at 0.05.

RESULTS

The sample included 123 OCD outpatients, distributed as follows: 50 patients from ASST Fatebenefratelli Sacco, Milano

(40.7%), 54 patients from AOU San Luigi Gonzaga, Torino (43.9%), 19 patients from Azienda Sanitaria Universitaria Giuliano-Isontina, Trieste (15.4%). Main socio-demographic and clinical variables of the samples are listed in **Tables 1** and **2**. No significant differences in terms of age and gender distribution were found between the three centers, therefore they could be considered comparable.

Six percent of the whole sample received an in-person interview, while 94% received a telephone interview. No significant differences emerged between the two subgroups in term of socio-demographic and clinical features.

Overall, more than one third of the whole sample reported a clinical OW. The whole sample was then divided in two subgroups: patients with vs without a clinical OW (35.8% vs 64.2% of the total sample). The two subgroups showed comparable mean ages and gender frequencies. No significant differences between patients with and without OW in terms of obsessive phenotypes emerged, the most frequent being violence/harm and multiple phenotypes in both subgroups. Nevertheless, the development of new obsessions (29.5% vs 1.3%; p<0.005) and the recurrence of past obsessions (40.9% vs 0%, p<0.005) was significantly higher in the OW group compared to patients without OW (**Figure 1**).

The most frequent phenotypes of compulsions were washing and cleaning and multiple phenotypes in both subgroups, but no significant differences emerged. However, patients with OW showed a significant increase in both new (29.5% vs 0%; p< 0.001) and past compulsions (29.5% vs 0%; p<0.001) compared to patients without OW. Moreover, worsened patients experienced an increase in avoidance behaviors (OW vs without OW: 65.9% vs 20.3%; p<0.005). No significant differences in terms of inflated responsibility emerged.

No differences occurred in terms of psychiatric comorbidities and pharmacological stability rates, equally represented in both groups with and without OW.

Patients with vs without OW showed a globally impaired clinical picture; in particular, they showed significantly higher rates of pharmacological therapy adjustment (70.5% vs 13.9%; p<0.005), suicidal ideation (9.1% vs 0%; p<0.05), Internet checking for reassurance (52.3% vs 27.8%; p<0.05), family accommodation (68.2% vs 13.9%; p<0.005) and sleep disturbances (52.3% vs 10.1%; p<0.001).

As regards job status, 38.6% of OW patients were working at the time of the interview with no significant differences when compared to the group without OW. However, patients with vs without OW reported significantly higher rates of job difficulties (36.4% vs 15.2%; p<0.05).

A further analysis was made subdividing the whole sample in three age subgroups: 16–30 years; 30–65 years; > 65 years. No differences were found in terms of OCD worsening, nor regarding other clinical features. However, patients in the age range 30–65 years showed higher rates of job difficulties compared to the age ranges 16–30 years and > 65 years (89.3% vs 10.7% vs 0%).

DISCUSSION

The present study was aimed at giving a snapshot of the clinical status of a multicentric sample of OCD patients during the ongoing COVID-19 pandemics. Main results highlighted that more than one third of the whole multicentric sample presented a OW, assessed through a psychiatric interview, with serious clinical consequences. A first relevant clinical feature related to the OW was the onset of new obsessions and compulsions and

TABLE 2 | Comparison of socio-demographic and clinical variables of OCD patients with vs without clinical worsening.

	Patients with OW	Patients without OW
N (%)	44(35.8%)	79(64.2%)
Gender (M:F)	24(54.5%):20(45.5%)	44(55.7%);35(44.3%)
Mean age (years)	39.75 ± 13.52	39.95 ± 13.72
Pharmacological Stability	31(70.5%)	60(75.9%)
Pharmacological Changes	**31(70.5%)****	**11(13.9%)**
Psychiatric Comorbidity	29(65.9%)	44(55.7%)
New obsessions development	**13(29.5%)****	**1(1.3%)**
Past obsessions occurrence	**18(40.9%)****	**0(0%)**
New Compulsions development	**13(29.5%)****	**0(0%)**
Past Compulsions occurrence	**13(29.5%)****	**0(0%)**
Suicidal ideation	**4(9.1%)***	**0(0%)**
Internet Checking	**23(52.3%)***	**22(27.8%)**
Family Accomodation increase	**30(68.2%)****	**11(13.9%)**
Avoidance behaviors increase	**29(65.9%)****	**16(20.3%)**
Sleep disturbances	**23(52.3%)****	**8(10.1%)**
Working	17(38.6%)	22(27.8%)
Job difficulties	**16(36.4%)***	**12(15.2%)**

*Values for categorical and continuous variables are expressed in percentages and mean ± SD, respectively. Boldface indicates significant differences between subgroups; **p < 0.005 *p < 0.05. OW, OCD Worsening.*

TABLE 1 | Socio-demographic and clinical variables of OCD patients across centers.

	Ospedale Sacco-Polo Universitario, Milano (Lombardia)	AOU San Luigi Gonzaga, Torino (Piemonte)	ASU GITrieste(Friuli Venezia Giulia)	Total sample
N (%)	50 (40.7%)	54 (43.9%)	19 (15.4%)	123
Gender (M:F)	27 (54%); 23 (46%)	31 (57.4%); 23 (42.6%)	10 (52.6%); 9 (47.4%)	68 (55.3%); 55 (44.7%)
Mean Age (years)	41.04 ± 14.34	39.89 ± 13.16	36.79 ± 12.99	39.88 ± 13.59
OCD worsening	22 (44%)	15 (27.8%)	7(36.8%)	44 (35.8%)

Values for categorical and continuous variables are expressed in percentages and mean ± SD, respectively.

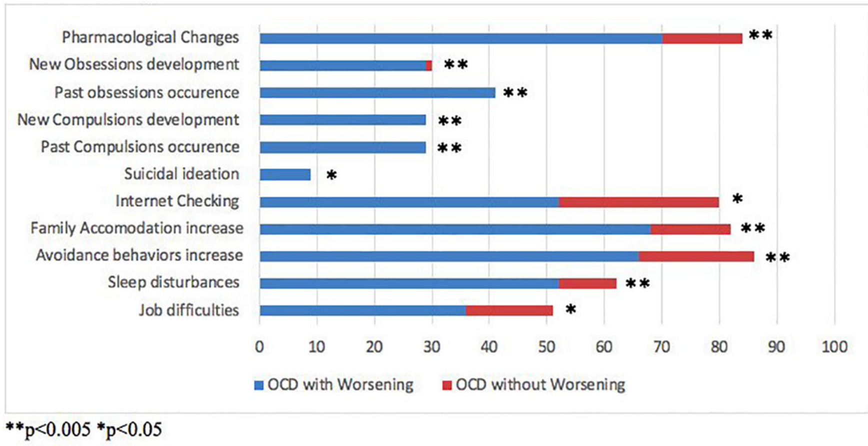

FIGURE 1 | Comparison of socio-demographical and clinical variables between Obsessive Compulsive Disorder (OCD) patients with vs without clinical worsening.

the re-experiencing of past obsessions and compulsions, which were absent before the beginning of the pandemic. The onset of new and past obsessions and compulsions could be related to the need of major control against potential contamination or the increase of spare time during the lockdown, leading to an increase in repetitive behaviors. Moreover, the OW group showed increased rates of avoidance behaviours, mostly related to the fear of a possible contamination.

The exacerbation of OCD symptomatology has been well-documented during previous outbreaks, such as Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS), and Influenza (14). According to these evidences, recent studies on COVID-19 and OCD already reported the need to carefully monitor potential relapse of OCD symptoms and their proportionality to the current situation, to prevent backsliding (8, 15, 16).

Functional disability and impairment of health-related quality of life were previously linked to a symptoms relapse in OCD patients (17). In addition, the OW and the loneliness and the social isolation related to the lockdown may have influenced the increased rates of suicidal ideation reported in the OW subgroup (14). OCD *per se* has already been associated with increased levels of suicidality compared with the general population (18).

OW patients showed higher rates of Internet checking, mainly for health reassurance or news checking: this could be interpreted as a response to the current global uncertainty and lack of accessibility to non-priority medical services. The impact of media reports on the exacerbation on some OCD features, such as high intolerance of uncertainty along with frequent and excessive online health search have already been described in OCD patients (7, 19, 20).

Higher rates of family accommodation were found in patients with OW. This result may be directly correlated to both an increase in the frequency and in the manifestation of OC phenotypes co-occurring at the same time. Previous literature showed a correlation of family accommodation with OCD severity and higher functional impairment (21).

The OW subgroup showed a significantly higher need for pharmacological adjustments, also in pharmacologically stable patients. It should be noticed that the OW subgroup also reported higher rates of suicidal ideation and sleep quality worsening: these symptoms may have required further changes in the pharmacological treatment. The revision of the medication status was stated as a treatment priority of OCD during the COVID-19 pandemic (8). This important result should be considered since, especially during the lockdown, the accessibility to non-priority medical services has been difficult. Hence, even patients who needed a therapeutic adjustment, may have had difficulty to achieve it. Moreover, clinical symptoms such as insomnia have been described also in healthy subjects being quarantined (22).

Eventually, the clinical worsening of OCD showed consequences also in the working area, since more than 35% of OW patients reported job difficulties during the last three months. A further analysis on different age classes revealed a higher prevalence of job difficulties in the age range 30-65 years, representing the most numerous subgroups. OCD has a profound impact on patients' quality of life and working struggles have been previously described in affected individuals (17, 23). The potential risk of contamination in the workplace, the increase in the OC frequency and phenotypes and the higher need of reassurance, along with avoidance behaviours in the workplace may represent triggering factors for the perceived job difficulties.

Main limitations of the present study were represented by the lack of specific psychometric assessment and its cross-sectional nature. In fact, the clinical picture of assessed patients may change in the next months of the current pandemic. Moreover, assessed patients were all living in regions not only particularly hit by COVID-19 but also involved earlier in its management, compared to other European countries.

Further research with specific psychometric measures and follow-up assessment of the sample is warranted to clarify the potential risk and clinical consequences of the current COVID-19 pandemic on OCD patients.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author, upon request. Requests to access the datasets should be directed to beatricebenatti@gmail.com.

ETHICS STATEMENT

The study was conducted in accordance with the declaration of Helsinki. The patients provided their written informed consent to participate in this study and for the use of their anonymised data for research purposes.

AUTHOR CONTRIBUTIONS

Conception and design of study: BB, UA, GM, AF, BD'O, and NF. Acquisition of data/data analysis and interpretation: BB, LC, NG, SB, and SR. Revising the manuscript critically for important intellectual content: BB, UA, GM, AF, BD'O, and NF. All authors contributed to the article and approved the submitted version.

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Association Between Current Physical Activity and Current Perceived Anxiety and Mood in the Initial Phase of COVID-19 Confinement

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The World Health Organization (WHO) has declared a world pandemic due to COVID-19, and several enacted measures such as compulsory confinement may have collateral consequences on both physical and mental health. We aimed to investigate associations between current physical activity (PA) and current perceived anxiety and mood among a sample of Spanish adults confined due to COVID-19 restrictions of movement. Using an online survey, we collected data on the Spanish adult population regarding health habits during the first days of enacted confinement. A total of 2250 participants (54.8% women) aged 35.3 (SD 13.6) completed the survey, which included questions about sociodemographic characteristics (i.e. age, gender, civil status, education, and occupation), health habits (i.e. prior PA, alcohol consumption, smoking, screen exposure, and sleep hours) and COVID-19 confinement context (i.e. number of isolation days, solitude, and exposure to COVID-19). Physical Activity Vital Sign (PAVS) short form was used to estimate weekly minutes of PA, whereas a single-item question was used to assess both current perceived anxiety and mood. We conducted weighted binomial logistic regressions to check associations between current adherence to WHO guidelines of PA and current perceived anxiety and mood of confined adults. Significant inverse associations between overall adherence to PA and current perceived anxiety in the final adjusted model (OR, 0.66; 95% CI, 0.54–0.79) as well as in several subgroup analyses such as younger women were observed. In addition, a borderline significant inverse association was found between current PA and current perceived worse mood when fully adjusted (OR, 0.82; 95% CI, 0.68–1.00); this association was significantly stronger in women than men. The results of the present study indicate that current PA adherence to WHO guidelines in the initial phase of COVID-19 confinement associates with both lower current perceived anxiety and lower current perceived worse mood among a sample of Spanish adults.

Keywords: physical activity, mental health, Spain, adults, COVID-19

INTRODUCTION

Coronavirus disease 2019 (COVID-19) is considered a global pandemic by the World Health Organization (WHO) since March 11, 2020 (1). The current number of cases (date 4 April 2020) globally diagnosed is 972,203, which has resulted in 50,321 people dead so far (2). Spain is one of the most inflicted countries, with a total of 124,736 cases diagnosed, resulting in 11,744 deaths until now (3).

Due to this situation, in an attempt to fight the spread of this virus, the Spanish Government approved a period of confinement as of 15th March of 2020; some of the immediate consequences of the confinement period are that people have to stay at home more than usual, interrupt their usual activities and change their habits (4). Also, telework has been recommended to many Spanish people during this period and, in this context, to perform PA at home has been further recommended (4, 5).

As prolonged home stays can increase behaviors that lead to inactivity, maintaining regular PA, and routinely exercising in a safe home environment is an important strategy for healthy living during the coronavirus crisis (6). Doing regular PA during COVID-19 confinement is also very important for mental health because moderate PA improves mood (7) and helps to prevent anxiety and depression (8). Low PA is associated with feelings of loneliness and lack of social support (9, 10). In this specific situation of isolation created by the confinement, special attention should be paid to mental health, particularly in those living alone and/or experiencing loneliness (11); only during the initial phase of the COVID-19 outbreak in China, 53.8% of respondents rated the psychological impact as moderate-severe, with 16.5% reporting moderate-severe depressive symptoms and 28.8% reporting moderate-severe anxiety symptoms (12).

Furthermore, the use of PA to prevent mental health problems during the confinement is a very adequate strategy, because previous research has found that PA produces not only long-term benefits in mental health but also immediate psychological benefits for mood and anxiety due to the acute effects of PA (13–15). Due to these reasons, PA has now been recommended as a therapy to fight against the mental and physical consequences of COVID-19 confinement (16).

While people should perform at least the PA recommended by WHO (15, 16), also during the confinement period, this may be extremely difficult to achieve. The recommendation of WHO for adults is to do at least 150 minutes of moderate-intensity PA per week, or 75 minutes of vigorous-intensity PA per week, or an equivalent combination of moderate- and vigorous-intensity physical activity achieving at least 600 MET-minutes/week (17, 18). However, recent recommendations suggest that, during the confinement, people should do even more PA than these recommendations to compensate for the increase in sedentary time at home (16). While many people are unlikely to exceed this threshold of PA, the adverse influence on mental health needs to be investigated. Also, we found PA particularly critical to analyze since prior research has suggested the importance of PA during the COVID-19 confinement (6, 16).

In view of this context, it is necessary and urgent to analyze the association between PA and mental health in adults confined due to COVID-19, in order to prevent mental health problems associated with the expected reduction of PA during the confinement. Thereby, the main objective of this study was to evaluate the association between current PA and current perceived both anxiety and mood among Spanish adults confined due to COVID-19.

METHODS

We conducted a cross-sectional study to check associations regarding current PA and both current perceived anxiety and mood among a sample of the confined Spanish population due to COVID-19. Retrieved data from an online health survey carried out during the Spanish confinement period were used.

The Survey

Data were collected through a web-form link during the period 22nd to 29th of March, 2020 (i.e. from the seventh official day of Government-enacted national confinement). The link was launched on social media encouraging Spanish resident users to answer the survey. According to server analytics, 2,850 media users covering all the Spanish regions were asked to participate. Participants were previously informed about the aims of the study, gave informed consent to participate, and confirmed that they were in an isolation situation due to COVID-19 enacted restrictions. The survey was anonymous and treated accordingly to Spanish legislation as regards general data protection. At the end of the survey, participants were provided with information on how to exercise at home and its potential benefits. The study was carried out accordingly with the principles of the World Medical Declaration of Helsinki, and got the approval of the Ethics Committee of Research in Humans of the University of Valencia, with register code 1278789. The reporting of this study adheres to the Strengthening the Reporting of Observational Studies in Epidemiology statement (STROBE) (19).

Current Physical Activity

Estimations of current PA were conducted using the Physical Activity Vital Sign (PAVS) short version. The participants answered two questions concerning the number of days and minutes a week they did PA before and during a confinement week, with possible answers comprising 0, 1, 2, 3, 4, 5, 6, or 7 days of PA per week and 10, 20, 30, 40, 50, 60, 90, and 150 or more daily minutes (20, 21). To implement PAVS to that particular context of population confinement, the word "isolation" replaced the word "usual" when referring to the week they performed PA. Accordingly to PAVS original procedure, weekly minutes of PA were estimated by multiplying days with minutes.

Participants were categorized into those not achieving WHO recommended guidelines regarding moderate-intensity aerobic PA (i.e. those who did not perform a minimum of 150 weekly minutes of PA) and those who did.

Current Perceived Anxiety and Mood

Outcome variables were estimated through the following questions: "how do you assess your anxiety level during the COVID-19 confinement?", with possible responses comprising "lower than before the COVID-19 confinement", "equal than before the COVID-19 confinement", or "higher than before the COVID-19 confinement". As regards mood, we asked the participants through the following question: "how do you assess your mood during the COVID-19 confinement?", and possible answers including the following options: "worse than before the COVID-19 confinement", "equal than before the COVID-19 confinement", or "better than before the COVID-19 confinement". We later categorized the current perceived anxiety variable into two groups; those having lower or equal levels of current perceived anxiety and those having higher levels. On the other hand, the current perceived mood variable were also categorized into those having a better or equal current perceived mood and those having worse.

Covariates

Following previous studies (22–24), the present work also estimated age, gender, socioeconomic status (marital status, occupation, and education), and health habits (smoking, alcohol consumption, hours sleeping, and time exposed to screens). In addition, other variables concerning the confinement context were also controlled: number of days isolated because of COVID-19 confinement, whether participants were living alone during COVID-19 confinement, and, last, whether they were exposed or infected with COVID-19. Self-reported answers were categorized as follows: marital status ("married or having a partner" or "not married neither having a partner"), occupation ("employed" or "not employed"), education ("having a university degree" or "not having a university degree"), smoking habits ("current smoker" or "not a current smoker"), alcohol consumption ("usual", "moderate" or "never"), solitude during the COVID-19 confinement ("alone while confined" or "not alone while confined"), and exposure to COVID 19 ("infected with COVID-19 or close to an infected person" or "not exposed"). Quantitative control variables were reported as follows: time sleeping ("number of average hours sleeping while COVID-19 confinement"), time exposed to screens ("number of average hours exposed to screens such as watching TV, cell phone, and tablet during COVID-19 confinement"), and number of days isolated because of the COVID-19 confinement ("number of days isolated since the 15th of March, 2020", i.e. the first enacted COVID-19 confinement day in Spain).

Statistical Analyses

Statistical analyses were conducted using the Statistical Package for Social Sciences (SPSS) version 23.0 (SPSS Inc., Chicago, IL). The Kołmogorov–Smirnov test was applied to check normality. We computed weighted binomial logistic regression tests to check associations between the current adherence to WHO guidelines regarding PA and current perceived both anxiety and mood in the COVID-19 confinement period, providing odds ratios (ORs) and 95% confidence intervals (CIs) for the overall sample. Stratified analyses were also conducted to assess such associations concerning age (i.e. cutoff point of 45 years old, which is a critical point regarding mental conditions for both sexes in the Spanish population) (25), and gender. Participants with missing data in any of the variables were discarded for the study (n=60). Levels of significance were set at $P < 0.05$.

RESULTS

A total of 2250 participants aged 35.3 (SD 13.6) completed the survey. Descriptive statistics of the sample are illustrated in **Table 1**, in which 1232 participants (54.8%) are women, and 210 (9.3%) declared to be infected with COVID-19 or being close to someone who was. On average, participants were confined for 7.2 days (SD 2.9), and 168 (7.5%) were alone while confined. The mean for weekly minutes of PA while confined was 182.5 (SD 180.7).

Overall, participants achieving PA recommended guidelines show significantly lower odds of experiencing higher current perceived anxiety than those who do not when adjusting for age and gender: (OR, 0.65; 95% CI, 0.55–0.78). Even when the models were adjusted for socioeconomic, health, and COVID-19–related- context variables, the odds for experiencing higher current perceived anxiety remained significantly lower for those following the PA guidelines (OR, 0.66; 95% CI, 0.54–0.79) when compared to those who did not. **Table 2** also shows subgroup analyses, in which women (OR, 0.61; 95% CI, 0.47–0.78), and younger women (OR, 0.59; 95% CI, 0.43–0.79) present the lowest values for the full adjusted model.

Table 3 features borderline significantly lower odds for current perceived worse mood while confined in all the participants who meet the recommended PA guidelines in the final adjusted model (OR, 0.82; 95% CI, 0.68–1.00). Fully adjusted subgroup analyses present significant value for women (OR, 0.74; 95% CI, 0.57-0.95), and borderline significance for younger women (OR, 0.76; 95% CI, 0.56–1.01).

DISCUSSION

The present study in a wide sample of the Spanish adult population found that to achieve a minimum of 150 weekly minutes of PA was significantly associated with lower odds for experiencing higher current perceived anxiety while the COVID-19 confinement. Similarly, participants performing PA guidelines also observed lower odds for current perceived

TABLE 1 | Characteristics of the study population.

N = 2,250	n (%)	Mean (SD)
Age (y)		35.3 (13.6)
Gender		
Men	1,018 (45.2)	
Women	1,232 (54.8)	
Marital status		
Married or having a partner	1,105 (49.1)	
Not married or having a partner	1,145 (50.9)	
Occupation		
Employed	1,399 (62.2)	
Not employed	851 (37.8)	
Education		
Holding a university degree	1,377 (61.2)	
Not holding a university degree	873 (38.8)	
Alcohol consumption		
Never	634 (28.2)	
Moderate	1,446 (64.2)	
Usual	170 (7.6)	
Smoker		
No	1,928 (85.7)	
Yes	322 (14.3)	
Sleep time (h)		7.9 (1.1)
Screen time (h)		5.8 (2.3)
Exposure to COVID-19		
Yes	210 (9.3)	
No	2,040 (90.7)	
Alone while COVID-19 lockdown		
Yes	168 (7.5)	
No	2,082 (92.5)	
Days isolated from COVID-19		7.2 (2.9)
PA weekly minutes while isolated from COVID-19		182.5 (180.7)
WHO PA recommendations while isolated from COVID-19		
Yes	1,142 (50.8)	
No	1,108 (49.2)	
PA weekly minutes before isolated from COVID-19		222.4 (190.9)
WHO PA recommendations before isolated from COVID-19		
Yes	1,374 (38.9)	
No	876 (61.1)	
Current perceived higher anxiety		
Yes	970 (43.1)	
No	1,280 (56.9)	
Current perceived worse mood		
Yes	984 (43.7)	
No	1,266 (56.3)	

worse mood, although these associations remained solely significant in particular subgroups such as women and women aged below 45 years. These results support the notion that current higher levels of perceived anxiety and worse mood might be mitigated through achieving a minimum amount of weekly PA in this confinement context. In addition, our study provides novel data from a different setting, in which governmental enacted restrictions of free circulation had been implemented for, at least, a period of a month.

Current Perceived Anxiety

Similarly to our hypothesis, a review of systematic reviews of randomized control trials by Kandola et al. (26), found physical exercise useful to reduce anxiety as well as other mental disorders symptoms. However, these authors pointed at the fact that little is known about how physiological mechanisms of PA influence mental health (26, 27). A meta-analysis by Stubbs et al. (28) observed anxiolytic effects for physical exercise when compared with controls in subjects with diagnosed anxiety or other stress-related disorders.

Regarding the amount of current PA associated with lower current perceived anxiety, previous studies found recommended WHO guidelines to reduce both anxiety symptoms and status in a general population of Irish adults; nevertheless, higher levels of weekly PA showed similar inverse associations with anxiety than the recommended levels (29). Further, PA was observed to significantly reduce anxiety just ten minutes after exercising in both normal and anxiety-diagnosed subjects; although it was a vigorous exercise which more reduced anxiety as regards basal levels (15).

In contrast with the present study, in which women achieving recommended PA guidelines had lower odds for higher current perceived anxiety while confined, Mc Dowell et al. (29) found higher odds for women than for men as regards inverse associations of PA with changes in perceived anxiety; such gender differences might be because both contextual and cultural differences contribute to influencing anxiety (30, 31). Other differences among subgroups could result from the habits of performing PA, since previous studies have indicated a mediator effect of usual exposure to PA over acute anxiety responses (32). Also, the type of PA might play an important role in this association, since recent research has emphasized the effects of specific physical exercise such as high interval intensity training (HIIT) on mental health, showing higher improvements than moderate-intensity continuous training in individuals experiencing mental disorders (33).

Current Perceived Mood

Our study found a relevant association overall between higher current PA and lower current perceived worse mood among the study sample; however, significant associations were solely observed among specific subgroups. Similarly, a significant body of work has observed improvements in mood state associated with higher levels of PA (34, 35). Furthermore, not only were healthy populations that showed mood enhancement, but also populations with previous conditions (32, 36); even short bouts of PA have been observed to improve mood in older adults (37). Particularly, the acute responses to low-intensity aerobic exercise were those that enhanced mood the most in young women when compared with responses to high-intensity aerobic exercise (37). Interestingly, a recent study found that the largest associations between PA and mental health were for popular team sports, cycling and aerobic and gym activities, as well as durations of 45 min and frequencies of three-five times/week (38). The antidepressant benefits of PA might be explained by the activation of the endocannabinoid system and upregulation of brain-derived neurotrophic factor, as has been observed after 90-minute exercise bouts (39). As indicated by Kandola et al. (27), the effects of PA over depressive symptoms could be also related to social and psychologic mechanisms such as the improvement of self-esteem, sociability, and perceived self-efficacy.

As observed in the present research, differences among subgroups have also been detected in other studies. A close exam to related literature showed previous physical fitness levels,

TABLE 2 | Adjusted odds ratios (95% confidence interval) for higher current perceived anxiety than usual in relation to WHO physical activity guidelines (reference: less than 150 weekly minutes of physical activity) in the entire study population and in age and gender subgroups.

N = 2250	WHO	n	%	Model 1[a]	Model 2[b]	Model 3[c]	Model 4[d]
All	No	1,108	49.2	1	1	1	1
	Yes	1,142	50.8	0.65 (0.55–0.78)	0.66 (0.55–0.78)	0.68 (0.57–0.81)	0.66 (0.54–0.79)
<45 years	No	736	43.8	1	1	1	1
	Yes	944	56.2	0.66 (0.54–0.80)	0.65 (0.54–0.80)	0.69 (0.53–0.81)	0.64 (0.52–0.80)
≥45 years	No	372	65.3	1	1	1	1
	Yes	198	34.7	0.64 (0.44–0.93)	0.63 (0.44–0.92)	0.64 (0.43–0.95)	0.67 (0.45–1.01)
Men	No	465	45.7	1	1	1	1
	Yes	553	54.3	0.67 (0.52–0.87)	0.68 (0.52–0.88)	0.74 (0.52–1.06)	0.75 (0.56–1.01)
Women	No	643	52.2	1	1	1	1
	Yes	589	47.8	0.63 (0.51–0.81)	0.64 (0.51–0.81)	0.62 (0.48–0.79)	0.61 (0.47–0.78)
Men <45 years	No	340	41.5	1	1	1	1
	Yes	479	58.5	0.69 (0.52–0.92)	0.70 (0.52–0.93)	0.74 (0.54–1.01)	0.74 (0.54–1.02)
Women <45 years	No	396	45.6	1	1	1	1
	Yes	465	54.0	0.63 (0.48–0.82)	0.63 (0.48–0.82)	0.60 (0.45–0.81)	0.59 (0.43–0.79)
Men ≥45 years	No	125	62.8	1	1	1	1
	Yes	74	37.2	0.59 (0.32–1.11)	0.60 (0.32–1.13)	0.62 (0.31–1.24)	0.75 (0.36–1.55)
Women ≥45 years	No	247	66.6	1	1	1	1
	Yes	124	33.4	0.67 (0.42–1.06)	0.65 (0.41–1.03)	0.66 (0.40–1.09)	0.67 (0.41–1.11)

[a]Adjusted for age and gender (all participants), for gender (<45 y, ≥45 y), for age (men, women) and crude model for gender and age subgroups (men < 45 years, women < 45 years, men ≥ 45 years, women ≥ 45 years).
[b]Model 1+ socioeconomic features (civil status, occupation and education).
[c]Model 2+ lifestyle (previous PA, alcohol consumption, smoking habit, sleep time and screen exposure).
[d]Model 3+ COVID-19 isolation context (isolation days, number of partners and proximity to COVID-19).

TABLE 3 | Adjusted odds ratios (95% confidence interval) for current perceived worse mood in relation to WHO physical activity guidelines (reference: less than 150 weekly minutes of physical activity) in the entire study population and in age and gender subgroups.

N=2250	WHO	n	%	Model 1[a]	Model 2[b]	Model 3[c]	Model 4[d]
All	No	1,108	49.2	1	1	1	1
	Yes	1,142	50.8	0.80 (0.68–0.95)	0.80 (0.67–0.95)	0.84 (0.70–1.00)	0.83 (0.70–1.00)
<45 years	No	736	43.8	1	1	1	1
	Yes	944	56.2	0.83 (0.69–1.01)	0.82 (0.67–1.00)	0.87 (0.71–1.06)	0.86 (0.70–1.05)
≥45 years	No	372	65.3	1	1	1	1
	Yes	198	34.7	0.70 (0.49–1.01)	0.69 (0.48–1.00)	0.73 (0.50–1.06)	0.75 (0.51–1.09)
Men	No	465	45.7	1	1	1	1
	Yes	553	54.3	0.88 (0.69–1.14)	0.89 (0.69–1.16)	0.94 (0.72–1.23)	0.95 (0.73–1.25)
Women	No	643	52.2	1	1	1	1
	Yes	589	47.8	0.74 (0.59–0.93)	0.73 (0.58–0.93)	0.77 (0.61–0.98)	0.77 (0.60–0.97)
Men <45 years	No	340	41.5	1	1	1	1
	Yes	479	58.5	0.93 (0.70–1.23)	0.95 (0.71–1.27)	1.01 (0.75–1.35)	1.01 (0.75–1.36)
Women <45 years	No	396	45.6	1	1	1	1
	Yes	465	54.0	0.75 (0.58–0.99)	0.74 (0.56–0.97)	0.78 (0.59–1.03)	0.76 (0.57–1.01)
Men ≥45 years	No	125	62.8	1	1	1	1
	Yes	74	37.2	0.70 (0.40–1.30)	0.69 (0.37–1.30)	0.69 (0.37–1.30)	0.76 (0.39–1.46)
Women ≥45 years	No	247	66.6	1	1	1	1
	Yes	124	33.4	0.68 (0.44–1.10)	0.70 (0.44–1.10)	0.75 (0.47–1.20)	0.76 (0.47–1.21)

[a]Adjusted for age and gender (all participants), for gender (<45 y, ≥45 y), for age (men, women) and crude model for gender and age subgroups (men < 45 years, women < 45 years, men ≥ 45 years, women ≥ 45 years).
[b]Model 1+ socioeconomic features (civil status, occupation and education).
[c]Model 2+ lifestyle (alcohol consumption, smoking habit, sleep time and screen exposure).
[d]Model 3+ COVID-19 isolation context (isolation days, number of partners and proximity to COVID-19).

as well as exercise intensity, to influence the acute responses of training over mood responses (40). Comparably reasons may also apply to our study sample. Also, a meta-analysis by Reed et al. (41) focused on acute responses to aerobic exercise over positive activated affect, with higher improvements for those presenting lower levels before the aerobic training; thus, a similar effect might be experienced in participants with worse pre-PA over current perceived mood. In addition, findings from a study by Rocheleau et al. (42) are also noteworthy since they strengthen the notion that gender, exertion level, and training duration might explain differences among study subgroups.

Finally, because COVID-19 settings have been observed to have a greater psychological impact in those with proximal experiences (43), women, students, and people with specific physical symptoms and poor self-rated health status (12), PA could play a critical role in preserving mental health during the confinement period among these subgroups.

Strengths and Limitations

Strengths of the current study consist of examining a wide and large sample of Spanish adults (i.e. participants representing all the Spanish regions) and using a validated question to estimate PA. Moreover, a wide set of control variables, including novel variables such as the number of days isolated or exposure to COVID-19 have been included in the regression models; although the study did not control other potentially relevant variables (i.e. both physical and pre-diagnosed mental health or either perceived anxiety or mood). In addition, several limitations should be underscored for this study. Firstly, since PA and other variables are self-reported, there is still a chance of an information bias; also, there is a possibility of selection bias (i.e. due to the sampling method we do not know whether the respondents represented the Spanish population in general). Further, of all invited to participate in the survey, 540 individuals (18.9%) declined. In these, no characteristic was observed to be substantially different compared to the group of individuals who agreed to participate (i.e. age, gender, and region). Yet, there is a possibility that those who declined to participate may have had either lower or no benefit from current PA for their current perceived anxiety and mood. Nevertheless, the analyses stratified for age and gender showed important associations between PA adherence to WHO guidelines and lower current perceived anxiety in most of the study subgroups, providing consistency to our findings (i.e. the association between current PA and current perceived anxiety and mood is widely observed across study subgroups). During the present circumstances and due to the necessity to collect data rapidly, it was not possible to use time-consuming methods ensuring a representative sample. Secondly, because young adults are overrepresented in the examined sample, estimated current PA adherence, as well as both current perceived anxiety and mood, might be different than in other older adult population; also, estimated current PA levels might be higher than in the general Spanish population of adults. According to the figures from the National Statistics Institute of Spain (44), the characteristics of this study sample substantially differ from the Spanish general population in variables such as age and education (i.e. the participants of this study are younger and higher educated than the average Spanish general population of adults), hence the findings of the present study should be interpreted in the light of this information. Thirdly, the outcome variables were assessed with a not validated tool, which could lead to an information bias; nevertheless, similar single-item questions have been used in prior research to estimate different mental health conditions, and have shown moderate correlation with validated mental health scales (45, 46). Due to their brevity, single-item questions have been further recommended to apply in specific contexts of illness and frailty, hence, the authors decided to use it in this specific confinement context due to COVID-19 pandemic (47). Last, due to the cross-sectional design, the present study does not allow inferring causal conclusions; thus, randomized controlled trials are further necessary to confirm these findings. However, as the epidemic and subsequent confinement could not be foreseen, it was simply not possible to collect data on pre-confinement conditions to allow for assessment of more causal associations. In closing, because the data of the survey were mainly referred to the first days of the COVID-19 outbreak in Spain, the present results might not be reflecting the worse period of the confinement. (i.e. more days of isolation might lead to higher current perceived anxiety and worse mood). Therefore, future research should focus on how PA adherence might influence perceived anxiety and mood regarding longer-term isolation. Also, the use of larger and validated measurement scales would better contribute to understanding how complex subjects such as anxiety and mood can be affected in a confinement context, and the influence of PA in this relationship.

CONCLUSION

The results of the present study indicate that current PA adherence to WHO guidelines in the initial phase of COVID-19 confinement significantly associates with lower current perceived anxiety and lower current perceived worse mood in a large sample of Spanish confined adults. Healthy habits seem to influence both associations which could be stronger among women. Thus, home-based strategies are recommended in this population of adults.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics Committee of Research in Humans of the

University of Valencia. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

RL-B, GL-S, JAC, LS, and JC contributed conception and design of the study. RL-B organized the database. RL-B and GL-S performed the statistical analysis; RL-B and GL-S wrote the first draft of the manuscript. JC, LS, LA, YE, and JAC wrote sections of the manuscript. All authors contributed to the article and approved the submitted version.

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Multidimensional Assessment of COVID-19-Related Fears (MAC-RF): A Theory-Based Instrument for the Assessment of Clinically Relevant Fears During Pandemics

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In this article, we present the development and psychometric properties of the Multidimensional Assessment of COVID-19–Related Fears (MAC-RF). The MAC-RF is an eight-item, self-report scale that has been developed to assess clinically relevant domains of fear during the COVID-19 pandemic. The MAC-RF is based on a comprehensive theoretical model conceptualizing fears during the pandemics as resulting from an interaction of bodily, interpersonal, cognitive, and behavioral experiences. The MAC-RF was administered to a sample of 623 Italian adults from the community aged between 18 and 76 years old (M= 35.67, SD= 12.93), along with a measure of current clinical symptoms. Item response theory analyses demonstrated that each item of the MAC-RF provided sufficient information about the underlying construct of fear. The statistical fit of the scale was satisfactory. MAC-RF total scores correlated significantly and positively with total scores on the measure of psychopathology and with the clinical symptom domain scores. A ROC (receiver operating characteristic) curve analysis showed that the MAC-RF total score was sufficiently able to identify cases with high levels of current psychopathology, with an area under the curve of.76. These findings suggest that the MAC-RF can be used to assess pathological fear during pandemics. The English, Italian, and French versions of the MAC-RF are annexed to this article for use by clinicians and health services.

Keywords: coronavirus disease 2019, fear, psychopathology, assessment, Multidimensional Assessment of COVID-19_Related Fears

INTRODUCTION

Fear is an unpleasant emotion caused by the perception of threat, which relates to danger, harm, or pain. This emotion stems from subcortical and cortical interactions that especially involve the "affective network" system of the brain (1), which includes the amygdala, orbitofrontal cortex, temporal cortex, pallidum, and insular cortex, among other structures. The amygdala and the thalamic pathways are responsible for the automatic and rapid appraisal of threat, whereas the hippocampus and the cortical pathways provide more detailed information on the specific context and characteristics of the threatening stimuli (2). Thus, activation of the amygdala by threatening stimuli is cognitively processed by the prefrontal and orbitofrontal cortex, leading to an experience of fear.

Fear emerged during brain evolution to allow animals to cope with dangers, e.g., by escaping or freezing (3), and it is usually activated by potentially dangerous external stimuli that evoke stress responses modulated by the hypothalamic-pituitary-adrenal (HPA) axis and glucocorticoid hormones. The relationship between fear and stress is complex and although both are often experienced concurrently, stress is assumed to be broader and usually encompassing fear. Therefore, stress responses do not always entail fear, while acute fear typically occurs as a stress response (4).

High levels of fear in humans represent a threat to the sense of safety and security, which elicit further negative emotions and generate alterations in physiological arousal and reactivity (5), distress, and heightened anxiety sensitivity (6). These alterations increase the risk of emotion dysregulation (7) and consequently, the risk of psychopathology (8). In fact, intense experiences of fear, especially when prolonged in time, may alter the regulation of genes controlling the neuroendocrine response to stress (e.g., by an excessive synthesis and secretion of glucocorticoids) (9), fostering physical and mental diseases (10).

Notably, fear experiences are common during a pandemic. Pandemics are unique in terms of causing prominent fear responses because the infection is transmitted invisibly, rapidly and with an increased risk of mortality (11). This limits the capacity of individuals to use adequate emotion regulation strategies (e.g., positive reappraisal of the situation) for coping with the situation, which has often been the case during the COVID-19 pandemic. It has been suggested that the pandemic has generated intense fear experiences among many individuals (12), that an adequate screening of these fears is necessary (13, 14) and that in some cases psychological interventions are needed (15). Therefore, understanding fears in the context of the COVID-19 pandemic is important, using both a theoretical model and a valid measure that would assess the fears and test the model.

The "Four Horsemen" of Fear

Schimmenti, Billieux, and Starcevic (12) proposed a theoretical framework to account for fear experiences during the COVID-19 pandemic. They argued that a pandemic might generate fears that involve main psychological means of grasping the reality. Accordingly, bodily, relational, cognitive, and behavioral domains are involved in fear experiences during a pandemic, with these four domains of fear being interrelated. Furthermore, the model proposes that the four domains of fear are not structured in a hierarchical manner, and that instead, they are organized around a dialectical structure: the bodily domain involves a) fear of the body and b) fear for the body; the interpersonal domain involves c) fear of others and d) fear for others; the cognitive domain involves e) fear of knowing and f) fear of not knowing; the behavioral domain involves g) fear of action and h) fear of inaction. **Table 1** summarizes the types, characteristics and domains of fear experience according to Schimmenti et al.'s (12) theoretical model.

This theoretical model of fear experiences might contribute to our understanding of the origin and maintenance of fear-related symptoms during the COVID-19 pandemic. Based on the described theoretical framework, we developed a brief instrument, the Multidimensional Assessment of COVID-19-Related Fears (MAC-RF). The name of the measure reflects the fact that it is aimed to assess the four dimensions of fear described in the theoretical model.

The MAC-RF could be used for several purposes. First, the MAC-RF could serve as a screening instrument for clinically significant fears, which would indicate a need for a thorough clinical assessment if screening positive. Second, the MAC-RF could be used to identify the specific fear experiences that would help tailor preventive and treatment approaches. Third, this tool could serve the purpose of monitoring changes in the level of fear over time and measuring treatment response. This article aims to present the development and preliminary psychometric properties of the MAC-RF.

TABLE 1 | Fear experiences during the coronavirus pandemic.

Types of fear experience	Characteristics of fear experience	Fear domains
Fear of the body	Sense of one's physical vulnerability due to which the body is perceived as a potential source of danger.	Bodily domain
Fear for the body	Notion that one's body needs to be protected.	
Fear of others	Threat originates from contacts with other persons, including key attachment figures, because of the possibility of being infected.	Interpersonal domain
Fear for others	Threat concerns one's contacts with other people, including the loved ones, because of the possibility of infecting them.	
Fear of knowing	Avoidance of information about the pandemic as a way of reducing the effect of the perceived threat.	Cognitive domain
Fear of not knowing	Coping with negative feelings by collecting all information about the pandemic.	
Fear of action	Indecisiveness about taking action and a sense of being paralyzed by uncertainty.	Behavioral domain
Fear of inaction	Inner pressure to take action and do anything to avoid negative feelings and thinking about the pandemic.	

METHOD

Development of the Scale

Before starting the study, we first established the quality criteria for assessing the adequacy of the MAC-RF as follows:

a. The measure should assess all eight facets of fear identified in Schimmenti et al.'s (12) theoretical model;
b. The measure should be brief, easy to administer and easy to score to facilitate its use in health and community services, i.e., only one item for each of the eight fear facets should be retained;
c. The measure should have satisfactory psychometric properties in terms of internal structure and convergent and predictive validity (i.e., the scale should be positively, significantly, and at least moderately correlated with an independent measure of psychopathology and it should be able to identify individuals with clinically significant fear experiences associated with psychopathology).

In order to develop a measure that would be consistent with the quality criterion (a), the first author developed an original pool of 16 items to correspond to each facet of fear (two items for each type of fear experience described in **Table 1**). Each item was scored on a 5-point Likert scale (from 0 = very unlike me to 4 = very like me), with higher scores on each item indicating higher levels of the corresponding fear facet. The wording of all 16 items was discussed with members of the research team and it was iteratively modified until consensus was reached on face validity of each item. It was then decided that an instrument with all 16 items would be administered in the validation study, with its final version including only a single item for each facet of fear, in accordance with the quality criterion (b).

Participants

Participants in this study were 623 Italian community-dwelling adults (448 females, 71.9%) recruited online, ranging in age from 18 to 76 years (M= 35.67, SD= 12.93). Participants had 16.52 years of education on average (SD= 3.18). Their employment status was as follows: employed (n=231, 37.1%), self-employed (n=149, 23.9%), full-time students (n=151, 24.2%), homemakers (n=20, 3.2%) and unemployed (n=72, 11.6%). Only 9% of participants (n=56) lived alone and 8.7% (n=54) lived with friends, whereas the majority lived with their partner and offspring (n= 265, 42.5%) or with parents (n= 248, 39.8%). At the time of the survey completion, the mean duration of pandemic-related restrictions, such as lockdown, self-isolation, or quarantine, was 48.82 days (SD=12.47).

Procedure

The study received an approval from the institutional review board for psychological research of the first author's university (code UKE-IRBPSY-04.20.04). Participation was anonymous and voluntary and participants received no compensation for completing the survey. Participants were recruited by advertisements placed on social media platforms, with a request for the survey to be disseminated *via* respondents' social media platforms. Participants signed an electronic informed consent before being directed to an online survey, which consisted of a sociodemographic questionnaire, the pool of 16 items developed by the research team to assess fear-related experiences during the pandemic according to Schimmenti et al.'s (12) theoretical model, a measure of psychopathology, and additional instruments not directly related to the objective of the current study. The survey was opened for 10 days, from 27 April 2020 to 5 May 2020. Of 628 total respondents, 623 completed the survey. The survey software did not allow participants to skip any question and therefore, there were no missing or incomplete responses in the dataset.

Measures

Sociodemographic Questionnaire

Participants were asked to provide sociodemographic information, including gender, age, number of years of education, employment status, and marital status during the COVID-19 pandemic.

Multidimensional Assessment of COVID-19-Related Fears

The MAC-RF is an eight-item self-report measure scored on a five-point Likert scale (from 0 to 4) that was developed by the authors of this article to assess the eight facets of fear identified by Schimmenti et al. (12). The MAC-RF was derived from a set of 16 items. Using item response theory (IRT) analysis, the eight items that were most discriminating for each facet of fear (i.e., those displaying the higher *a*-value in the current study) were selected and included in the final version of the instrument. Scores of the MAC-RF can range from 0 to 32, with higher scores indicating higher COVID-19-related fears. The MAC-RF was developed in Italian, French, and English languages (see the **Supplementary Material**), with team consensus on translation and back-translation of its items. Findings reported in this study concern the Italian version of the measure. The psychometric properties of the French and English version of the MAC-RF are still under examination, as data collection in French- and English-speaking countries started later than in Italy, in which lockdown measures have been taken since early March 2020. The psychometric properties of the Italian translation of the measure are extensively described below in the *Results* section.

DSM-5 Self-Rated Level 1 Cross-Cutting Symptom Measure-Adult (CCSM)

The Cross-Cutting Symptom Measure-Adult (CCSM) is a 23-item, self-report measure used for screening of various domains of psychopathology. It assesses relevant clinical symptoms that occurred in the preceding 2 weeks on a 0 to 4 Likert scale (from "none" to "severe"). The CCSM is included in the Diagnostic and Statistical Manual of Mental Disorders—Fifth Edition (DSM-5; American Psychiatric Association, 2013) and provides 13 clinical symptom domain scores (depression, anxiety, anger, mania, somatic symptoms, suicidal ideation, psychosis, sleep problems, memory problems, obsessive-compulsive symptoms, dissociation, maladaptive personality functioning, and substance use). A total score on the CCSM is obtained by averaging the scores on clinical symptom domains. A sample item is "little interest or pleasure in doing things" (related to the symptom domain of depression). The

CCSM has demonstrated adequate psychometric properties in the DSM field trials (16) and many studies across the world (17, 18). Internal consistency (Cronbach's alpha value) of the CCSM in the current study was.89.

Statistical Analyses

To select the eight items to be retained in the final version of the MAC-RF, the Pearson's *r* correlation between the item scores and the total score of the original sixteen items were examined. This procedure was complemented with an exploratory use of item response theory (IRT) analysis, and the *a*-parameter value of each item was calculated. For each pair of items per fear facet, we retained the item showing the highest correlation with the total score of the 16 items (thus the item being more consistent with the entire measure) and showing the highest *a*-value (thus showing the highest capacity to discriminate the hypothesized latent construct of COVID-19 related fear). Subsequently, we tested *via* exploratory factor analysis if the eight selected items would tap into a single factor. After verifying that this condition was met, unidimensional IRT analyses based on graded model were conducted to examine the psychometric properties of the final eight-item version of the MAC-RF in reflecting adequately the latent construct of COVID-19-related fears. In particular, we considered the values of the *a* parameter (the larger this value, the better the item is able to discriminate between people with varying degrees of the latent construct θ) and *b* parameter (where high *b* values indicate a difficult item, that is, a decreased probability that high scores on the item are endorsed). We also examined the test information function (the amount of information yielded by the test at any level of the dimensionally conceptualized construct), and we assessed the goodness of fit of the IRT model by testing exact (M_2) and approximate (root mean square error of approximation, RMSEA) fit. Nonsignificant M_2 probability indicates exact fit. However, in IRT applications it is highly unlikely that a model will exactly fit the data, thus statistics for approximate fit are used, such as the RMSEA, that takes into account both the M_2 value and the degrees of freedom of the model. An RMSEA below.05 indicates adequate fit, that is, indicates that the latent trait dimensionality is correctly specified (19). Descriptive statistics were then computed for all study variables. Gender differences were tested through t-tests for independent samples. Correlational analyses were performed to examine the associations between MAC-RF scores and scores on various domains of psychopathology.

A receiver operating characteristic curve (ROC) analysis was conducted to further test the ability of the MAC-RF to predict the severity of clinical symptoms in the sample, using the 75th percentile of the CCSM total score to dichotomize between cases and non-cases with high levels of psychopathology (20, 21). By applying this rule of thumb, we were able to identify a cutoff value for the CCSM that took into account the global increase in clinical symptoms observed in the population as a response to the COVID-19 pandemic (22). Sensitivity (the proportion of true positive individuals with the condition in a total group of subjects with the condition), specificity (the proportion of participants without the condition with negative test result in the total of participants without the condition), positive likelihood ratio (the likelihood that positive test results occur in participants with the condition compared to those without the condition), negative likelihood ratio (the ratio of the probability that negative results occur in participants with the condition to the probability that the same result will occur in participants without the condition), positive predictive value (the probability of having the condition in a subject with positive results), and negative predictive value (the probability of not having the condition in participants with negative test result) were calculated to test the ability of the MAC-RF to identify participants with a "condition" (i.e., those with high levels of psychopathology).

RESULTS

Item Selection, Internal Structure, and Reliability

Item-total correlation values and *a*-values of an IRT analysis based on graded model were first examined to select the single item to retain for each of the eight fear facets of Schimmenti et al.'s (12) theoretical model. **Supplementary Table 1** displays the original 16 items, their item-total correlation values, their *a*-values, and the outcome (whether or not they were retained for the eight-item MAC-RF). We compared the *r*s of item-total correlations and the *a*-values of the item pairs related to each fear facet, and then selected one item that better reflected each fear facet. This empirically based selection of items allowed us to include in the MAC-RF only one item for each fear facet, as per our quality criteria.

We then performed an exploratory factor analysis on the eight item of the MAC-RF, to test if a single-factor solution was tenable. We used the principal axis factoring method selecting the oblimin rotation to allow the potentially identified factors to correlate, as per theoretical model prediction. The data were homoscedastic [Bartlett's χ^2 (28) = 1,719.29, p <.001], and the sample size was adequate for factor analysis (Keyser-Meyer-Olkin = .87). A single factor was extracted that explained 41.47% of variance, with all items loading above.40 on the factor. The examination of the eigenvalues and the scree-plot clearly supported the single factor solution for the eight items (with the first five eigenvalues being 3.85,.91,.84,.67, and.54).

After the positive testing for unidimensionality, we proceeded with unidimensional IRT analysis of the final measure. The results of IRT analysis based on graded model are summarized in **Table 2**. Each item of the MAC-RF provided sufficient (item 5) to excellent (item 2) level of information on the latent construct of the specific fear facet. The most discriminant item (i.e., the item with higher *a*-value) was item 2 (concerning a fear for the body), while the most difficult item (i.e., the item with the highest *b*-value and with the lowest probability to receive a high score) was item 6 (related to the fear of not knowing).

With regards to the information provided by the MAC-RF at different levels of θ (in IRT analyses, θ represents the latent

TABLE 2 | Multidimensional Assessment of COVID-19-Related Fears (MAC-RF) item parameter estimates.

Item	Facet of fear	*a*	b_1	b_2	b_3	b_4
1	Fear of the body	1.87	–0.37	0.43	1.15	1.89
2	Fear for the body	3.24	–0.46	0.19	0.79	1.44
3	Fear of others	2.03	–1.03	–0.05	0.78	1.86
4	Fear for others	2.11	–1.35	–0.49	0.18	1.00
5	Fear of knowing	0.93	–0.50	0.63	1.76	3.35
6	Fear of not knowing	1.20	–0.04	1.08	2.07	3.49
7	Fear of action	2.10	–0.14	0.62	1.24	2.05
8	Fear of inaction	1.11	–0.70	0.32	1.25	2.51

variable that is standardized to have a mean of 0 and a standard deviation of 1), the MAC-RF provided most information on the latent construct of fear at levels of θ between 0 and + 0.8 (**Table 3**). The MAC-RF was not particularly informative at its lowest total scores, as expected of a measure that aims to identify individuals with clinically relevant levels of fear. With the MAC-RF total scores of 11 (which corresponds to a θ of 0 in the population-based distribution conversion table from summed score to scale score) or above, the instrument provided a highly relevant information on the latent construct of each fear facet. A total MAC-RF score of 20 corresponded to a θ of 1, suggesting that this score might be a cut-off value for identifying heightened experiences of fear that deserve clinical attention.

A marginal reliability for response pattern scores was .87. **Table 4** shows factor loadings of the MAC-RF items. The statistics based on one-way, two-way, and full marginal tables showed a significant M_2 (728.16, df=440, p<.001), but a satisfactory RMSEA of.03 indicating that the latent trait dimensionality was correctly specified in the IRT model. All eight items loaded positively and moderately to highly on the latent construct.

Further analyses based on the classical test theory showed a good internal consistency (Cronbach's alpha = .84) of the MAC-RF, satisfactory split-half reliability (Spearman-Brown r= .78), and an average inter-item correlation of.39 (thus in the suggested range between.20 and.40). All items of the MAC-RF were moderately to strongly correlated with its total score (from r = .54 to r = .80, all ps<.001).

These results suggest that the MAC-RF is an informative and reliable measure of COVID-19-related fears.

TABLE 4 | Factor loadings of the Multidimensional Assessment of COVID-19-Related Fears (MAC-RF) items.

Item	Item content	*λ*	*s.e.*
1	I don't trust my own body to protect me against the coronavirus infection.	0.74	0.05
2	I am frightened about my body being in contact with objects contaminated by the coronavirus.	0.89	0.03
3	I fear that people who are around me can infect me.	0.77	0.04
4	I am frightened about my family members or close friends being in contact with other people and becoming infected with the coronavirus.	0.78	0.04
5	I do not want to be exposed to information about the coronavirus infection because it makes me feel upset and anxious.	0.48	0.07
6	I feel upset if I cannot collect all the information I need about the coronavirus.	0.58	0.06
7	During the coronavirus pandemic I feel paralyzed by indecisiveness or fear of doing something wrong.	0.78	0.04
8	During the coronavirus pandemic I constantly feel that I have to do something.	0.55	0.06

Descriptive Statistics

MAC-RF total scores ranged from 0 to 30 (M=11.21, SD=7.04; interquartile range= 6–16; skewness=.36, kurtosis=–.68). CCSM total scores ranged from 0 to 3.51 (M=.96, SD=.62). **Table 4** displays descriptive statistics for the MAC-RF and CCSM scores for the full sample and for males and females separately.

As **Table 5** shows, the fear for significant others (item 4) was more strongly endorsed compared to all other fear facets. Participants also reported significant levels of symptoms of anger, depression, anxiety, mania, and sleep problems on average (more than one or two episodes in the preceding 2 weeks). Concerning gender differences, females reported significantly increased COVID-19-related fear experiences on all the items of the MAC-RF except for item 6, related to the fear of not knowing. As a result, MAC-RF total scores were also significantly higher in females. This pattern of results on the MAC-RF corresponds to the CCSM scores, where females reported significantly more symptoms than males. A series of t-tests for independent samples with Bonferroni's correction for multiple comparisons showed that females reported significantly higher levels of the symptoms of depression, mania and anxiety,

TABLE 3 | Item information function of the Multidimensional Assessment of COVID-19-Related Fears (MAC-RF) at different values of θ (from –2.8 to 2.8).

Item	Facet of fear	–2.8	–2.4	–2.0	–1.6	–1.2	–0.8	–0.4	0.0	0.4	0.8	1.2	1.6	2.0	2.4	2.8
1	Fear of the body	0.04	0.07	0.15	0.29	0.51	0.77	0.97	1.06	1.09	1.09	1.09	1.05	0.94	0.72	0.46
2	Fear for the body	0.01	0.02	0.07	0.25	0.81	2.00	2.91	3.04	3.10	3.10	2.99	2.54	1.27	0.43	0.12
3	Fear of others	0.11	0.23	0.44	0.76	1.05	1.18	1.21	1.24	1.25	1.23	1.18	1.16	1.06	0.78	0.47
4	Fear for others	0.19	0.39	0.72	1.08	1.27	1.33	1.37	1.37	1.35	1.29	1.11	0.77	0.43	0.21	0.09
5	Fear of knowing	0.08	0.11	0.14	0.17	0.20	0.23	0.25	0.26	0.27	0.27	0.27	0.27	0.27	0.26	0.26
6	Fear of not knowing	0.05	0.08	0.11	0.17	0.23	0.30	0.37	0.41	0.44	0.45	0.46	0.46	0.45	0.44	0.44
7	Fear of action	0.02	0.04	0.08	0.19	0.39	0.71	1.07	1.28	1.35	1.37	1.36	1.33	1.24	1.00	0.63
8	Fear of inaction	0.10	0.14	0.19	0.25	0.30	0.34	0.37	0.39	0.39	0.39	0.39	0.38	0.37	0.36	0.32
Test information:		1.59	2.08	2.92	4.15	5.77	7.86	9.52	10.06	10.23	10.20	9.86	8.96	7.04	5.20	3.79
Expected s.e.:		0.79	0.69	0.59	0.49	0.42	0.36	0.32	0.32	0.31	0.31	0.32	0.33	0.38	0.44	0.51

TABLE 5 | Descriptive statistics of the Multidimensional Assessment of COVID-19-Related Fears (MAC-RF) and Cross-Cutting Symptom Measure-Adult (CCSM) and gender differences.

	Total (N = 623)		Males (n = 175)		Females (n = 448)		t(621)	p
	M	SD	M	SD	M	SD		
MAC-RF total score	11.21	7.04	9.47	6.25	11.89	7.22	–3.91	<.001
MAC-RF item 1	1.27	1.31	0.96	1.11	1.39	1.36	–3.70	<.001
MAC-RF item 2	1.44	1.34	1.13	1.24	1.56	1.36	–3.62	<.001
MAC-RF item 3	1.65	1.23	1.45	1.16	1.72	1.25	–2.47	.014
MAC-RF item 4	2.20	1.37	1.87	1.26	2.33	1.39	–3.86	<.001
MAC-RF item 5	1.23	1.27	0.99	1.16	1.32	1.29	–2.99	.003
MAC-RF item 6	0.91	1.11	0.96	1.11	0.90	1.11	.66	.51
MAC-RF item 7	1.09	1.25	0.89	1.1	1.16	1.30	–2.45	.015
MAC-RF item 8	1.43	1.33	1.22	1.21	1.51	1.37	–2.46	.014
CCSM total score	0.96	0.62	0.85	0.58	1.00	0.63	–2.79	.005
Depression	1.64	1.07	1.42	1.07	1.73	1.06	–3.33	.001
Anger	1.91	1.20	1.78	1.24	1.96	1.19	–1.72	.085
Mania	1.32	0.99	1.20	0.93	1.37	1.01	–1.97	.050
Anxiety	1.47	1.05	1.08	0.96	1.63	1.05	–6.04	<.001
Somatic symptoms	0.90	1.03	0.71	0.92	0.97	1.07	–2.92	.004
Suicidal ideation	0.17	0.59	0.20	0.65	0.16	0.56	.71	.480
Psychosis	0.11	0.43	0.10	0.36	0.12	0.45	–.50	.621
Sleep problems	1.45	1.37	1.31	1.33	1.50	1.38	–1.54	.124
Memory problems	0.51	0.97	0.37	0.81	0.56	1.02	–2.26	.024
Obsession/compulsion	0.66	0.97	0.63	0.95	0.67	0.98	–.40	.693
Dissociation	0.57	1.00	0.45	0.89	0.62	1.03	–1.95	.052
Maladaptive personality	1.12	1.15	1.05	1.05	1.15	1.18	–1.01	.313
Substance use	0.62	0.80	0.74	0.82	0.57	0.79	2.42	.016

as well as somatic symptoms and memory problems, whereas males reported significantly higher levels of substance use.

Association With Psychopathology and Convergent Validity

The MAC-RF total and item scores were significantly correlated with CCSM total scores, with the levels of associations being in the moderate range (*r* = .55 for the association between MAC-RF total scores and CCSM total scores, *r*s ranging from.31 to.47 for the associations between MAC-RF item scores and CCSM total scores, all *p*s <.001). **Table 6** shows correlations between the MAC-RF total and item scores and the CCSM domain scores. All correlations between the total MAC-RF scores and CCSM domain scores were significant, except for substance use. MAC-RF total and item scores showed the strongest associations with anxiety symptoms. The patterns of these associations did not change when partial correlations were examined and the effects of gender, age, education, and days spent in pandemic-related restriction conditions were partialled out. Overall, the correlational findings support the convergent validity of the MAC-RF.

Identifying Cases With High Levels of Current Psychopathology

Finally, we performed a ROC curve analysis to test the ability of the MAC-RF to identify cases with high levels of current psychopathology. The 75th percentile of the total CCSM score (i.e., the last quartile) corresponding to scores above 1.32 was used to delineate participants with high levels of current psychopathology. An area under the curve was.76 (95% C.I.72–.81, p<.001), indicating that the MAC-RF total score is sufficiently able to identify cases with high levels of current psychopathology. Examining the potential cut-off scores of the MAC-RF, we found that a cut-off score of 12 seemed to suggest high levels of current psychopathology. This is based on the sensitivity of 75.80%, specificity of 62.45%, positive likelihood ratio of 2.02, negative likelihood ratio of 0.39, positive predictive value of 40.48%, and negative predictive value of 88.45%. These findings confirm the positive relationship between COVID-19-related fears and overall psychopathology.

DISCUSSION

This article examined the psychometric properties of the Italian version of the MAC-RF, a theory-based measure that was developed for the screening and assessment of clinically relevant fears during the COVID-19 pandemic. Even though the MAC-RF is not the first measure that was developed to assess COVID-19-related fears (13, 23), it might have some theoretical and clinical advantages over other dedicated instruments. The advantages of a theory-based measure include interpretability of item scores according to theory, testing the theory itself, and the possibility to combine theory with results of the assessment to guide clinical decision-making. Our findings suggest that the MAC-RF adequately taps all the eight domains of fear during the COVID-19 pandemic proposed by Schimmenti and colleagues (12). The instrument might also have some predictive value in identifying individuals at increased risk of current psychopathology during the COVID-19 pandemic.

The eight items of the MAC-RF identified by IRT analysis provided sufficient to excellent information on the latent

TABLE 6 | Pearson's r correlation between Multidimensional Assessment of COVID-19-Related Fears (MAC-RF) scores and Cross-Cutting Symptom Measure-Adult (CCSM) domain scores.

	Depression	Anger	Mania	Anxiety	Somatic symptoms	Suicidal ideation	Psychosis	Sleep problems	Memory problems	Obsession/ compulsion	Dissociation	Maladaptive personality	Substance use
MAC-RF total score	.42**	.38**	.27**	.63**	.50**	.16**	.23**	.33**	.26**	.36**	.33**	.37**	.05
MAC-RF item 1	.35**	.25**	.10**	.47**	.40**	.11**	.16**	.22**	.15**	.24**	.20**	.24**	.08
MAC-RF item 2	.28**	.27**	.16**	.48**	.36**	.08*	.18**	.20**	.16**	.26**	.24**	.23**	−.02
MAC-RF item 3	.25**	.24**	.15**	.41**	.33**	.08*	.09*	.24**	.18**	.16**	.18**	.24**	.04
MAC-RF item 4	.28**	.24**	.18**	.44**	.33**	.08*	.12**	.25**	.19**	.24**	.22**	.26**	.01
MAC-RF item 5	.27**	.25**	.23**	.42**	.30**	.09*	.14**	.20**	.07	.24**	.22**	.26**	−.02
MAC-RF item 6	.25**	.25**	.15**	.35**	.29**	.07	.08	.18**	.21**	.20**	.18**	.17**	.08
MAC-RF item 7	.34**	.31**	.20**	.53**	.40**	.21**	.27**	.21**	.25**	.34**	.30**	.36**	.04
MAC-RF item 8	.31**	.30**	.29**	.38**	.36**	.13**	.21**	.27**	.23**	.34**	.24**	.29**	.08

** p<.01, ** p<.01 (two tailed).*

construct of fear (see **Table 2**), with values of the *a* parameter ranging from 0.93 to 3.24. Notably, the highest value of the *a* parameter was found for item 2, related to the fear for the body, and thus to the fear of being contaminated by the virus. This finding is consistent with research (13) and theory (24) suggesting that the most prominent fear during the pandemics relates to the risk of illness and death. Results of the validation studies of the other two instruments developed to assess fear and related constructs in the context of the COVID-19 pandemic are also in agreement with our findings. Thus, one of the item of the fear of COVID-19 scale on which the participants had the highest scores assessed a fear of death resulting from COVID-19 (13). Similarly, a factor concerning danger and contamination fears extracted from the COVID Stress Scales accounted for most variance compared to other factors (23). In contrast, the lowest value of the *a* parameter (and thus the lowest discrimination ability for the underlying construct of fear) was observed for item 5 of the MAC-RF which regards the fear of knowing. This result suggests that knowledge about COVID-19 and the associated risks is perceived as promoting a sense of control, with the fear of not having that knowledge being most distressing.

The most difficult item (i.e., the item with the highest value in the IRT *b* parameter) of the MAC-RF was the fear of not knowing, seemingly opposite from the item concerning the fear of knowing. This apparently paradoxical result is consistent with the theory on COVID-19-related fears proposed by Schimmenti et al. (12), which posits the dialectical alternation of fears of knowing and not knowing during the pandemic. This finding may be explained by the reluctance of many people to know "too much" about the pandemic to avoid being overwhelmed by frightening information.

The fit indices of the MAC-RF were good (see **Table 4**), with all items loading above.45 on the latent construct and a good RMSEA of.03 (25). Also, internal reliability was good and the average inter-item correlations were in the suggested range between.20 and.40 (26). Thus, the MAC-RF can be considered an internally valid and reliable measure of the fears related to COVID-19.

We also found gender differences, with females displaying higher levels of fears than males on the total MAC-RF scores and on all item scores, except for item 6 related to the fear of not knowing (see **Table 5**). These gender differences were analogous to gender differences on the general psychopathology scores, where females reported higher levels of depression, mania, anxiety, somatic symptoms, and memory problems than males, while males reported higher substance use than females. These findings are highly consistent with previous research reporting increased levels of fear among females (27, 28), and more generally with research showing that females are more prone to internalizing symptoms, such as anxiety and depression, whereas males are more prone to externalizing symptoms, such as substance use and antisocial behaviors (29, 30).

It is worth noting that the scores on various domains of psychopathology were quite high in our sample (see **Table 5**), with mean scores of 1 or above on the specific domains of depression, anger, mania, anxiety, sleep problems, and maladaptive personality functioning. This means that, on average, our participants reported the presence of symptoms related to these domains as occurring at least once in the 2 weeks before completing the survey. We believe that these high scores are a consequence of the pandemic situation. It has been suggested in recent literature that the COVID-19 pandemic may have profoundly negative effects on the overall functioning of individuals by altering their habits and daily life (31), evoking uncertainty and insecurity in the relationship between the self and the world (1) and causing intense anxiety responses (13).

Results of correlational analyses supported the convergent validity of the MAC-RF, whose items correlated positively and significantly with the total score of a measure assessing different types of psychopathological symptoms (see **Table 6**). This suggests that the MAC-RF assesses clinically relevant fears associated with a more severe current psychopathology. Notably, the strongest correlation of the MAC-RF was observed with anxiety, which is consistent with theory and neurobiological evidence that fear and anxiety are highly connected and that they overlap (2). However, the MAC-RF was positively and significantly associated with several other psychopathological domains, supporting a view that domains of fear assessed by the MAC-RF are relevant for identifying overall psychopathology and not only its anxiety domain.

We examined the ability of the MAC-RF to identify cases with high levels of current psychopathology *via* a ROC curve analysis. This analysis revealed that the MAC-RF performed sufficiently well in this regard, with an area under the curve of.76. However, the MAC-RF displayed an adequate sensitivity but a limited specificity at the suggested cut-off value of 12, indicating that its use in screening practice should be complemented with other specific measures on psychopathology. Nonetheless, the overall results of the ROC analysis, especially the positive likelihood ratio of 2.02 and the negative predictive value of 88.45%, suggests that the MAC-RF maintains some usefulness in identifying those individuals whose COVID-19-related fear experiences are associated with increased clinical symptoms.

The present study has several limitations. First, the MAC-RF is based on a specific theory about different domains of fear during a pandemic. While this is an advantage and the theory is rather comprehensive, it is possible that some relevant domains of fears have been overlooked by the theory and therefore, they are not assessed by the MAC-RF. Second, the study was cross-sectional, precluding any conclusions about possible causal relationships between domains of fear and various aspects of psychopathology. Longitudinal studies using the MAC-RF are needed to better understand these relationships. Third, findings of the study were based on self-report, which is subject to various biases. In this context, it is noteworthy that individuals with high levels of psychopathology have been identified using an empirically-derived cutoff value on a self-report measure. Future studies should test the validity of the MAC-RF against a more strict criterion, such as the presence of a psychiatric diagnosis. Finally, the study was conducted in Italian adults recruited online from the general population and its findings do not necessarily generalize to other population groups, such as adolescents, people with various mental disorders, and individuals from a different ethnic background. Therefore, studies in samples more clearly representative of the general population of various countries, as well as studies in clinical samples, are warranted.

CONCLUSIONS

Findings of the present study support use of the MAC-RF as a brief, theory-based instrument for assessment of clinically relevant fears related to the COVID-19 pandemic. Although the MAC-RF was developed for use in the context of this pandemic, it could be administered to assess fear experience in other public health emergencies, especially future pandemics during which the causative agent spreads rapidly *via* human contact and is associated with mortality and much uncertainty. Modifications of the MAC-RF for this purpose would be simple, with changes in the wording of the relevant items (e.g., by replacing the term "coronavirus" with a term related to another pandemic situation). The MAC-RF was simultaneously developed in three languages and its versions in Italian, English, and French are presented in the **Supplementary Material** to this article.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Internal Review Board for Psychological Research of the UKE - Kore University of Enna (code: UKE-IRBPSY-04.20.04). The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

All authors contributed to the study design and to the development of the items of the Multidimensional Assessment of the COVID-19-Related Fears (MAC-RF). AS collected and analyzed the data, and was responsible for preparing the first draft of the article. All authors contributed to the article and approved the submitted version.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2020.00748/full#supplementary-material

SUPPLEMENTARY TABLE 1 | Development of the MAC-RF: original items, related theoretical facets, item-total correlation, *a*-paramenter values, and retention of items.

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BRIEF RESEARCH REPORT
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COVID-19 Pandemic and Lockdown Measures Impact on Mental Health Among the General Population in Italy

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Background: The psychological impact of the COronaVIrus Disease 2019 (COVID-19) outbreak and lockdown measures on the Italian population are unknown. The current study assesses rates of mental health outcomes in the Italian general population three to 4 weeks into lockdown measures and explores the impact of COVID-19 related potential risk factors.

Methods: A web-based survey spread throughout the internet between March 27th and April 6th 2020. Eighteen thousand one hundred forty-seven individuals completed the questionnaire, 79.6% women. Selected outcomes were post-traumatic stress symptoms (PTSS), depression, anxiety, insomnia, perceived stress, and adjustment disorder symptoms (ADS). Seemingly unrelated logistic regression analysis was performed to identify COVID-19 related risk factors.

Results: Endorsement rates for PTSS were 6,604 (37%), 3,084 (17.3%) for depression, 3,700 (20.8%) for anxiety, 1,301 (7.3%) for insomnia, 3,895 (21.8%) for high perceived stress and 4,092 (22.9%) for adjustment disorder. Being woman and younger age were associated with all of the selected outcomes. Quarantine was associated with PTSS, anxiety and ADS. Any recent COVID-related stressful life event was associated with all the selected outcomes. Discontinued working activity due to the COVID-19 was associated with all the selected outcomes, except for ADS; working more than usual was associated with PTSS, Perceived stress and ADS. Having a loved one deceased by COVID-19 was associated with PTSS, depression, perceived stress, and insomnia.

Conclusion: We found high rates of negative mental health outcomes in the Italian general population 3 weeks into the COVID-19 lockdown measures and different COVID-

19 related risk factors. These findings warrant further monitoring on the Italian population's mental health.

Keywords: covid-19, mental health, trauma, depression, anxiety, stress

BACKGROUND

The psychological impact of the COronaVIrus Disease 2019 (COVID-19) outbreak and related lockdown measures among the Italian population are unknown. The COVID-19 pandemic is a global health emergency that could potentially have a serious impact on public health, including mental health (1, 2). Since clusters of atypical pneumonia of unknown aetiology were discovered in the city of Wuhan, Hubei province, in late December 2019, the viral disease has continued to exponentially spread throughout China and worldwide. Italy has been the first European country that had to face the pandemic. On March 9th 2020, lockdown measures were enforced by the government on entire national territory. Lockdown measures included travel restrictions, the mandatory closure of schools, nonessential commercial activities and industries. People were asked to stay at home and socially isolate themselves to prevent being infected.

As previously reported, health emergencies such as epidemics can lead to detrimental and long-lasting psychosocial consequences, due to disease related fear and anxiety, large-scale social isolation, and the overabundance of (mis) information on social media and elsewhere (3). At the individual level, epidemics are associated with a wide range of psychiatric comorbidities including anxiety, panic, depression, and trauma-related disorders (4). The psychosocial impact of health emergences seems to be even higher during quarantine measures (5). Quarantine has been associated with high stress levels (6), depression (7), irritability and insomnia (8). Furthermore, being quarantined is associated with acute stress (9) and trauma-related (10) disorders, particularly in specific at-risk populations such as health workers (11).

Concerning the COVID-19 pandemic, a study on 1210 respondents in China found rates of 30% of anxiety and 17% of depression (12). Further, in a nationwide survey including more than 50,000 Chinese respondents, almost 35% of the participants reported trauma-related distress symptoms, with women and young adults showing significantly higher psychological distress (13).

Together, these findings strongly suggest the need to accurately and timely assess the magnitude of mental health outcomes in the general population exposed to COVID-19 pandemic, with particular regard to the implementation of preventive and early interventions strategies for those at higher risk. However, no study to date has investigated mental health outcomes and associated risk factors in the Italian population. This could be of additional relevance considering the implementation of the strict lockdown and social distancing measures imposed on the entire national territory.

The aim of the current study was to assess rates of mental health outcomes in the Italian general population three to 4 weeks into lockdown measures and to explore the impact of COVID-19 related potential risk factors. This study aims at providing evidence that could potentially inform subsequent research strategies and mental health delivery in Italy and Europe. Our hypothesis is that specific COVID-19 related risk factors could show a relevant association with mental health in the general population.

METHODS

Study Design

A cross-sectional web-based survey design was adopted. Approval for this study was obtained from the local IRB at University of L'Aquila. On-line consent was obtained from the participants. Participants were allowed to terminate the survey at any time they desired. The survey was anonymous, and confidentiality of information was assured.

Data on mental health were collected between March 27th and April 6th 2020 using an on-line questionnaire spread throughout the internet, using sponsored social network advertisement together with a snowball recruiting technique. Questionnaires were evenly distributed across the national territory. The investigated timeframe corresponds to the contagion peak in Italy, according to epidemiological data confirmed by the World Health Organization (1). The survey was developed using the free software Google Forms®.

Participants

All Italian citizens ≥ 18 years were eligible. A total of 18,147 individuals completed the questionnaire, of which 14,447 (79.6%) women, median age was 38 (IQR=23). Because of the web-based design, no response rate could be estimated as it was not possible to estimate how many persons were reached by social network advertisement.

Mental Health Outcomes

Post-Traumatic Stress Symptoms (PTSS), depression symptoms, anxiety symptoms, insomnia, perceived stress and adjustment disorder symptoms (ADS) were assessed using the Italian versions of the following instruments and cut-offs or scoring:

- The Global Psychotrauma Screen, post-traumatic stress symptoms subscale (GPS-PTSS) (14): PTSS were considered of clinical relevance if more than three out of five symptoms were reported as present. In our sample, internal consistency was α=0.54.

- the 9-item Patient Health Questionnaire (PHQ-9) (15), using the cut-off for severe depression symptoms at ≥15. In our sample, internal consistency was α=0.87
- the 7-item Generalized Anxiety Disorder scale (GAD-7) (16), using the cut-off for severe anxiety symptoms at ≥15. In our sample, internal consistency was α=0.91
- the 7-item Insomnia Severity Index (ISI) (17), using the cut-off at ≥22 for severe insomnia. In our sample, internal consistency was α=0.90
- the 10-item Perceived Stress Scale (PSS) (18), using a quartile split to separate the higher quartile from the remaining participants. In our sample, internal consistency was α=0.87
- the International Adjustment Disorder Questionnaire (IADQ) (19), using the standard scoring system. IADQ comprises a brief checklist of potentially stressful events, such as financial, work, health or housing problems. The IADQ checklist was modified in order to ascertain if the reported problem was due to COVID-19. ADS were rated as present if a stressful life event correlated to COVID-19 was present, together with preoccupation and failure to adapt symptoms and a relevant impact on global functioning. In our sample, internal consistency was α=0.90

Independent Variables

Standardized age, gender, and region of residence (Northern Italy: Aosta Valley, Piedmont, Liguria, Lombardy, Trentino-Alto Adige, Veneto, Friuli-Venezia Giulia, Emilia-Romagna; Central Italy: Tuscany, Umbria, Marche, Lazio; Southern Italy: Abruzzo, Molise, Apulia, Campania, Basilicata, Calabria, Sicily, and Sardinia) were inserted as independent variables. Region of residence was inserted in order to account for the different incidence of COVID-19 among Italian regions. COVID-19 related independent variables were:

- being under quarantine either because infected or in close proximity to infected people;
- any changes in working activity compared to "working as usual" (e.g., smart-working, working activity discontinued due to lockdown measures, higher workload due to COVID-19);
- having a loved one infected, hospitalized or deceased due to COVID-19;
- any stressful events comprised in the IDAQ checklist, purposely modified in order to capture only stressful events due to COVID-19. The IADQ checklist comprises eight questions about any potential stressful life event occurred in the recent past, with a yes/no response, including financial, working, educational, housing, relationship, own or loved one's health and caregiving problems. In order to separate COVID-19 related stressful life events from non-COVID-19 related events, responses to the checklist were modified as follows: "no"; "yes"; "yes, due to COVID-19". Responses were collapsed in a binary variable where 1="any stressful life evet only if due to COVID-19" and 0="no stressful life events or presence of a stressful life event not due to COVID-19".

Confounders

A history of childhood trauma and any previous mental illness, as assessed by the dedicated GPS module; education level, occupation (employed, unemployed, student, retired) and being in a relationship.

Statistical Analysis

Frequency analysis were performed in order to ascertain the prevalence of each outcome, separately for Northern, Central, and Southern Italy.

A seemingly-unrelated multivariate logistic regression model was fitted in order to explore the impact of the proposed covariates and confounders on the selected outcomes. Seemingly unrelated regression models are systems of equations that allow to jointly model several outcomes, assuming correlation among their errors. Because of the very low missing data rates (<3%), missing data were treated with listwise deletion in regression analysis.

Data analysis was performed using Stata v. 16® (StataCorp). Seemingly unrelated logistic regression was performed using the -suest- postestimation command after running a panel of logistic regressions.

RESULTS

Socio-demographic characteristics of the sample, along with rates of mental health outcomes, are reported in **Table 1**. Of the 18,147 respondents, 6,666 (37.14%) reported ≥3/5 PTSS, with a median total GPS symptom score of 7 (IQR=6, range 0-17); 3,099 respondents (17.3%) reported severe depressive symptoms, with a PHQ total median score of 8 (IQR=6, range 0-17); 3,732 (20.8%) respondents reported severe anxiety symptoms, with GAD median score of 8 (range 0-21, IQR=10); 1,306 (7.3%) respondents reported severe insomnia symptoms, with ISI median total score of 10 (range 0-28, IQR=12); PSS total score median was 25 (range 4-44, IQR=13), 75th percentile was 31, with 3,933 (21.9%) respondents scoring above this threshold; 4,129 (23.0%) respondents reported a IADQ scoring compatible with the suspect of a presence of an adjustment disorder.

Seemingly unrelated logistic regression analyses are reported in **Table 2**. Being a woman was associated with all of the selected outcomes. Younger age was associated with PTSS, depression symptoms, anxiety symptoms, and perceived stress. Compared to Northern Italy, participants from Southern Italy showed higher odds of all of the selected outcomes, except for ADS. Being under quarantine because infected or in close proximity to infected people was associated with PTSS, Anxiety and ADS. Having experienced a stressful life event due to COVID-19, as assessed by the modified IADQ checklist, was associated with all of the selected outcomes. OR of IADQ-Checklist on ADS was not estimated due to the perfect prediction, because having an IADQ checklist event is a prerequisite for having a suspected Adjustment Disorder. Working activity discontinued due to COVID-19 was associated with all of the selected outcomes except for ADS, while working more than usual due to the COVID-19 was associated with PTSS, perceived

TABLE 1 | Demographic characteristics and rates of mental health outcomes in the sample.

	Total	North	Centre	South
	No./Median (%/IQR)	*No./Median (%/IQR)*	*No./Median (%/IQR)*	*No./Median (%/IQR)*
Age	38 (23)	38 (23)	38 (24)	38 (31)
Gender				
Women	14207 (79.5)	6310 (79)	3729 (79.4)	4168 (80.6)
Men	3653 (20.5)	1681 (21)	966 (20.6)	1006 (19.4)
Education				
≤Undergraduate	8538 (47.8)	3770 (47.2)	2243 (47.8)	2525 (48.8)
≥Postgraduate	7674 (43)	3411 (42.7)	2112 (45)	2151 (41.6)
Lower education	1649 (9.2)	810 (10.1)	340 (7.2)	499 (9.6)
Occupation				
Homemaker	1139 (6.4)	367 (4.6)	244 (5.2)	528 (10.2)
Unemployed	2094 (11.7)	793 (9.9)	484 (10.3)	817 (15.8)
Employed	10881 (60.9)	5349 (66.9)	2867 (61.1)	2665 (51.5)
Retired	291 (1.6)	124 (1.6)	77 (1.6)	90 (1.7)
Student	3456 (19.3)	1358 (17)	1023 (21.8)	1075 (20.8)
Currently on Quarantine	141 (0.8)	101 (1.3)	21 (0.5)	19 (0.4)
Working activity change				
As usual	2320 (13.5)	977 (12.6)	633 (14)	710 (14.5)
Smart-working	6688 (38.9)	3088 (39.9)	1847 (40.9)	1753 (35.7)
Discontinued	7500 (43.7)	3347 (43.2)	1870 (41.4)	2283 (46.5)
More than usual	665 (3.9)	335 (4.3)	168 (3.7)	162 (3.3)
Loved one's status				
None	16312 (91.8)	6987 (87.6)	4431 (94.7)	4894 (95.5)
Infected	789 (4.4)	519 (6.5)	139 (3)	131 (2.6)
Deceased	253 (1.4)	183 (2.3)	30 (0.6)	40 (0.8)
Hospitalized	424 (2.4)	284 (3.6)	80 (1.7)	60 (1.2)
GPS PTSS≥3	6604 (37)	2876 (36)	1560 (33.2)	2168 (41.9)
PHQ ≥15	3084 (17.3)	1349 (16.9)	703 (15)	1032 (20)
GAD ≥15	3700 (20.8)	1613 (20.2)	854 (18.3)	1233 (23.9)
ISI ≥22	1301 (7.3)	542 (6.8)	280 (6)	479 (9.3)
PSS 75th percentile	3895 (21.8)	1720 (21.5)	918 (19.6)	1257 (24.3)
ADS	4092 (22.9)	1900 (23.8)	1032 (22)	1160 (22.4)

GPS, Global Psychotrauma Screen; PHQ, Patient Health Questionnaire; GAD, Generalized Anxiety Disorder scale; ISI, Insomnia severity Index; PSS, Perceived Stress Scale; ADS, Adjustment Disorder Symptom; IQR, Interquartile range.

stress and ADS. Having a loved one deceased by COVID-19 was associated with PTSS, while having a loved one diagnosed with COVID-19 was associated with PTSS.

DISCUSSION

In this study, we report for the first time on the mental health outcomes related to COVID-19 outbreak and related lockdown measures on the general population in Italy. To the best of our knowledge, this is the first study to report on mental health outcomes related to the COVID-19 outbreak in Europe on such a large sample size. This study shows relatively high rates of PTSS, Depression symptoms, Anxiety symptoms, Insomnia, Perceived stress and ADS, with young women having higher odds of endorsing a mental health outcome. These outcomes were associated with a number of COVID-19-related risk factors, including being under quarantine, having a loved one deceased by COVID-19, working activity discontinued due to lockdown measures, or experiencing other stressful events (i.e. working, financial, relationship, or housing problems) due to the pandemic or lockdown measures. These findings were adjusted for previous psychiatric illness and a history of childhood trauma, suggesting that the COVID-19 pandemic is exerting an independent effect on the population mental health.

Previous Literature

Compared to previous reports on common mental disorders in the Italian population, our data suggest in increase in rates of common mental disorders such as depression symptoms and anxiety symptoms (20). However, this comparison should be taken with caution, because of the inherently different assessment methods used (interview *vs.* self-report) and sampling strategy. Furthermore, our study uses screening tools that may only suggest the presence of a mental disorders. To the best of our knowledge, no large epidemiological study has ever been conducted in Italy on stress-related disorders, so no comparison with pre-covid evidence can be proposed.

Compared to an early report on the mental health outcomes related to COVID-19 in China on 1210 respondents (12), we found lower rates of anxiety, similar rates of depression and higher levels of perceived stress, notwithstanding differences in assessment tools. The negative association with age and the positive association with female gender were confirmed, suggesting that young women may be at heightened risk for mental disorders. Compared to another large web-based survey from China on 52,730 respondents that evaluated peritraumatic stress-related symptoms, we found similar rates of PTSS (13). Another study on 285 participants from hardest-hit Hubei province found substantially lower rates of PTSS, around 7% (21). Such disparities could be due to different assessment tools used and differences in sample size. A study on 7,143 medical students in China (22) found severe anxiety rates, assessed as GAD≥15, to be 0.9%, compared to our 20.9%. This inconsistence could be due to the particular population investigated, having a high education level. Indeed, higher education was associated with better outcomes in our study. Furthermore, cultural, social, and health care system differences between China and Italy could explain differences in reported mental health outcomes.

Coherently with previous reports from China, female gender (12, 13, 21) and younger age (12, 13) were consistently associated with higher risk for different mental health outcomes. If confirmed in other populations worldwide, these findings could be of great importance for subsequent intervention strategy for global mental health related to COVID-19.

Relevance

Monitoring populations' mental health is critical during a pandemic, as generalized fear and fear-induced over-reactive behaviour among the public could impede infection control (3). Further, the current strict lockdown measures and the home confinement of unknown duration represent an unprecedented stressful event potentially leading to significant long-term health costs. Epidemiological monitoring and targeted intervention should be therefore timely implemented to prevent further mental health problems. Indeed, once the outbreak will be over, its negative socio-economic consequences may have a

TABLE 2 | Seemingly unrelated logistic regression.

	PTSS	Depression	Anxiety	Perceived Stress	Insomnia	ADS
	OR [95%CI]	***OR [95%CI]***	***OR [95%CI]***	***OR [95%CI]***	***OR [95%CI]***	***OR [95%CI]***
Age[§]	1.49*** [1.39,1.60]	1.55*** [1.42,1.69]	1.72*** [1.59,1.87]	1.76*** [1.62,1.90]	1.01 [0.97,1.05]	1.05 [0.75,1.47]
Gender						
Men	1.00 (ref)					
Women	2.12*** [1.94,2.31]	1.39*** [1.24,1.56]	1.77*** [1.59,1.97]	2.06*** [1.85,2.30]	1.50*** [1.26,1.78]	1.64*** [1.45,1.84]
Region						
North	1.00 (ref)					
Centre	0.93 [0.86,1.01]	0.87* [0.78,0.97]	0.90* [0.82,1.00]	0.90* [0.82,0.99]	0.9 [0.77,1.05]	0.91 [0.81,1.02]
South	1.36*** [1.26,1.47]	1.25*** [1.13,1.37]	1.29*** [1.18,1.41]	1.20*** [1.10,1.32]	1.41*** [1.24,1.62]	0.95 [0.85,1.06]
COVID-19-Related Stressful Event	1.46*** [1.37,1.56]	1.58*** [1.45,1.72]	1.64*** [1.51,1.78]	1.82*** [1.68,1.97]	1.58*** [1.40,1.79]	n.a. n.a.
Currently On Quarantine	1.74** [1.21,2.49]	1.49 [0.98,2.26]	1.52* [1.05,2.22]	1.42 [0.97,2.07]	1.23 [0.69,2.18]	2.28*** [1.44,3.61]
Working Activity Change						
As Usual	1.00 (ref)					
Smart-Working	1.01 [0.91,1.12]	0.99 [0.86,1.14]	0.97 [0.85,1.10]	1.02 [0.90,1.15]	0.9 [0.74,1.10]	1.07 [0.91,1.25]
Discontinued	1.15** [1.05,1.27]	1.40*** [1.23,1.59]	1.16* [1.03,1.31]	1.19** [1.06,1.34]	1.22* [1.03,1.46]	1.1 [0.95,1.28]
More Than Usual	1.42*** [1.18,1.71]	1.26 [0.98,1.63]	1.25 [1.00,1.57]	1.71*** [1.38,2.12]	1.29 [0.93,1.80]	1.39* [1.04,1.87]
Loved One's Condition						
None	1.00 (ref)					
Infected	1.22* [1.05,1.42]	1.05 [0.87,1.28]	0.91 [0.75,1.10]	0.88 [0.73,1.05]	1.02 [0.77,1.35]	0.96 [0.79,1.17]
Deceased	1.68*** [1.30,2.16]	1.41* [1.03,1.93]	1.22 [0.91,1.65]	1.34* [1.01,1.78]	1.74** [1.18,2.54]	1.21 [0.87,1.68]
Hospitalized	1.22 [1.00,1.48]	1.09 [0.84,1.41]	1.25 [0.99,1.57]	1.1 [0.87,1.39]	1.1 [0.76,1.60]	1.16 [0.91,1.49]
In A Relationship	1.14*** [1.06,1.22]	0.92 [0.84,1.00]	1.11* [1.02,1.22]	1.11* [1.02,1.21]	1.08 [0.94,1.23]	1.07 [0.97,1.19]
Education						
≥Postgraduate	1.00 (ref)					
≤Undergraduate	1.12** [1.04,1.20]	1.30*** [1.19,1.43]	1.28*** [1.18,1.39]	1.25*** [1.15,1.36]	1.31*** [1.15,1.50]	1.05 [0.95,1.16]
Lower Education	1.25*** [1.11,1.41]	1.62*** [1.40,1.87]	1.51*** [1.32,1.74]	1.47*** [1.28,1.69]	1.76*** [1.46,2.13]	1.21* [1.01,1.44]
Occupation						
Employed	1.00 (ref)					
Homemaker	1.28*** [1.11,1.47]	1.35** [1.12,1.63]	1.31** [1.11,1.55]	1.21* [1.03,1.44]	1.39** [1.11,1.74]	1.05 [0.83,1.32]
Unemployed	1.05 [0.94,1.17]	1.59*** [1.40,1.80]	1.39*** [1.23,1.57]	1.22** [1.08,1.37]	1.33** [1.12,1.58]	1.09 [0.93,1.27]
Retired	0.9 [0.66,1.22]	1.17 [0.79,1.75]	1.02 [0.69,1.51]	1.39 [0.96,2.01]	0.88 [0.52,1.48]	0.46* [0.22,0.97]
Student	0.79*** [0.71,0.88]	1.60*** [1.41,1.83]	1.02 [0.90,1.16]	1.28*** [1.13,1.44]	1.02 [0.86,1.22]	1.16 [0.84,1.62]
Childhood Trauma	1.06 [0.99,1.13]	1.41*** [1.30,1.54]	1.29*** [1.19,1.39]	1.01 [0.93,1.09]	1.50*** [1.33,1.70]	1.10* [1.01,1.21]
Prior Psychiatric Diagnosis	1.59*** [1.48,1.71]	2.19*** [2.01,2.39]	2.10*** [1.94,2.28]	1.73*** [1.59,1.87]	1.76*** [1.56,1.98]	1.25*** [1.13,1.39]

*$p < 0.05$; **$p < 0.005$; ***$p < 0.001$; n.a., Not Applicable; PTSS, Post-Traumatic Stress Symptoms; ADS, Adjustment Disorder Symptom; [§]Age is standardized and reversed, younger age has an OR>1 if associated with heightened risk.*

detrimental effect on the population's mental health, as suggested by our finding of an heightened risk of mental health issues due to COVID-19 related working difficulties and by earlier studies related to the last economic crisis (23).

Limitations and Future Directions

This study has some important limitations due to the sampling technique. Relying on social networks voluntary recruitment and re-sharing could have introduced an important selection bias, firstly excluding people not on social networks, and secondly introducing a self-selection bias, as suggested by the highly unbalanced gender ratio observed. This latter bias could have affected also two other large web-based surveys in China, that reported on samples with a 64.7% and 67.3% proportion of woman (12, 13). For these reasons, rates of mental health outcomes should be interpreted with caution. Secondly, this survey was based on self-report instruments that could introduce a systematic bias and return different rates compared to interview-based measures.

This study has also several strengths, including a very large sample size and the sampling timeframe that corresponded to the pandemic peak in Italy.

Future studies will need to monitor the trajectory of mental health outcomes, in order to define mental health interventions at a population level.

Moreover, these results suggests that appropriate mental health care delivery should be at the centre of future re-organization healthcare management, anticipating the needs, planning, and delivering much needed mental health protection of the whole community as well as in special populations (i.e. healthcare workers, adolescents, older age).

CONCLUSIONS

We found high rates of negative mental health outcomes in the Italian general population three to 4 weeks into the COVID-19 pandemic and lockdown measures. COVID-19 related factors were associated with these outcomes independently from previous mental illness or childhood trauma. These findings warrant further monitoring on the Italian population's mental health and could serve to inform structured interventions in order to mitigate the impact on mental health of the outbreak.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Internal review board, University of L'Aquila. The patients/participants provided their written informed consent to participate in this study.

AUTHORS CONTRIBUTION

Conceptualization: RR, VS, FP, GL. Methodology: RR. Formal Analysis: RR. Data Curation: RR, SM, GL. Writing—Original Draft: RR, VS. Writing—Review and Editing: RR, VS, DT, AM, FP, SM, CN, AR, AS, GL.

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Psychological and Behavioral Responses to the COVID-19 Pandemic in Greece

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Objective: Fear of COVID-19 was associated with more severe depressive and anxiety symptoms. This study aimed to explore COVID-19-related fear, depressive and anxiety symptoms, social responsibility, and behavioral responses during the COVID-19 pandemic in Greece.

Method: A cross-sectional study was conducted from April 10 to April 13, 2020. Members of the Greek general population completed anonymously an online survey, distributed through the social media. Among the 3,700 adult respondents, 3,029 fulfilled inclusion criteria. The survey included sociodemographic questions, questions exploring potential risk factors for increased fear of COVID-19, questions about the employment of safety and checking behaviors, and questions about compliance with public health guidelines. In addition, four psychometric scales were used, the Fear of COVID-19 Scale (FCV-19S), the Brief Patient Health Questionnaire (PHQ-9) depression scale, the Generalized Anxiety Disorder scale (GAD-7), and Steele's Social Responsibility Motivation scale. Multivariate General Linear Models (GLM) were used to depict significant differences among dependent variables (FCV-19S, PHQ-9, GAD-7) and independent variables (potential risk factors, safety and checking behaviors, compliance with guidelines). The relationship between the FCV-19S total score and influencing factors was quantified by linear regression analysis.

Results: Several participants reported high levels of COVID-19-related fear (35.7%) and moderate to severe depressive symptoms (22.8%), while a significant proportion reported moderate to severe anxiety symptoms (77.4%). Women scored altogether significantly higher than men. Respondents under the age of 30 reported less fear and depressive symptoms and showed the least social responsibility. Based on GLM, a significant other's COVID-19 illness, being on psychiatric medication, employment of safety and checking behaviors, and compliance with guidelines were associated with higher COVID-19-related fear. Linear regression analysis revealed that gender, age, depressive, and anxiety symptoms modified levels of COVID-19-related fear.

Conclusions: Greater behavioral responses to the pandemic, that is, excessive employment of safety/checking behaviors and greater compliance with guidelines, were shown to amplify fear, potentially due to increased contamination awareness. In addition, female gender, older age, and more severe anxiety symptoms were related with higher COVID-19-related fear. Describing and weighing carefully the psychosocial and behavioral impact of the pandemic will enable the implementation of both supportive and preventive interventions.

Keywords: COVID-19, 2019-nCoV, Fear of COVID-19 Scale, fear, depression, anxiety, social responsibility, compliance

INTRODUCTION

On December 31, 2019, the World Health Organization (WHO) China Country Office received information about the outbreak of a series of pneumonia cases in Wuhan, Hubei, China. The cause was yet unknown, though clinical manifestation resembled pneumonia of a viral origin. A week later, a novel coronavirus, 2019-nCoV, was isolated in China and the information was shared worldwide for the development of diagnostic test kits. WHO announced the emersion of pneumonia in 41 confirmed cases, without specific recommendations for health measures by travelers (1). On January 13, the first COVID-19 case was detected outside China, in Thailand. As a result, WHO recommended that health authorities should raise awareness to limit the spread of respiratory infections through traveling, without suggesting travel/trade restriction measures (2). From there on, the virus started spreading to neighbor Asian countries, to Europe, reaching United States on January 21, when the first confirmed COVID-19 case, a patient who had recently returned from Wuhan, was reported in Washington (3). On January 30, WHO declared COVID-19 a "Public Health Emergency of International Concern" (4). By the end of February, the virus had spread to countries worldwide (5), so that on March 11, WHO declared COVID-19 a pandemic, placing Europe at its center with over 20,000 confirmed cases and as many as 1,000 reported deaths. WHO/Europe advised European countries to prepare for different public health scenarios and encouraged the public to become accustomed, among others, to hand hygiene and social distancing (6).

The first confirmed COVID-19 case, a Greek woman who had just returned home from North Italy, was reported on February 26 in Thessaloniki, the second largest city in Greece. As early as next day, the Greek Government started to impose measures against the spread of COVID-19. The Greek Carnival festivals were canceled and restriction measures were taken regionally, mostly in affected areas in the Southern part of Greece, including selective suspension of schools and cultural events. Within a short period and after the COVID-19 cases had risen to 89, the Greek government declared closure of all educational institutions at a national level on March 10. After the first COVID-19-related death had been reported on March 12, the Greek government rapidly escalated restriction measures until March 22, when the Greek Prime Minister announced restriction on movement without cause throughout the country, beginning on March 23 until April 6. The national lockdown was timely imposed, since it was declared as soon as the number of COVID-19 positive cases was 695 and the number of COVID-19-related deaths 17 (**Figure 1**) (7). During the national lockdown, citizens were allowed to leave their house only for specific purposes and after they had filled out a special movement permit handed out by the Greek civil protection or after having texted a designated number, set out for this purpose (8). Moreover, the Hellenic National Public Health Organization (NPHO) released guidelines for proactive controls at incoming and outcoming country sites, that is, airports, harbors, railway stations and road networks (9), as well as for self-quarantine at home for a period of 2 weeks in case of exposure or potential exposure to COVID-19 (10). Two days before the expiring date, restriction measures were extended

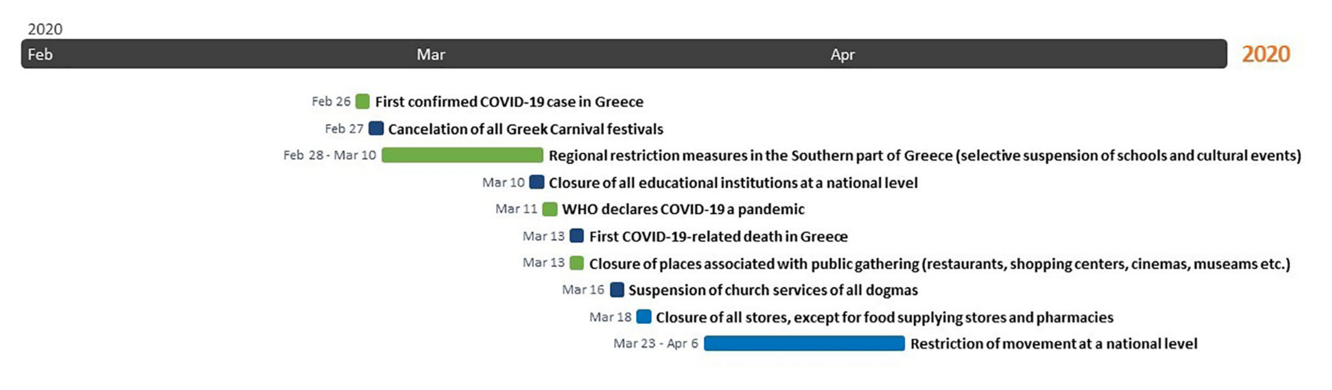

FIGURE 1 | Restriction measures imposed during the COVID-19 pandemic in Greece.

until April 27, that is, after the Orthodox Easter holiday was over. Consequently, they were further extended until May 4 (11). In summary, in less than a month after the first Greek COVID-19 positive case had been announced, the Greek Government imposed curfew to prevent purposeless movements, restricted traveling and locked city areas and villages down, a novel experience for Greek residents.

Greece has suffered endemics and epidemics before, such as the outbreak of the West Nile virus (2010-2011) and the human immunodeficiency virus (HIV) among injecting drug users (2011). In these cases, although the psychological impact on the general population was not evaluated, it was probably low, since the number of deaths due to the West Nile virus was limited, while the HIV outbreak was confined to a specific subpopulation (12). With regard to the SARS 2003 epidemic, although the Greek hospitals took measures and got prepared to receive cases, the epidemic did not affect Greece (13). With regard to the pandemic influenza A (H1N1), one epidemiologic study provided data related with fatal cases in an effort to enlighten risk factors associated with poor prognosis (14). Within 10 months (May 2009-February 2010), Greece had suffered 140 H1N1-related deaths among 18,075 laboratory-confirmed cases (15). Within 2 months (February 26-April 27), Greece suffered 136 COVID-19-related deaths among 2,534 laboratory confirmed cases (16). Although the psychological impact of H1N1 on the Greek general population was not investigated, a study of healthcare workers revealed that a significant proportion (over half of the participants) were worried about the pandemic, reporting moderately high concern (17). Moreover, the "fear virus" spread by the media was associated with negative attitudes towards H1N1 vaccination, resulting in low compliance rates (18).

Currently, Greece is rather recollecting the experience with the 1918 influenza pandemic or "Spanish flu", the most severe pandemic crisis in recent history (19), which killed up to one third of the infected population in some areas in Greece (20). During that period, restriction measures had been imposed, including closure of schools, prohibition of pedestrian traffic between 05:00 p.m. and 05.00 a.m. and of any assembly. Violators were arrested immediately (21). A century after the Spanish flu, Greece is reliving strict regulations imposed to restrict the spread of COVID-19. The pandemic disrupted social life, family life, occupational life, education, transportation, traveling, and other aspects of every-day life. It affected Greece during Easter time, the greatest religious holiday of the Orthodox Christian majority of the population, associated with massive celebrations and family reunions throughout the country. Moreover, the future impact on tourism, the spearhead of Greek economy, and finances remain to be seen. According to the World Economic Outlook report released by the International Monetary Fund (IMF), Greece's unemployment rate is expected to increase by 5 points due to the pandemic, raising from 17.3% to 22.3%. The impact on mental well-being due to the following financial crisis may be prolonged (22).

A pandemic is a public health emergency situation, a life-threatening condition with an impact on community's normal functioning. Even before a pandemic has reached a country and moreover during the pandemic, a psychological burden is imposed on the general population. Anxiety, fear and uncertainty are common psychological responses to this frightening condition (23). The outbreak of an infectious disease evokes automatically an alert response that may be related with the collective memory of past deadly plagues (24). Fear, embedded in human nature as a result of historical accounts of former frightful epidemics, is amplified by fictional, though vivid dramatizations in the movies (25).

The psychological impact of epidemics on the general population is also associated with the nature of the virus. COVID-19 is an unfamiliar, readily contagious disease associated with mortality. Following the "germ panic" during the 20th century, the COVID-19 pandemic revived the "viral panic" of the 21st century (26). According to a poll of a Canadian (27) and a US population (28), as well as an online survey of a German (29) and a United Kingdom population (30), the COVID-19 pandemic elicited worry. Levels of COVID-19-related fear were positively associated with depressive and anxiety symptoms' severity (31).

Fear of COVID-19 has different facets. It involves, among others, fear for the body in case of contracting the virus, as well as fear for significant others (32). A cross-sectional study aiming to explore coronavirus-related fear reported that a great proportion of the participants (46.22%) were concerned about the health of friends, grandparents, and loved ones. Moreover, perceived risk of infection and serious illness of loved ones was the strongest predictor of coronavirus-related fear (33). Similarly, a previous study of the psychological impact of H1N1 on Greek healthcare workers reported that most of the participants (60.5%) were worried about their family and friends being infected, as well as about the disease's dangerousness (54.9%) and consequences on functional ability (43.2%) (17). Lastly, it is expected that people with mental health disorders are likely to be more affected by COVID-19 due to higher vulnerability to stress compared with the general population (23, 34). Taken together, personal experience with COVID-19, COVID-19 illness of significant others, and psychiatric medication intake (indicative of a psychiatric disease's presence), may be considered as potential risk factors for increased levels of COVID-19-related fear.

From an evolutionary perspective, fear is associated with self-protective responses and therefore risk-avoiding behaviors, promoting self-perseverance (35). In accordance, fear of COVID-19 was related with employment of public health behaviors (30). Compliance with guidelines by health authorities and the government was a remedy for preventing the spread of COVID-19. The last time Greece experienced such a pandemic was a century ago. Since then, strict restriction measures to avoid spread of a virus had never been necessary.

Up to date, the impact of infectious disease outbreaks on mental health has not been investigated in the Greek general population. Based on experience from the 2002–2003 SARS epidemic, socio-cultural factors influence the psychological impact of a pandemic (36, 37). Moreover, the members of the general population may demonstrate different responses during a crisis based on age, gender, educational status and other factors. Therefore, the main aim of the present study was to explore the psychological responses, that is, fear of COVID-19, depressive and anxiety symptoms during the COVID-19 pandemic in Greece, as well as to highlight factors that may modulate severity of the COVID-19-related psychological impact. Secondary aims were to explore three potential risk factors for increased levels of COVID-19-related fear (personal experience with COVID-19; COVID-19 illness of significant others; psychiatric medication intake, indicative of a psychiatric disease's presence), to investigate behavioral responses (safety behaviors; checking behaviors), as well as to assess compliance with public health guidelines and social responsibility motivation. Lastly, the association between psychological and behavior responses was examined.

METHODS

Participants

A cross-sectional study was conducted from April 10 until April 13, 2020, that is, 3 weeks after the national lockdown measures had been imposed, *via* an online survey. The survey was distributed through the social media (e.g. Facebook, LinkedIn). Members of the Greek general population were invited to join the study voluntarily. Potential participants accessing the survey platform were informed about the nature of the research and data usage. Before entering the survey, respondents were requested to indicate their consent by ticking the consent checkbox, a required field. The questionnaires were filled out anonymously to protect participants' personal data. In order to secure anonymity, the setting "anonymize responses" was enabled while creating the survey on the online platform; enabling this setting prevented recording of any personal information and permanently removed contact association from the results, before saving in the data (38). Inclusion criteria were: i) acceptance to participate; ii) being adult; iii) completion of over 96% of survey questions, a setting enabled while creating the online survey to obtain adequately filled out surveys (38).

Out of the 3,700 responded surveys obtained within the 3-day study period, 671 were excluded because they did not fulfill the criterion of 96% completion. Therefore, 3,029 participants entered the study (81.86% completion rate).

Ethical approval was received from the Scientific Committee of the General Hospital "Papageorgiou" Review Board prior to data collection.

Survey Design

At first, the survey questions and scales were selected based on author's experience and available literature on pandemics. After selection and synthesis of the survey's material, it was significant to investigate whether participants could perceive the survey's scope, as well as to detect potential difficulties encountered during questions' completion. Consequently, a survey sample was distributed to six mental health professionals, three psychiatrists and three psychologists during the pre-survey phase. Upon completion of the material, professional's feedback contributed to appropriate modifications prior to survey's web publication. Conciseness was achieved through removal of redundant and irrelevant queries that could bring confusion. Questions were placed in a logical sequence to provide a better mental roadmap while filling out the survey (39).

The final survey format, established after all necessary changes had been applied, included a total of 113 queries in Greek. The time required for survey completion was estimated at around 15 min. The online survey platform was created using the Qualtrics platform (40).

Measures

The survey included a) basic sociodemographic questions, including age, gender, place of residence (urban, small city, rural), living status (alone, with family, with significant others), educational level (elementary, high school 3 or 6 years, Master degree, PhD) and employment status (employed versus unemployed); b) questions exploring three potential risk factors (PRF) for increased fear of COVID-19, three types of safety behaviors (SB), three types of checking behaviors (ChB), as well as compliance (Comp) with the WHO and the Greek government's guidelines (**Table 1**); c) psychometric scales assessing fear of COVID-19, depression, anxiety and social responsibility, namely:

1. The Fear of COVID-19 Scale (FCV-19S), a reliable and valid unidimensional scale for assessing COVID-19-related fear (31) that was recently developed to support management of the COVID-19 pandemic. This is a 7-item self-report tool, measuring fear of COVID-19 (e.g. item 1, "I am most afraid of coronavirus-19"; item 4, "I am afraid of losing my life because of coronavirus-19"; item 7, "My heart races or palpitates when I think about getting coronavirus-19") based on a 5-point scale (1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree). Total scores range between 7 and 35. Higher scores reflect greater fear of COVID-19. The current study applied the Greek version of FCV-19S, which demonstrated a very good reliability (Cronbach's alpha coefficient based on standardized items was 0.87), good concurrent validity [high statistical significant correlation between FCV-19S and GAD-7 ($r = 0.71$, $p < .001$); moderate correlation between FCV-19S and PHQ-9 ($r = 0.47$, $p < .001$)], as well as good fit indices (RMSE = 0.11; 90% CI = [0.10, 0.11]; CFI = 0.89; TLI = 0.83; and SRMR = 0.06). The cutoff score equal or above 19 indicated high levels of COVID-19-related fear (41, 42).
2. The Brief Patient Health Questionnaire (PHQ-9) depression scale, the 9-item depression module from the complete Patient Health Questionnaire (PHQ) (43), is a self-administered tool for the diagnosis of both major depression and subthreshold depression in the general population (44). The scale assesses symptoms' severity over the past 2 weeks. Items (e.g. item 1, "Little interest or pleasure in doing things") are scored based on a 4-point severity scale (0 = not at all, 1 = several days, 2 =

TABLE 1 | Survey questions exploring potential risk factors for increased fear of COVID-19, safety behaviors, checking behaviors, and compliance with guidelines.

Questions	Possible answers
Potential Risk Factors (PRF):	
Have you contracted the virus? (PRF1)	Yes/No/I don't know
Has someone close to you contracted the virus? (PRF2)	Yes/No/I don't know
Have you been on psychiatric medication during the past 6 months? (PRF3)	Yes/No
Safety Behaviors (SB):	
I clean/disinfect the objects that I use (SB1)	Never/Rarely/Often/Always
I take care of my personal hygiene (e.g. washing my hands) (SB2)	Same as before/According to NPHO/Excessively
I use personal protective equipment (e.g. face masks, disposable gloves) (SB3)	Never/Rarely/Often/Always
Checking Behaviors (ChB):	
I check myself for COVID-19 symptoms (e.g. using thermometer) (ChB1)	Never/Rarely/Some days/Daily
I have restricted physical contact with other people (kisses, hugs, sex, and handshakes) (ChB2)	Yes/No
I communicate with my family doctor because I think I have COVID-19 (ChB3)	Never/Rarely/Often
Compliance with guidelines (Comp):	
I follow the instructions of the World Health Organization (Comp1)	Never/Rarely/Often/Always
I abide by the measures that the government has enacted to avoid spread of COVID-19 (Comp2)	Never/Rarely/Often/Always

NPHO, National Public Health Organization.

more than half the days, 3 = nearly every day). Total scores range between 0 and 27, with higher scores indicating more severe depressive symptoms. The cutoff point of 10 or greater corresponds to moderate to severe depressive symptoms, potentially indicating a clinically significant condition (cutoff scores: 0–4 = minimal or none; 5–9 = mild; 10–14 = moderate; 15–19 = moderately severe; 20–27 = severe). The current study applied the Greek version of PHQ-9 (45, 46).

3. The Generalized Anxiety Disorder scale (GAD-7), initially developed for the assessment of generalized anxiety disorder, is a useful self-report anxiety scale, assessing symptoms' severity over the past 2 weeks (47). Each of the seven items (e.g. item 1, "Feeling nervous, anxious or on edge") is scored based on a 4-point severity scale (0 = not at all, 1 = several days, 2 = more than half the days, 3 = nearly every day). Total scores range between 0 and 21. Higher scores indicate more severe anxiety symptoms. The cutoff point of 10 or greater corresponds to moderate to severe anxiety symptoms, potentially indicating a clinically significant condition (cutoff scores: 0–5 = mild; 6–10 = moderate; 11–15 = moderately severe; 15–21 = severe). The current study applied the Greek version of GAD-7 (45, 48).
4. The Social Responsibility Motivation Scale is a four-item tool applied as a proxy measure for motivation to undertake social responsibility (49). Items (e.g. item 2, "I believe that I have a responsibility to help others") are scored based on a 5-point scale (1 = not at all important; 5 = very important). Total scores range between 4 and 20. Higher scores indicate increased social responsibility motivation. The psychometric properties of the scale's Greek version indicated adequate reliability (Cronbach's alpha = 0.70).

Procedures

All participants answered questions and completed scales in the following order: sociodemographic data, potential risk factors for increased fear of COVID-19, safety behaviors, checking behaviors, social responsibility motivation scale, compliance with WHO and government' guidelines, FCV-19S, PHQ-9 and GAD-7. A short introduction was provided before every blog of questions, informing the participants about the questionnaire's scope. Respondents were asked to click on the circle corresponding to their chosen answer. All questions were single answer questions. Smart branching was also used.

Statistical Analysis

Data and parameter estimates were presented as mean values, standard deviations (SD), or numbers and percentages. The relationship between categorical variables was assessed by contingency tables and chi-square statistics. Assumptions of homoscedasticity and multicollinearity were checked before further analysis, and when significant interactions appeared between the variables, the file was split and only the significant findings were reported. Whenever Levene's test for homogeneity of variance was significant at the p level non parametric tests were used to confirm the results (parametric tests reported). Multivariate General Linear Models (GLM) were used to depict significant differences among dependent variables (FCV-19S, PHQ-9, GAD-7) and independent variables (potential risk factors, safety and checking behaviors, compliance with guidelines). The relationship between the FCV-19S total score and influencing factors (gender, age, PHQ-9, GAD-7) was quantified by linear regression analysis. All analyses were performed by the Statistical Package for Social Sciences (SPSS) version 26 (50).

RESULTS

Sociodemographic Characteristics

Among a total of 3,029 study participants, 2,177 were female (71.9%) and 737 were male (24.3%). The remaining 115 (3.8%) did not specify gender.

Although women's age (M_{age} = 34.99, SD = 12.50) was slightly lower than men's (M_{age} = 35.14, SD = 12.87), the difference was not statistically significant (p >.001).

The majority of the participants had a University Degree [N = 1,360 (68.3%)], and lived in an urban area [N = 2,298 (76.3%)] with their family or significant other [N = 2,538 (83.8%)].

Lastly, the unemployment rate was 14.2% (426 subjects).

Potential Risk Factors for Increased Fear of COVID-19

Among participants, 0.4% reported that they had contracted the virus, whereas 22.8% reported that they weren't sure. Another 2.3% of the sample had someone close to them that was infected by COVID-19, whereas 15.8% were uncertain. Lastly, only 8.3% of the respondents were on psychiatric medication during the past 6 months. Frequencies of the potential risk factors for increased fear of COVID-19 and their association with age are presented in **Table 2**.

Safety Behaviors

The majority of the sample (49.8%) reported that they often clean or disinfect the objects they are using, while some reported that they do it always (29.8%). The majority of the respondents (62.4%) followed the NPHO guidelines when it comes to taking care of personal hygiene, but some (17.3%) acknowledged that they may overdo it. Lastly, 37.4% of the respondents stated that they often use protective means, whereas 33.2% reported that they rarely use it. Safety behaviors and their association with age are presented in **Table 3**.

Checking Behaviors

With regard to checking behaviors, 44.9% of the respondents did not check themselves for COVID-19 symptoms, whereas 4.5% checked themselves daily. The vast majority (88.4%) restricted physical contact with other people, whereas 2.6% communicated often with their doctor because they were afraid of being sick with COVID-19. Checking behaviors and their association with age are presented in **Table 4**.

Compliance With Guidelines and Social Responsibility

Half of the participants stated that they always follow both WHO instructions (50.6%) and the Greek government's enacted measures (50.6%). Compliance and its association with age is presented in **Table 5**.

Subjects aged 18–30 showed less social responsibility. Specifically, *post hoc* analyses using the Bonferroni criterion indicated that social responsibility in this age category (Msrms = 16.09, SD = 2.12) was significantly lower [F(4,2558) = 5866, p <.001] than the age categories 31-45 (M = 16.30, SD = 2.07), 46–60 (M = 16.55, SD = 2.06), 46–60 (M = 16.55, SD = 2.06), 61–75 (M = 16.61, SD = 1.79), and over 75 (M = 16.55, SD = 2.10).

Psychometric Scales

Severity of fear of COVID-19, depressive and anxiety symptoms was categorized based on the proposed cutoff scores of the continuous scales FCV-19S, PHQ-9, and GAD-7. A significant proportion of the participants (35.7%) reported high levels of COVID-19 fear and severe anxiety symptoms (36.7%). Only a

TABLE 2 | Potential risk factors for increased fear of COVID-19 (PRF) and age.

		PRF1: Have you contracted the virus?			Total n (%)	Chi square tests of independence
		Yes n (%)	No n (%)	I don't know n (%)		
Age	18–30	4 (0.3%)	1160 (75.4%)	374 (24.3%)	1538 (100%)	$x^2(8) = 8.40$
	31–45	3 (0.4%)	586(78.3%)	159 (21.3%)	748 (100%)	p = .395
	46–60	2 (0.4%)	421 (77.4%)	121 (22.2%)	544 (100%)	V_{cramer} = .38 (ns)
	61–75	0 (0%)	82 (82%)	18 (18%)	100 (100%)	
	> 75	0 (0%)	11 (100%)	0 (100%)	11 (100%)	
Total (PRF1)		9 (0.4%)	2260 (76.8%)	672 (22.8%)	2941 (100%)	
		PRF2: Has someone close to you contracted the virus?			**Total n (%)**	**Chi square tests of independence**
		Yes n (%)	**No n (%)**	**I don't know n (%)**		
Age	18–30	41 (2.6%)	1273 (82.0%)	238 (15.3%)	1552 (100%)	$x^2(8) = 10.24$
	31–45	14 (1.8%)	616 (80.8%)	132 (17.3%)	762 (100%)	p = .248
	46–60	9 (1.6%)	455 (82.1%)	90 (16.2%)	554 (100%)	V_{cramer} = .04 (ns)
	61–75	3 (2.9%)	88 (86.3%)	11 (10.8%)	102 (100%)	
	> 75	1 (9.1%)	10 (9.1%)	0 (0%)	11 (100%)	
Total (PRF2)		68 (2.3%)	2442 (81.9%)	471 (15.8%)	2981 (100%)	
		PRF3: Have you been on psychiatric medication during the past 6 months?			**Total n (%)**	**Chi square tests of independence**
		Yes n (%)	**No n (%)**			
Age	18–30	74 (4.7%)	1485 (95.3%)		1559 (100%)	$x^2(4) = 8.40$
	31–45	73 (9.5%)	694 (90.5%)		767 (100%)	p <.001
	46–60	81 (14.6%)	473 (85.4%)		554 (100%)	V_{cramer} = .15
	61–75	19 (18.6%)	83 (81.4%)		102 (100%)	
	> 75	0 (0%)	11 (100%)		11 (100%)	
Total (PRF3)		247 (8.3%)	2746 (91.7%)		2993 (100%)	

TABLE 3 | Safety behaviors (SB) and age.

		SB1: I clean/disinfect the objects that I use				Total n (%)	Chi square tests of independence
		Never n (%)	Rarely n (%)	Often n (%)	Always n (%)		
Age	18–30	54 (3.5%)	272 (17.5%)	787 (50.7%)	440 (28.3%)	1553 (100%)	$x^2(12) = 36.27$
	31–45	29 (3.8%)	135 (17.8%)	386 (59.9%)	209 (27.5%)	759 (100%)	$p < .001$
	46–60	18 (3.3%)	81 (14.6%)	254 (45.9%)	200 (36.2%)	553 (100%)	$V_{cramer} = .06$
	61–75	2 (2%)	12 (11.9%)	51 (50.5%)	36 (35.6%)	101 (100%)	
	> 75	3 (27.3%)	1 (9.1%)	4 (36.4%)	3 (27.3%)	11 (100%)	
Total (SB1)		106 (3.6%)	501 (16.8%)	1482 (49.8%)	888 (29.8%)	2977 (100%)	

		SB2: I take care of my personal hygiene			Total n (%)	Chi square tests of independence
		Same as before n (%)	According to NPHO n (%)	Excessively n (%)		
Age	18–30	385 (25,9%)	883 (57.4%)	270 (17.6%)	1538 (100%)	$x^2(8) = 70.62$
	31–45	145 (19.4%)	491 (65.6%)	112 (15%)	748 (100%)	$p < .001$
	46–60	55 (10.2%)	379 (70.4%)	104 (19.3%)	538 (100%)	$V_{cramer} = .11$
	61–75	8 (8.7%)	68 (73.9%)	16 (17.4%)	92 (100%)	
	> 75	2 (22.2%)	4 (44%)	3 (33.3%)	9 (100%)	
Total (SB2)		595 (20.3%)	1825 (62.4%)	505 (17.3%)	2925 (100%)	

		SB3: I use personal protective equipment				Total n (%)	Chi square tests of independence
		Never n (%)	Rarely n (%)	Often n (%)	Always n (%)		
Age	18–30	290 (18.7%)	535 (34%)	558 (35.9%)	171 (11.0%)	1554 (100%)	$x^2(12) = 57.96$
	31–45	98 (12.9%)	240 (31.6%)	303 (39.9%)	119 (15.7%)	760 (100%)	$p < .001$
	46–60	68 (12.3%)	176 (31.9%)	209 (37.9%)	99 (17.9%)	552 (100%)	$V_{cramer} = .81$
	61–75	8 (8.0%)	36 (36.0%)	43 (43.0%)	13 (13%)	100 (100%)	
	> 75	5 (45.5%)	2 (18.2%)	0 (0%)	4 (36.4%)	11 (100%)	
Total (SB3)		469 (15.8)	989 (33.2%)	1113 (37.4%)	406 (13.6%)	2977 (100%)	

TABLE 4 | Checking behaviors (ChB) and age.

		ChB1: I check myself for COVID-19 symptoms				Total n (%)	Chi square tests of independence
		Never n (%)	Rarely n (%)	Some days n (%)	Daily n (%)		
Age	18–30	655 (42.1%)	505 (32.4%)	340 (21.8%)	57 (3.7%)	1557 (100%)	$x^2(12) = 26.99$
	31–45	351 (46.1%)	232 (30.5%)	142 (18.7%)	36 (4.7%)	761 (100%)	$p = .009$
	46–60	275 (49.7%)	144 (26.0%)	102 (18.4%)	32 (5.8%)	553 (100%)	$V_{cramer} = .55$
	61–75	50 (50%)	24 (24.0%)	18 (18%)	8 (8.0%)	100 (100%)	
	> 75	7 (63.6%)	2 (18.2%)	2 (18.2%)	0 (0%)	11 (100%)	
Total (ChB1)		1338 (44.9%)	907 (30.4%)	604 (20.3%)	133 (4.5%)	2982 (100%)	

		ChB2: I have restricted physical contact with other people		Total n (%)	Chi square tests of independence
		Yes n (%)	No n (%)		
Age	18–30	1333 (85.9%)	218 (14.1%)	1551 (100%)	$x^2(12) = 33.90$
	31–45	668 (88.5%)	87 (11.5%)	755 (100%)	$p < .001$
	46–60	508 (92.9%)	39 (7.1%)	547 (100%)	$V_{cramer} = .10$
	61–75	97 (97%)	0 (0%)	97 (100%)	
	> 75	11 (100%)	0 (0%)	11 (100%)	
Total (ChB2)		2617 (88.4%)	344 (11.6%)	2961 (100%)	

		ChB3: I communicate with my family doctor because I think I have COVID-19			Total n (%)	Chi square tests of independence
		Never n (%)	Rarely n (%)	Often n (%)		
Age	18–30	1387 (89.1%)	124 (8.0%)	46 (3.0%)	1557 (100%)	$x^2(12) = 14.26$
	31–45	695 (90.6%)	48 (6.3%)	24 (3.1%)	767 (100%)	$p > .075$
	46–60	517 (93%)	32 (5.8%)	7 (1.3%)	556 (100%)	$V_{cramer} = .04$
	61–75	96 (94.1%)	6 (5.9%)	0 (0%)	102 (100%)	
	> 75	11 (100%)	0 (0%)	0 (0%)	11 (100%)	
Total (ChB3)		2706 (90.4%)	210 (7.0%)	77 (2.6%)	2993 (100%)	

TABLE 5 | Compliance with guidelines (Comp) and age.

		Comp1: I follow the instructions of the World Health Organization				Total n (%)	Chi square tests of independence
		Never n (%)	Rarely n (%)	Often n (%)	Always n (%)		
	18–30	22 (1.4%)	108 (7.0%)	724 (46.6%)	698(45.0%)	1552 (100%)	
	31–45	2 (0.3%)	35 (4.6%)	334 (43.8%)	392 (51.4%)	763 (100%)	
Age	46–60	3 (0.5%)	20 (3.6%)	189 (34.2%)	341 (61.71%)	553 (100%)	$x^2(12) = 75.13$
	61–75	0 (0%)	0 (0%)	32 (31.4%)	70 (68.6%)	102 (100%)	p <.001
	> 75	0 (0%)	0 (0%)	4 (36.4%)	7 (63.6%)	11 (100%)	$V_{cramer} = .09$
Total (Comp1)		27 (0.9%)	163 (5.5%)	1283(43.0%)	1508 (50.6%)	2981 (100%)	
		Comp2: I abide by the measures that the government has enacted to avoid spread of COVID-19				**Total n (%)**	**Chi square tests of independence**
		Never n (%)	**Rarely n (%)**	**Often n (%)**	**Always n (%)**		
	18–30	8 (0.5%)	38 (2.4%)	533 (34.2%)	980(50.0%)	1559 (100%)	
	31–45	3 (0.4%)	6 (0.8%)	211 (27.5%)	547 (51.4%)	767 (100%)	
Age	46–60	0 (0%)	3 (0.5%)	99 (17.8%)	454 (61.7%)	556 (100%)	$x^2(12) = 95.68$
	61–75	3 (2.9%)	1 (1.0%)	20 (19.6%)	78 (76.5%)	102 (100%)	p <.001
	> 75	0 (0%)	0 (0%)	3 (27.3%)	8 (72.7%)	11 (100%)	$V_{cramer} = .10$
Total (Comp1)		14 (0.9%)	48 (5.5%)	866(43.0%)	2067 (50.6%)	2995 (100%)	

few (0.4%) reported severe depressive symptoms. Female participants had the highest representation in the more severe categories with a statically significant difference (**Table 6**).

As expected, FCV-19S, PHQ-9, and GAD-7 demonstrated significant concurrent correlations. Females reported higher levels of COVID-19-related fear and reported more severe depressive and anxiety symptoms compared with men. Younger respondents (aged 18–30) reported less fear and depressive symptomatology than the other age categories, but they did not present any differences with regard to anxiety symptoms. There were no significant correlations between other sociodemographic characteristics and the psychometric scales (**Table 7**).

The social responsibility scale presented neither a significant correlation with the other psychometric scales (p >.001) nor significant differences between males and females.

Linear Associations

A multivariate linear model was conducted to explore the relations between potential risk factors, safety behaviors, checking behaviors, compliance with guidelines and the psychometric scales. In testing our hypotheses through GLM modeling, fear of COVID-19 (assessed by FCV-19S), depressive symptoms (assessed by PHQ-9) and anxiety symptoms (assessed by GAD-7) were found to be significantly associated with every dependent variable tested (p <.001) in all but one case. The main effect for ChB2 was not significant [$F(3, 2012) = .52$, $p = .672$, $\eta^2 = .00$], suggesting that the linear combination of FCV-19S, PHQ-9, and GAD-7 was similar for each level of ChB2 (**Tables 8** and **9**).

A linear regression analysis was conducted to assess whether gender, age, PHQ-9, and GAD-7 significantly predicted FCV-19S. The "Enter" variable selection method was chosen for the

TABLE 6 | Participants' categorization based on FCV-19S, PHQ-9, and GAD-7 cutoff scores.

		Total		Male		Female		p
		n	%	n	%	n	%	
FCV-19S	Normal fear	1936	64.3	585	79.4	1302	59.8	$x^2 = 92.38$, df = 1, p = .001
	High fear	1074	35.7	152	20.6	875	40.2	
PHQ-9	Minimal-none	1079	35.9	384	52.1	660	30.3	$x^2 = 92.38$, df = 1, p = .001
	Mild	1241	41.3	264	35.8	942	43.3	
	Moderate	538	17.9	74	10.0	444	20.4	
	Moderately severe	136	4.5	13	1.8	118	5.4	
	Severe	13	0.4	2	0.3	11	0.5	
GAD-7	Mild	662	22.6	262	36.2	381	17.9	$x^2 = 92.38$, df = 1, p = .001
	Moderate	1195	40.7	313	43.3	848	39.9	
	Moderately severe	0	0	0	0	0	0	
	Severe	1077	36.7	148	20.5	894	42.1	

FCV-19S, Fear of COVID-19 Scale (cutoff scores: normal fear < 19; high fear ≥ 19); PHQ-9, Brief Patient Health Questionnaire Depression Scale (cutoff scores: minimal-none = 0–4; mild = 5–9; moderate = 10–14; moderately severe = 15–19; severe = 20–27); GAD-7, Generalized Anxiety Disorder scale (cutoff scores: mild = 0–5; moderate = 6–10; moderately severe = 11–15; severe = 15–21).

TABLE 7 | Descriptive statistics and correlations of key variables.

Variables	1	2	3	Age	Gender	
FCV-19S	–			$F(4,2952) = 21.96$, $p <.001$, $\eta^2 = 0.05$	Male: (14.69 ± 4.98) Female: (17.43 ± 5.09)	$t_{(2878)} = -12.63$ $p <.001$ $\eta^2 = 0.05$
PHQ-9	.47**	–		$F(4,2988) = 13.02$, $p <.001$, $\eta^2 = 0.05$	Male: (12.99 ± 3.90) Female: (15.26 ± 4.57)	$t_{(1471)} = -13.07$ $p <.001$ $\eta^2 = 0.02$
GAD-7	.71**	.76**	–	$F(4,3286) = 1.51$, $p = .185$, $\eta^2 = 0.06$	Male: (11.25 ± 4.12) Female: (13.89 ± 4.62)	$t_{(1386)} = -14.3$ $p <.001$ $\eta^2 = 0.05$
Mean	16.77	14.70	13.23			
SD	5.23	4.51	4.66			

FCV-19S, Fear of COVID-19 Scale; PHQ-9, Brief Patient Health Questionnaire Depression scale; GAD-7, Generalized Anxiety Disorder scale.

TABLE 8 | Multivariate General Linear Model.

Variable	Pillai's Trace	F	df	SE	p	η^2
Intercept	.16	171.43[b]	3	2640	<.001	.16
Gender	.05	49.89[b]	3	2640	<.001	.05
Age	.06	60.16[b]	3	2640	<.001	.06
PRF1	.00	2.14	6	5282	.045	.00
PRF2	.00	2.30	6	5282	.032	.00
PRF3	.02	19.04[b]	3	2640	<.001	.00
SB1	.01	4.93	9	7926	<.001	.02
SB2	.03	14.95	6	5282	<.001	.00
SB3	.01	4.34	9	7926	<.001	.01
ChB1	.03	9.59	9	7926	<.001	.00
ChB2	.00	1.16[b]	3	2640	.323	.01
ChB3	.01	6.01	6	5282	<.001	.00
Comp1	.00	2.56	9	7926	.006	.00
Comp2	.01	3.43	9	7926	<.001	.00

[a]Design: Intercept + Gender + Age + PRF1 + PRF2 + PRF3 + SB1 + SB2 + SB3 + ChB1 + ChB2 + ChB3 + Comp1 + Comp2; [b]Exact statistic; PRF1: Have you contracted the virus; PRF2: Has someone close to you contracted the virus; PRF3: Have you been on psychiatric medication during the past 6 months; SB1: I clean/disinfect the objects that I use; SB2: I take care of my personal hygiene; SB3: I use personal protective equipment; ChB1: I check myself for COVID-19 symptoms; ChB2: I have restricted physical contact with other people; ChB3: I communicate with my family doctor because I think I have COVID-19; Comp1: I follow the instructions of the World Health Organization; Comp2: I abide by the measures that the government has enacted to avoid spread of COVID-19.

linear regression model, which included the selected predictors. Assumptions of homoscedasticity and multicollinearity were met and all predictors in the regression model presented VIFs less than 10.

The results of the linear regression model were significant [F (12,2806) = 281.99, p <.001, R^2 = .55], indicating that approximately 55% of the variance in FCV-19S was explainable by gender, age, PHQ-9 and GAD-7. Specifically, the male category of gender significantly predicted the FCV-19S score [B = -0.76, t(2806) = -4.84, p <.001]. Based on this sample, this suggested that moving from the female to male gender category will decrease the mean value of FCV-19S score by 0.76 units on average. The 18-30 age category significantly predicted the FCV-19S score [B = -1.69, t(2806) = -9.13, p <.001]. Based on this sample, this suggested that moving from the 46–60 to the 18–30 age category will decrease the mean value of FCV-19S score by 1.69 units on average. The PHQ-9 score significantly predicted the FCV-19S score [B = -0.14, t(2806) = -6.24, p <.001]. This indicated that on average, a one-unit increase of PHQ-9 score will decrease the value of FCV-19S score by 0.14 units. Lastly, the GAD-7 score significantly predicted the FCV-19S score [B = 0.88, t(2806) = 39.72, p <.001]. This indicated that on average, a one-unit increase of GAD-7 score will increase the value of FCV-19S score by 0.88 units (**Table 10**).

DISCUSSION

Participants' Sociodemographic Characteristics

The survey was distributed through the social media, including Facebook, by far the most popular social networking site in Greece (51, 52). Statistics on social media users in Greece indicated that the majority of users is between 25 and 44 years of age (e.g. Facebook users: 47.9% = 25–44 years old) (53) and lives in urban areas (54). The mean age of this sample was 35 years old, while roughly three out of four lived in an urban area.

Although the sex difference between male and female Greek users is not great (e.g. Facebook users: 52.7% = men; 47.3% = women) (53), the majority of this survey's respondents were female. There is evidence of higher mental health literacy in

TABLE 9 | Between subjects effects.

Source	Dependent Variable	SS	df	Mean Square	F	p	η^2
Corrected Model	FCV-19S	18459.76[a]	27	683.69	33.94	<.001	.258
	PHQ-9	6968.83[b]	27	258.10	14.30	<.001	.128
	GAD-7	10784.32[c]	27	399.42	22.56	<.001	.187
Intercept	FCV-19S	5708.78	1	5708.78	283.39	<.001	.097
	PHQ-9	6952.90	1	6952.90	385.44	<.001	.127
	GAD-7	3385.56	1	3385.56	191.22	<.001	.067
Gender	FCV-19S	1916.79	1	1916.79	95.153	<.001	.035
	PHQ-9	2122.59	1	2122.59	117.67	<.001	.043
	GAD-7	2128.42	1	2128.42	120.21	<.001	.044
Age	FCV-19S	985.09	1	985.09	48.90	<.001	.018
	PHQ-9	864.28	1	864.28	47.91	<.001	.018
	GAD-7	78.81	1	78.81	4.45	.035	.002
PRF1	FCV-19S	60.46	2	30.23	1.50	.223	.001
	PHQ-9	64.47	2	32.23	1.78	.168	.001
	GAD-7	15.56	2	7.78	.44	.644	.000
PRF2	FCV-19S	236.10	2	118.05	5.86	.003	.004
	PHQ-9	40.25	2	20.12	1.11	.328	.001
	GAD-7	128.16	2	64.08	3.61	.027	.003
PRF3	FCV-19S	84.58	1	84.58	4.19	.041	.002
	PHQ-9	970.77	1	970.77	53.81	<.001	.020
	GAD-7	554.34	1	554.34	31.31	<.001	.012
SB1	FCV-19S	563.82	3	187.94	9.33	<.001	.010
	PHQ-9	66.86	3	22.28	1.23	.295	.001
	GAD-7	170.49	3	56.83	3.21	.022	.004
SB2	FCV-19S	1603.20	2	801.60	39.79	<.001	.029
	PHQ-9	598.49	2	299.24	16.58	<.001	.012
	GAD-7	1221.37	2	610.68	34.49	<.001	.025
SB3	FCV-19S	440.68	3	146.89	7.29	<.001	.008
	PHQ-9	183.05	3	61.01	3.38	.017	.004
	GAD-7	136.18	3	45.39	2.56	.053	.003
ChB1	FCV-19S	1502.30	3	500.76	24.85	<.001	.027
	PHQ-9	399.32	3	133.10	7.37	<.001	.008
	GAD-7	1141.84	3	380.61	21.49	<.001	.024
ChB2	FCV-19S	41.81	1	41.81	2.07	.150	.001
	PHQ-9	52.94	1	52.94	2.93	.087	.001
	GAD-7	43.02	1	43.02	2.43	.119	.001
ChB3	FCV-19S	583.07	2	291.53	14.47	<.001	.011
	PHQ-9	190.58	2	95.29	5.28	.005	.004
	GAD-7	123.90	2	61.95	3.49	.030	.003
Comp1	FCV-19S	163.55	3	54.51	2.70	.044	.003
	PHQ-9	35.29	3	11.76	.65	.581	.001
	GAD-7	56.40	3	18.80	1.06	.364	.001
Comp2	FCV-19S	284.62	3	94.87	4.71	.003	.005
	PHQ-9	8.33	3	2.77	.15	.927	.000
	GAD-7	164.42	3	54.80	3.09	.026	.004

[a]R^2 = .258 (Adjusted R^2 = .250); [b]R^2 = .128 (Adjusted R^2 = .119); [c]R^2 = .187 (Adjusted R^2 = .179); PRF1: Have you contracted the virus; PRF2: Has someone close to you contracted the virus; PRF3: Have you been on psychiatric medication during the past 6 months; SB1: I clean/disinfect the objects that I use; SB2: I take care of my personal hygiene; SB3: I use personal protective equipment; ChB1: I check myself for COVID-19 symptoms; ChB2: I have restricted physical contact with other people; ChB3: I communicate with my family doctor because I think I have COVID-19; Comp1: I follow the instructions of the World Health Organization; Comp2: I abide by the measures that the government has enacted to avoid spread of COVID-19.

women compared with men (55). Women are also more likely to participate in health-related online surveys, since they are more attracted to health topics and more active health-information seekers than men (56). Although there are no available Greek studies of mental health literacy and interest in health-related topics, evidence suggested that Greek women's attitude towards mental health issues is altogether more positive than men's (57). The survey's headline, "Psychological burden related with the COVID-19 pandemic crisis", may have attracted more female respondents due to its association with a health-related research purpose, a potential explanation for the abundancy of female responders.

Lastly, the majority of the respondents had a University Degree, something that may be related with the fact that Greece has the fourth highest tertiary enrolment rate among OECD countries, as well as high completion rates, that is, 81% for women and 74% for men (58).

Potential Risk Factors for Increased Fear of COVID-19

Novel experiences tend to be more frightful (59). The SARS-CoV-2 is a novel virus with a rapid person-to-person transmission. The virus may also be transmitted from pre-symptomatic patients and potentially by asymptomatic carriers, a threat promoting fear (60).

TABLE 10 | Linear regression with gender, age, education, PHQ-9, and GAD-7 predicting FCV-19S.

Variable	B	SE	CI	β	t	p
(Intercept)	8.16	0.30	[7.58, 8.75]	0.00	27.34	<.001
Gender = Male	-0.76	0.16	[-1.07, -0.45]	-0.06	-4.84	<.001
Age 31-45	-0.29	0.21	[-0.70, 0.11]	-0.02	-1.43	.153
Age 18-30	-1.69	0.19	[-2.05, -1.33]	-0.16	-9.13	<.001
Age 61-75	0.77	0.42	[-0.05, 1.59]	0.03	1.84	.065
Age > 75	2.18	1.24	[-0.26, 4.61]	0.02	1.76	.079
PHQ-9	-0.14	0.02	[-0.19, -0.10]	-0.12	-6.24	<.001
GAD-7	0.88	0.02	[0.84, 0.93]	0.79	39.72	<.001

*CI is at the 95% confidence level; Results: $F(12,2806) = 281.99$, $p < .001$, $R^2 = .55$; Unstandardized Regression Equation: FCV-19S = 8.16 - 0.76 * Gender = Male - 0.29 * Age 31–45 - 1.69 * Age 18–30 + 0.77 * Age 61–75 + 2.18 * Age > 75 -0.14 * PHQ-9 + 0.88 * GAD-7; FCV-19S, Fear of COVID-19 Scale; PHQ-9, Brief Patient Health Questionnaire Depression scale; GAD-7, Generalized Anxiety Disorder scale.*

By April 30, the COVID-19 case fatality rate (CFR) was estimated at 7.25% worldwide and at 5.40% in Greece (61). The risk of severe COVID-19 in populations with defined risk factors was considered "very high", while in the general population "moderate" (62). Although research revealed risk factors for severe illness and death, including male gender, age over 65 years and underlying chronic medical conditions, the overall profile of high-risk patients has not been accurately defined yet (63). By April 30, 24.3% of COVID-19-related deaths in Greece involved patients aged between 40 and 64 years of age, while the NPHO representative highlighted that no one is immune to the disease (64). Taking COVID-19 lethality and unpredictability into account, contracting the virus, as well as worry about the health of relatives and friends may be risk factors for increased levels of COVID-19-related fear (32, 33). Therefore, this study explored two potential risk factors for increased fear of COVID-19, having contracted the virus, that is, personal experience with the disease, and having someone close with COVID-19, that is, worry about family members, friends, and significant others.

Nine respondents reported that they had contracted the virus, none belonged though to the high-risk group of people over 65 years of age. In addition, 68 participants had an affected member in their close environment. Interestingly, a significant proportion of participants, roughly one out of four, was not sure about whether they had been infected or not, whereas there were also respondents not knowing whether their relatives had been infected.

Since people with mental health disorders are likely to be more affected by COVID-19 due to higher vulnerability to stress compared with the general population (23, 34), this study considered a third potential risk factor for increased levels of fear, that is, receiving psychiatric medication during the past 6 months, indicative of the presence of a mental disease. Less than one out of 10 participants was on psychiatric medication. The majority was over the age of 46.

Safety Behaviors

The fear of viral transmission during a pandemic is associated with precautionary measures, as well as avoidant behaviors to prevent infection. Preventive and mitigation measures include, among others, frequent hand hygiene, avoiding touching the face, wearing a medical mask in case of respiratory symptoms and keeping a minimum social distance of one meter. On March 19, WHO officially recommended a "rational use" of personal protective equipment to increase availability. For the healthy general population, emphasis was rather placed on hand hygiene and social distancing (65).

COVID-19 caused a "mask boom" worldwide. According to a Panhellenic survey conducted from March 17 to March 19 in 300 Greek pharmacies, products that had run out first were medical protective masks, antiseptics, disinfectant wipes, and alcohol solutions. In several areas, lack of masks and antiseptics had already been observed by the end of February (66). On April 9, a day before this study's start date, the Greek Health Ministry representative drew attention to the fact that the use of masks and protective gloves may provide a false sense of security. As a result, the crucial protective measures, that is, social distance, and hand washing, may be overlooked. Therefore, the use of medical masks was not recommended for the healthy members of the Greek general population. Furthermore, there was a dispute over the use of plastic gloves due to lack of supportive evidence for their protective effects against the virus (67). Altogether, the benefit of mask usage for self-protection, as well as for preventing the spread of COVID-19 is an issue that remained controversial (68). Some experts in Greece continued to suggest precautionary use of masks in enclosed public places in case of even the slightest possibility that their use might prevent some of the virus's transmission.

This study explored the employment of three safety behaviors, cleaning/disinfecting objects, taking care of personal hygiene and using personal protective equipment, such as face masks and disposable gloves. Almost half of the participants reported that they often clean/disinfect objects, while another 30% reported that they always do it. The majority of the respondents took care of personal hygiene according to the NPHO guidelines. Participants over the age of 46 tended to clean/disinfect objects and take care of personal hygiene more regularly compared with younger participants, while usage of personal protective equipment was more common at younger ages as well (over the age of 31).

Checking Behaviors

A severe widespread disease such as COVID-19 may easily exacerbate health anxiety concerns. Fear for the body may cause hypervigilance, a state of alert with regard to physical changes suggesting COVID-19 illness (32). As a result, checking behaviors, such as body checking for symptoms and avoidance of potentially contaminated objects, may be employed (69). This study investigated three checking behaviors reflecting health anxiety, self-monitoring for COVID-19 symptoms, restricting physical contact with other people and communicating with family doctor due to fear of having been infected.

According to study findings, daily self-monitoring for COVID-19 symptoms was more frequent in participants aged between 61 and 75. On the contrary, the majority of participants over the age of 75 avoided monitoring themselves, possibly due to increased fear of COVID-19. In addition, the vast majority of participants over the age of 61, the high-risk group for severe illness, restricted physical contact with others.

Interestingly, around 90% of the participants across all ages had never contacted their family physician. At first glance, this finding may indicate that this checking behavior was limited. There may be though another explanation. Until now, less than one fifth of the Greek population has been registered with a family doctor, a form of primary health care that has been provided only recently in Greece. A shortage of such doctors may be related with confusion and is associated with increased emergency hospital visits in Greece. According to the recommendations of the NPHO, people with respiratory, COVID-19 resembling symptoms should avoid visiting a hospital, that is, people were advised against a common practice in case of health emergencies. Instead, they should contact their family doctor first, a less common emergency practice in Greece. Therefore, maybe less people contacted a family doctor, because access had not been easy. This is a hypothesis though that warrants further investigation (70, 71).

Compliance With Guidelines and Social Responsibility

Compliance with guidelines by health authorities is a remedy for preventing the spread of the virus. Still, compliance, the "change in a person's behavior in response to a direct request" may be more than just a behavioral response. Compliance may be influenced by personal beliefs, as well as personality characteristics. A study of a mixed sample from the United States, the United Kingdom, and Germany showed that maintenance of physical distance during the COVID-9 crisis, a compliant behavior, was promoted by empathy for high-risk members of the community (72). On the contrary, psychopathy was associated with non-compliance with health-related behaviors to restrict spread of COVID-19 (73).

The present study explored compliance by asking whether participants follow WHO guidelines and if they abide by the Greek government's enacted measures. According to the results, half of the participants responded that they always comply with guidelines and over 40% that they often comply. Therefore, the proportion of the respondents who rarely or never comply was small (6.4%). Compliance with guidelines increased with age. In this sample, participants aged between 61 and 75 years displayed the most compliant behavior.

Social responsibility is an ethical concept. This study explored social responsibility motivation, that is, an individual's motivation to act for the benefit of others. People with high social responsibility motivation do not only consider helping others a responsibility, they also want to help and enjoy supporting people and the community during crises. A study of adolescents in the US revealed that greater social responsibility was associated with less hoarding, a behavior leading to shortage of products, as well as regular use of antiseptics (74). In this sample, respondents within the age range 18–30 years showed the least social responsibility motivation. Roughly, half of the survey's respondents belonged to this age group. Therefore, a potential explanation as to why some people overlook the health measures to restrict the spread of COVID-19 may be decreased social responsibility among younger members of the population, an observation that requires further investigation.

The Psychological Impact of COVID-19

The first studies of the psychological impact of COVID-19 on the general population were conducted in China, where the virus first emerged. A cross-sectional study in a Chinese population 2 weeks after the outbreak reported a moderate to severe impact on more than half of study participants. Roughly one out of three participants displayed moderate to severe anxiety symptoms, while several others depressive symptoms and increased stress levels. The psychological impact was greater in women, students, people with physical symptoms resembling COVID-19 and people with poor self-reported health status. On the contrary, psychological symptoms were alleviated when precautionary health measures were taken, possible due to a better sense of control (75). Another cross-sectional study explored the psychological and behavioral responses in Chinese people from Wuhan and Shanghai again shortly after the outbreak. The study reported that the prevalence of moderate to severe anxiety increased by 4–5 times. Participants with confirmed or suspected COVID-19 cases around them displayed more severe anxiety symptoms than others. The majority of the respondents (over 90%) were compliant with guidelines and recommendations (76). Worry and concerns related with COVID-19 were reported in a Canadian (27), a US (28), and a German population (29). Altogether, the COVID-19 pandemic is expected to cause increased levels of anxiety, similarly to previous infectious disease outbreaks (77). Upcoming studies of the psychological impact of COVID-19 are awaited (78).

This study showed that 35.7% of the participants expressed high levels of COVID-19-related fear. Furthermore, 22.8% of the participants reported moderate to severe depressive symptoms, while a significant proportion, 77.4% of the respondents, reported moderate to severe anxiety symptoms. The rates of moderate to severe depressive and anxiety symptoms in this study were much higher than the rates reported in a Chinese population (16.5% and 28.8% respectively) (75). Apart from the different sociocultural background, perhaps previous experience with an epidemic may influence a general population's reaction to the COVID-19 pandemic, explaining the different rates of severe depressive and anxiety symptoms between Greeks and Chinese. The last time Greece went through such a pandemic was a century ago, therefore the COVID-19 pandemic is a novel experience for the entire Greek population and novel experiences tend to be more frightful (59). On the contrary, China's previous experience with the SARS outbreak was more recent. Notably, in the beginning of February, WHO announced the name "COVID-19" for the SARS-CoV-2 virus disease. This name predominated in public communication worldwide to protect the population, especially Asians, from collective memories of the SARS outbreak in 2003 (79). Whether previous experience with other pandemics may ameliorate or increase the psychological burden of the current experience with COVID-19 remains to be evaluated.

Women showed significantly higher levels of COVID-19-related fear, as well as more severe anxiety symptoms, compared with men. This finding is in accordance with evidence suggesting that women report more fear and anxiety than men (80). In addition, women showed significantly more severe depressive symptoms than men. Based on the fact that depression is more common in Greek women, that is, seven out of ten depressive patients are female (81), it was expected that females would demonstrate more severe depressive symptoms than men in this sample. Altogether, this study observed a greater psychological burden in female compared with male responders. This observation is in accordance with findings of other studies, for instance a study of a German population that reported greater worry about COVID-19 in women compared with men (29), as well as a study of a Chinese population that revealed a greater psychological impact of COVID-19 on women, that is, higher levels of stress, anxiety, and depression, compared with men (75).

This study confirmed the significant positive correlations between fear of COVID-19, depressive, and anxiety symptoms reported previously (31). With regard to age, younger participants, under the age of 30, displayed less fear of COVID-19 and reported less severe depressive symptoms compared with older participants. Contrary to fear and depressive symptoms, anxiety symptoms' severity in younger participants did not differ significantly compared with older ones.

Fear of COVID-19

Infectious disease outbreaks evoke automatically a fear response, an alert state, possibly related with the collective memory of past deadly pandemics (24). Similarly, a significant psychological effect of the COVID-19 pandemic crisis is fear (82). People with mental diseases are more vulnerable to stress compared with the general population and are therefore more likely to be affected by COVID-19. As expected, this study revealed that being on psychiatric medication was associated with higher levels of COVID-19-related fear (23, 34).

Fear is considered a biologically "basic" emotion (83), an automatic "reflex" response to a specific external danger. There is a great overlap between fear and anxiety, the latter being more related with an unknown, vague or upcoming threat. From an evolutionary perspective, fear is associated with risk-avoiding behaviors, while anxiety with preparedness. Both emotional states promote adaptation and self-perseverance (35). Since fear is associated with self-perseverance, it may elicit checking behaviors (32) and promote self-protective responses (84). A recent study assessed fear of COVID-19 by the FCV-19S scale in 324 participants from the United Kingdom. According to the results, participants showing higher levels of fear employed more public health behaviors. Therefore, the authors concluded that this "functional" form of fear could be carefully used by health authorities to nurture safety behaviors (30). Still, it should be noted that fear does not only promote self-protective behaviors, but also defensive responses to control fear, such as denial (e.g., "I am not at risk of becoming infected"). These two competing responses are inversely correlated, that is, the more one remains in denial or defensive avoidance rejecting fear, the less one follows recommendations to escape the actual danger. Moreover, amplifying fear may promote defensive responses, rather than self-protective actions, particularly in individuals with weaker self-efficacy perceptions, that is, lower perceived ability to perform a self-protective behavior (84). Therefore, although fear has been used to address public health issues and to promote health education, definite beneficial effects of such an approach have not always been demonstrated (85, 86). Fear is effective in producing behavioral changes only when it is accompanied by high-efficacy messages, e.g. concrete references to the severity of a disease and/or the susceptibility to it (84).

Vice versa, although individuals employ safety behaviors to shield themselves from danger and harm, safety behaviors may intensify fear and anxiety. A study of undergraduate participants with different levels of contamination fear revealed that enforcement of daily safety behaviors raised awareness of contamination, increasing contamination-related fear. Worry of contamination increased in all participants, regardless of the initial levels of contamination fear (87). Except for contamination fear, safety behaviors were also associated with higher levels of health anxiety (88). Moreover, it is well known that safety and avoidant behaviors related with anxiety disorders, as well as control behaviors related with obsessive compulsive disorder, amplify fear and anxiety respectively (89). In accordance, this study showed that employment of safety behaviors, as well as checking behaviors, that is, self-monitoring for COVID-19 symptoms and communication with the family doctor, were associated with higher levels of fear. On the contrary, restricting physical contact with others was not related with fear. This finding may be explained by the fact that although personal experience with the virus was not associated with fear, a close person's COVID-19 illness was related with higher levels of fear. Taken together, it could be hypothesized that restricting physical contact was not associated with fear because this checking behavior protects family members and friends by securing social distancing. In addition, greater compliance with WHO guidelines and the measures that the government has enacted was also associated with increased levels of fear. Personal safety measures and self-monitoring behaviors are incorporated in WHO guidelines, in such, increased compliance with WHO may amplify fear. The regular controls by the Hellenic Police, the Municipal police and the Hellenic Coast Guard, deployed by the Greek government to ensure abidance to the restriction measures, potentially reinforced fear as well. Altogether, this study provided evidence that excessive behavioral responses to the pandemic amplify fear of COVID-19. Therefore, a vicious circle may be created between excessive behavioral responses and increased fear of COVID-19.

Based on previous experience with infectious disease outbreaks, fear may be related with various psychological factors. A recent study reported health anxiety and intolerance of uncertainty to be predictors of fear of coronavirus (33). This study showed that gender, age, depressive and anxiety symptoms modified levels of fear of COVID-19. Specifically, female gender, older age, as well as more severe anxiety symptoms indicated higher levels of COVID-19-related fear. These findings are interpretable, taking into account the fact that women report more fear than men (80), greater age is associated with a higher prevalence of underlying risk conditions for severe COVID-19 disease and mortality (90) and anxiety overlaps with fear (35). On the contrary, more severe depressive symptoms indicated lower levels of COVID-19-related fear. This finding is interpretable, taking into account the fact that depressive patients display reduced emotional responsiveness and aloof responses (91). Therefore, individuals with more severe depressive symptoms may remain indifferent towards the threat of COVID-19, experiencing less fear.

Study's Usefulness and Limitations

A pandemic is a public health emergency situation. Pandemics are not only life-threatening conditions; they have an impact on mental health. The magnitude of the psychosocial impact during the COVID-19 pandemic, as well as the long-term consequences, may be affected by personal, socio-cultural and other situational factors, as well as by a country's economy. Due to the globalization, studies of a variety of populations across different countries are necessary to gain an overall understanding of the impact of COVID-19 to implement management strategies. Up to date, there are no available studies of the psychosocial impact of previous epidemics on the Greek population. Moreover, to the best of our knowledge, this was the first study exploring fear of COVID-19 in a Greek population. The study was conducted as soon as 3 weeks after a national lockdown had been imposed to explore fear during the initial phase of this novel experience. Studies of fear during a pandemic, describing the sociodemographic factors associated with fear together with other modulators, enable the creation of both supportive and preventive interventions, targeting risk groups.

Still, the present study had some limitations: i) the study's cross-sectional design did not permit the elucidation of causal relationships (92); ii) the results were obtained based on self-report information and self-administered tools, and may therefore suffer from bias (93); iii) the respondents' characteristics with regard to occupational status were not described in detail (lack of data on number of students and retirees). In addition, the questions exploring safety behaviors did not consider potential lack of information about NPHO health guidelines; iv) due to the strict restriction measures, participants completed online survey questionnaires. Although there is evidence supporting the view that online data collection is equivalent to paper-and-pencil data collection (94, 95), online surveys remain subjected to criticism with regard to data quality; v) although an online survey may provide a large amount of data within a short period, the internet community may not be representative of the general population, as older, less educated and socially disadvantaged groups may not be adequately represented. In addition, online surveys suffer from the so-called "volunteer-effect", associated with the fact that people respond to surveys when they are interested in the topic or when they identify themselves with the survey's scope. Therefore, bias associated with self-selection cannot be excluded, since responders' characteristics may differ substantially from non-responders, limiting results' generalizability (56).

CONCLUSIONS

A pandemic is a dread risk, a relatively rare event causing death to many people within a short period of time. People respond with more fear and anxiety to dread risks compared with continuous risks, affecting people over a longer period (96). This study investigated the psychological impact of COVID-19 in Greece during the initial phase of the pandemic, as well as the complex associations between fear of COVID-19, depressive symptoms, anxiety symptoms, potential risk factors for increased COVID-19-related fear, safety behaviors, checking behaviors, compliance with guidelines and social responsibility. Based on this study's results, excessive safety, and checking behaviors, as well as greater compliance with guidelines may amplify fear, potentially due to increased contamination awareness. Therefore, this study underscores the danger of a vicious circle's creation between fear of COVID-19 and behavioral responses to the pandemic. Furthermore, female gender, older age, as well as more severe depressive and anxiety symptoms were shown to modulate levels of COVID-19-related fear.

Meanwhile, a brief mental health screening questionnaire for COVID-19-related anxiety was developed, the Coronavirus Anxiety Scale (CAS), not available when this study was conducted (97). Specific psychometric tools, such as the FCV-19S and CAS scales, may support future studies. Additional studies are required to describe psychologically vulnerable groups with regard to religiosity, personality traits and other factors (82). Future studies, focusing on groups that are more vulnerable to the pandemic-related stress, such as the COVID-19 patients, victims' relatives, people with medical conditions, psychiatric patients and health-care professionals, are also of great importance (23).

Conclusively, since previous experience with the SARS epidemic in 2003 yielded evidence that outbreaks of infectious diseases may be associated with long-lasting consequences on mental health (98), the long-term impact of COVID-19 remains to be evaluated.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

This study involving human participants was reviewed by the Scientific Committee of the General Hospital "Papageorgiou" Review Board, Thessaloniki, Greece. Ethical approval was received prior to data collection. The study was anonymous. Before entering the online-survey, respondents were requested to indicate their consent. To secure anonymity, the selection "anonymize responses" chosen on the online platform prevented recording of any personal information and assured removal of all contact associations.

AUTHOR CONTRIBUTIONS

EP and V contributed equally to this study. EP contributed to intellectual input and wrote the first draft of the manuscript. VH contributed to study's conception and design, as well as to data management interpretation. PV, AB, IG, AG, and GP contributed to literature search and paper editing. KaP, AD, AC, VB, SP, MS, KP, and CK contributed to study's design, creation, and distribution of the online survey and data management. ID supervised the study and contributed to the final revision of the manuscript. All authors contributed to the article and approved the submitted version.

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The Association Between Physical and Mental Health and Face Mask Use During the COVID-19 Pandemic: A Comparison of Two Countries With Different Views and Practices

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Background: The physical and mental health of citizens living in a country that encouraged face masks (China) and discouraged face masks (Poland) during the initial stage of the COVID-19 pandemic remained unknown. We conducted a cross-country study to compare the psychological impact of the COVID-19 pandemic on Poles and Chinese. This study aimed to compare the levels of psychological impact of pandemic and levels of anxiety and depression between China and Poland.

Methods: The survey collected information on demographic data, physical symptoms, contact history, and precautionary measures. The psychological impact was assessed using the Impact of Event Scale-Revised (IES-R), and mental health status was assessed by the Depression, Anxiety and Stress Scale (DASS-21). The chi-squared test was used to analyze the differences in categorical variables between the two populations. Linear regression was used to calculate the bivariate associations between independents variables (e.g., physical symptoms and precautionary measures) and dependent variables (e.g., mental health outcomes).

Results: This study included a total of 2,266 respondents from both countries (1,056 Poles and 1,210 Chinese). There were significantly less Polish respondents who wore face masks (Poles: 35.0%; Chinese: 96.8% $p < 0.001$). Significantly more Polish respondents reported physical symptoms resembling COVID-19 infection ($p < 0.001$), recent medical consultation ($p < 0.01$), recent COVID-19 testing ($p < 0.001$), and hospitalization ($p < 0.01$). Furthermore, Polish respondents had significantly higher levels of anxiety, depression and stress ($p < 0.001$) than Chinese. The mean IES-R scores of Poland

and China were above the cut-off for post-traumatic stress disorder (PTSD) symptoms. Besides precautionary measures, unemployment, retirement, physical symptoms resembling COVID-19 infection, recent medical consultation or COVID-19 testing, and long daily duration of home confinement were risk factors for PTSD symptoms, anxiety, depression, or stress for Polish respondents.

Conclusion: Use of face masks at the community level may safeguard better physical and mental health during the COVID-19 pandemic. There is a need of health education with scientific information from Polish health authority on the proper use of face masks and reduce social stigma. This study was limited by the respondent sampling method that had compromised the representativeness of samples.

Keywords: anxiety, COVID-19, depression, mask, knowledge, precaution, psychological impact, stress

INTRODUCTION

The World Health Organization (WHO) declared the coronavirus disease 2019 (COVID-19) outbreak a pandemic on March 11, 2020 (1). In Asia, China was the first country that was affected by COVID-19. After the outbreak of severe acute respiratory syndrome (SARS), China has built a public health infrastructure to react promptly to the COVID-19 pandemic (2). As of February 2, the number of confirmed cases was 17,205 and the number of death cases was 361 in China (3). Besides enhancing policies on lockdown, social distancing, and personal hygiene (4), China was the first country that enforced compulsory face mask policies for healthy people outside the home environment (5). Due to previous experience with SARS and air pollution (6), wearing a face mask has become a common practice in China and some Asian countries.

Outside China, the number of COVID-19 cases surged in Europe. The local transmission of COVID-19 in Poland was first declared to the WHO on March 10 (7). A new law on specific solutions related to the prevention and eradication of COVID-19 (called "specustawa", special act) was passed to enforce social distance, prohibition of gathering, closure of business and school, and home confinement (8). As of March 26, the number of confirmed cases of COVID-19 infections was 1221, and there were 16 deaths in Poland (9). In contrast to China, Poland was not affected by SARS in 2003 and Polish medical experts discouraged public from wearing face masks as it was seen as a cultural practice in Asia (10, 11).

Various precautionary measures are adopted during the COVID-19 pandemic. While it is clear that physical distancing can cause loneliness (12), the effects of facemasks has sparked a debate in the medical field and caused confusion. During the initial stage of COVID-19 pandemic, neither the WHO nor Centers for Disease Control and Prevention (CDC) encouraged the usage of face masks for the general public (5, 13). Medical and public health experts from some European countries (e.g., United Kingdom) believed there was no direct evidence of airborne transmission of COVID-19 (14). In contrast, respiratory clinicians and public health experts in China argued that lack of evidence does not equate to evidence of ineffectiveness of face masks (15). The use of face masks, by most people in Hong Kong have played an important role in controlling the spread of COVID-19 (16). Although air quality and ventilation experts believed wearing face mask could offer psychological benefits (14), the mixed opinion, contradictory messaging, and shortage of face masks could possibly lead to public anxiety and confusion. Furthermore, the public might be concerned about emerging clinical reports about the spread of COVID-19 by asymptomatic carriers (17).

One of the methods to study the possible association between wearing face masks and mental health parameters during the COVID-19 pandemic is to compare mental health of two countries with different views and practices with similar mental health status before the COVID-19 pandemic (18). Recent studies reported the mental health of Chinese during the pandemic (19–21) but there was no similar study on Poles. We hypothesized that (a) More Chinese respondents would prefer to wear face masks as a preventive measure; (b) the frequencies of physical symptoms and levels of psychological impact, depression, anxiety, and stress were different between Polish and Chinese respondents; (c) different factors were associated with psychological impact, depression, anxiety, and stress in Polish and Chinese respondents.

METHODS

Study Design and Study Population

We conducted a cross-country study to compare the psychological impact of the COVID-19 pandemic on Poles and Chinese. The study was conducted from January 31 to February 2 in China and March 22 to March 26 in Poland, during the initial stages of the epidemic in both countries. A respondent driven sampling strategy focused on recruiting the general public during the COVID-19 pandemic was utilized. The formula to calculate sample size is listed as follows (22):

The sample size n and margin of error E are given by

$$x = Z(^{c}/_{100})^{2} r(100 - r)$$
$$n = {}^{Nx}/_{((N-1)E^{2}+x)}$$
$$E = Sqrt[^{(N-n)x}/_{n(N-1)}]$$

where N is the population size, r is the fraction of responses, and Z (c/100) is the critical value for the confidence level c. The minimum sample size for China was 664 (margin error is 5%, confidence level at 99%; the population of China is 1,439,525,218; response distribution: 50%) (22). The minimum sample size for Poland was 384 (margin error is 5%, confidence level at 99%; the population of Poland is 37,845,009) (22). Inclusion criteria for respondents were access to the Internet, able to read Chinese or Polish, residing in China or Poland during the recruitment period. Exclusion criteria were no access to the Internet, illiteracy, and not residing in China or Poland at the time of recruitment.

Procedure

In order to comply with social distancing and lockdown measures in both countries, potential respondents were electronically invited by existing study respondents by the respondent sampling technique. They completed the questionnaires through an online survey platform (Google Forms Online Survey in Poland and "SurveyStar", Changsha Ranxing Science and Technology, Shanghai in China). The Institutional Review Board of the SWPS University (Poland) (IRB Reference Number WKEB62/04/2020), Huaibei Normal University (China) (HBU-IRB-2020-002) approved the research proposals. All respondents provided informed consent and anonymous data were kept confidential.

Outcomes

This study used the National University of Singapore COVID-19 questionnaire, and its psychometric properties had been established during the COVID-19 outbreak (23) and pandemic (24). The National University of Singapore COVID-19 questionnaire consisted of questions that covered five main areas: (1) demographic data; (2) physical symptoms related to COVID-19 in the past 14 days; (3) contact history with COVID-19 in the past 14 days; (4) knowledge and concerns about COVID-19; and (5) precautionary measures against COVID-19 in the past 14 days.

Demographic data about age, gender, education, household size, and marital status were collected. Physical symptoms related to COVID-19 included breathing difficulty, chills, coryza, cough, dizziness, fever, headache, myalgia, sore throat, and fever. Respondents also rated their physical health status and stated their history of chronic medical illness. Health service utilization variables in the past 14 days included consultation with a doctor in the clinic, quarantine experience, and recent testing for COVID-19. Precautionary measures against COVID-19 included covering mouth when coughing and sneezing, hand hygiene, and wearing a face mask regardless of the presence or absence of symptoms. The respondents were asked the average number of hours of home confinement per day during the COVID-19 pandemic.

The psychological impact of COVID-19 was measured using the Impact of Event Scale-Revised (IES-R). The IES-R was validated in Polish and Chinese population for determining the extent of psychological impact after exposure to a recent event that might threaten survival (i.e., the COVID-19 pandemic) (25–27). This 22-item questionnaire which is composed of three subscales, aims to measure the mean avoidance, intrusion, and hyperarousal (28). The total IES-R score is divided into 0–23 (normal), 24–32 (mild psychological impact), 33–36 (moderate psychological impact) and >37 (severe psychological impact) (29). The total IES-R score > 24 suggests the presence of post-traumatic stress disorder (PTSD) symptoms (30). The Chinese version of IES-R was a valid and reliable measure of psychological distress. Based on factor analysis and subscale correlation, the three subscales of the Chinese version of IES-R were highly related and reliability was verified (31). The Chinese version of IES-R demonstrated external validity with significant correlation with General Health Questionnaire (31). Similarly, the Polish version of IES-R was found to be reliable and valid method. The factor structure is similar to the proposed theoretical structure (32). Principal component analysis identified three factors including intrusion, hyperarousal, and avoidance (32). IES-R was previously used in research related to the COVID-19 epidemic (23, 33, 34). We also assessed the reliability and validity of IES-R for this study. For reliability, the internal consistency or homogeneity of items of IES-R was measured by the Cronbach's alpha. Cronbach's alpha of 0.70 or higher is considered "acceptable" in most social science research (35). In this study, the Cronbach's alpha for Chinese version of IES-R was 0.949 and Cronbach's alpha for Polish version of IES-R was 0.883. The Spearman-Brown split half reliability coefficient is used to estimate full test reliability based on split-half reliability measures and the Spearman-Brown coefficient of 0.80 or higher is considered to demonstrate good reliability. In this study, the Spearman-Brown coefficient for Chinese version of IES-R was 0.916 and Cronbach's alpha for Polish version of IES-R was 0.87. For face validity, there was 100% completion rate for both Chinese and Polish respondents and indicated good comprehensibility and interpretability of IES-R. Construct validity was assessed by the confirmatory factor analysis (CFA). The goodness-of-fit indices revealed a good fit of the data model [Chinese version of IES-R: $\chi2$/d.f. = 2.467 (<3: excellent), RMSEA = 0.07 (<0.1: acceptable), CFI = 0.937 (>0.9: acceptable), IFI = 0.937 (>0.9 acceptable), NFI = 0.899 (>0.90: acceptable); Polish version of IES-R: $\chi2$/d.f. = 2.269 (<3: excellent), RMSEA = 0.065 (<0.1: acceptable), CFI = 0.917 (>0.9: acceptable), IFI = 0.919 (>0.9 acceptable), NFI = 0.863 (>0.90: acceptable)].

The mental health status of respondents was measured using the Depression, Anxiety and Stress Scale (DASS-21) and calculation of scores was based on a previous study (36). The DASS-21 was recommended to meaningfully compare the relationships between variables across different ethnic groups (37). DASS-21 has been demonstrated to be a reliable and valid measure in assessing mental health in Poles (37) and Chinese (38–40). Previous study reported that each of the three subscales of DASS-21 demonstrated good internal consistency, test-retest reliability and convergent validity with other established scales such as Chinese version of Beck Depression Inventory (BDI) and State-Trait Anxiety Inventory (STAI) (40). Confirmatory factor analysis of the assumed three-factor model of Polish version of DASS-21 suggested that the model was appropriate for Poles (37). DASS-21 was previously used in research related to the COVID-19 epidemic (23, 33, 34). We also assessed the reliability and validity of DASS-21 for this study. For internal consistency, the Cronbach's alpha of Chinese version of DASS-21 was listed as follows: DASS-21 stress: 0.888, DASS-21 anxiety: 0.845, DASS-21 depression: 0.878. The Cronbach's alpha of Polish version of DASS-21 was listed as follows: DASS-21 stress: 0.890, DASS-21 anxiety: 0.854, DASS-21 depression: 0.886. For split-half reliability, the Spearman-Brown coefficient for Chinese version of DASS-21 was 0.929 and Cronbach's alpha for Polish version of DASS-21 was 0.937. For face validity, there was 100% completion rate for both Chinese and Polish respondents and indicated good comprehensibility and interpretability of DASS-21. For construct validity, the CFA revealed a good fit of the data model [Chinese version of DASS-21: $\chi 2$/d.f. = 2.382 (< 3: excellent), RMSEA = 0.068 (<0.1: acceptable) CFI = 0.944 (>0.9: acceptable), IFI = 0.944 (>0.9 acceptable), NFI = 0.908 (>0.90: acceptable); Polish version of DASS-21: $\chi 2$/d.f. = 2.201 (<3: excellent), RMSEA = 0.063 (<0.1: acceptable), CFI = 0.950 (>0.9: acceptable), IFI = 0.951 (>0.9 acceptable), NFI = 0.913 (>0.90: acceptable)].

Statistical Analysis

Descriptive statistics were calculated for demographic characteristics, physical symptom, and health service utilization variables, contact history variables, and precautionary measure variables. The scores of IES-R and DASS subscales were expressed as mean and standard deviation. To analyze the differences in psychological impact, levels of depression, anxiety and stress, the independent sample t-test was used to compare the mean score between the Polish and Chinese respondents. Percentages of response to other questions were calculated according to the number of respondents per response to the number of total responses of a question and presented as categorical variables. The chi-squared test was used to analyze the differences in categorical variables between the two samples. We used linear regressions to calculate the bivariate associations between independent variables including demographic characteristics, physical symptoms and health status, and precautionary measures, and dependent variables including the IES-S score and DASS stress, anxiety, and depression subscale scores for the Poles and Chinese separately. The maximum probability of a Type I error remains alpha ($p < 0.05$). In this study, there are three levels of p-values: $p < 0.05$, $p < 0.01$, and $p < 0.001$ for the significant regression analysis results. For example, a *p*-value of 0.01 would mean there is a 1% chance of committing a Type I error [2]. Statistical analysis was performed on SPSS Statistic 21.0.

RESULTS

Comparison Between the Polish and Chinese Respondents and Their Mental Health Status

For the study in Poland, we received responses from 1,064 respondents, and 8 respondents did not complete the questionnaires. Eventually, we included 1,056 respondents from Poland who had completed the questionnaires (99.2%). For the China sample, we excluded 94 incomplete questionnaires, which yielded 1,210 of a total of 1,304 (92.79%) valid questionnaires from China. As a result, there were a total of 2,266 individual respondents who participated in both countries.

Figure 1 compares the mean scores of DASS-stress, anxiety, and depression subscales and IES-R scores between the Polish and Chinese respondents. For the DASS-stress subscale ($M_{China} = 7.76$, $SD_{China} = 7.74$; $M_{Poland} = 14.00$, $SD_{Poland} = 10.09$), Chinese had significantly lower stress scores ($t = 16.32$, $p < 0.001$, 95%CI 5.50 to 7.00). For the DASS-anxiety subscale ($M_{China} = 6.16$, $SD_{China} = 6.57$; $M_{Poland} = 7.65$, $SD_{Poland} = 8.12$), Chinese had significantly lower anxiety scores ($t = 4.76$, $p < 0.001$, 95% CI 0.87 to 2.11). For the DASS-depression subscale ($M_{China} = 6.25$, $SD_{China} = 7.16$; $M_{Poland} = 10.06$, $SD_{Poland} = 9.23$), Chinese had significantly lower depression scores ($t = 10.88$, $p < 0.001$, 95% CI 3.13 to 4.51). For IES-R ($M_{China} =32.98$, $SD_{China} = 15.42$; $M_{Poland} = 31.14$, $SD_{Poland} = 13.59$), Chinese had significantly higher IES-R scores ($t = -3.03$, $p < 0.01$, 95% CI −3.04 to −0.65). Nevertheless, the mean IES-R scores of both countries were higher than 24 points, indicating the presence of PTSD symptoms in Polish and Chinese respondents.

Demographic Characteristics and Its Association With Psychological Impact and Adverse Mental Health Status

The majority of Polish respondents were women (76.1%), of middle adulthood with the average age of 31 to 40 years (45.4%), married (55.5%) having a household size of 3–5 people (57.4%), employed (84.5%), and well educated (72.9% with a bachelor or higher degree). Similarly, the majority of Chinese respondents were women (67.3%), married (76.4%), of young adulthood with age 22 to 30 years (53.2%), having a household size of 3–5 people (80.7%), students (52.8%), and well educated (87.9 with a bachelor or higher degree) (see **Table 1**).

For Polish respondents, the male gender was significantly associated with the lower score of IES-R and DASS-21 subscale scores ($p < 0.01$) (see **Table 2**). In contrast, male gender was significantly associated with the lower score of IES-R but higher DASS-21 subscale scores in Chinese respondents ($p < 0.05$). Notwithstanding, there were other differences between Polish and Chinese respondents. Unemployment and retirement were significantly associated with higher IES-R scores in Poles ($p < 0.05$). Higher education levels were associated with lower DASS-21 depression scores ($p < 0.01$) in Poles but higher IES-R scores in Chinese ($p < 0.05$). Polish students were significantly associated with higher DASS-21 depression scores ($p < 0.001$) while Chinese students were significantly associated with higher IES-R, DASS-21 stress and anxiety scores ($p < 0.05$).

Physical Symptoms, Health Status, and Its Association With Psychological Impact and Adverse Mental Health Status

For physical symptoms resembling COVID-19 and health status, there were a significantly higher proportion of Polish respondents who reported fever ($p < 0.001$), breathing difficulty ($p < 0.001$), coryza ($p < 0.001$), sore throat ($p < 0.001$), recent consultation with a doctor ($p < 0.01$), recent COVID-19 testing ($p < 0.001$), recent hospitalization ($p < 0.01$), chronic illness ($p < 0.01$), indirect contact with a confirmed case of COVID-19 ($p < 0.05$), and contact with infected materials ($p < 0.001$) as compared to Chinese (see **Table 3**). Significantly less Chinese respondents reported good health status ($p < 0.001$) and more Chinese respondents had recent quarantine experience ($p < 0.01$). Of the Polish respondents, 614 respondents (58.1%) had no symptom, 227 respondents (21.5%) had one symptom, 126 respondents (11.9%) had two symptoms, and 52 (4.9%) respondents had three symptoms. Of the Chinese respondents, 793 respondents reported no symptoms (60.81%), 182 respondents reported one symptom (15.04%), 114 respondents reported two symptoms (9.42%), and 68 respondents reported three symptoms (5.62%).

For both countries, linear regression showed that chills and myalgia were significantly associated with higher IES-R scores, DASS-21 stress, anxiety, and depression subscale scores after adjustment for age, gender, and education levels ($p < 0.05$) (see **Table 4**). Cough and poor physical status were significantly associated with higher DASS-21 stress, anxiety, and depression subscale scores ($p < 0.05$). The presence of chronic illness and sore throat were significantly associated with higher IES-R scores, stress, and anxiety ($p < 0.05$). Breathing difficulty was associated with higher DASS-21 anxiety and depression scores ($p < 0.01$). Contact with infected material by COVID-19 was associated with higher DASS-21 anxiety scores ($p < 0.05$). Concerns about other family members contracting COVID-19 were significantly associated with higher IES-R scores ($p < 0.05$). Recent quarantine was not associated with IES-R and DASS-21 subscale score ($p > 0.05$). There were other differences between

TABLE 1 | Comparison of demographic characteristics between Polish and Chinese respondents (N = 2,266).

Demographic characteristics	Poland (N = 1,056) N (%)	China (N = 1,210) N (%)
Gender		
Male	252 (23.9)	396 (32.7)
Female	804 (76.1)	814 (67.3)
Age range		
[12–21]	74 (7.0)	344 (28.4)
[22–30]	217 (20.5)	643 (53.2)
[31–40]	479 (45.4)	94 (7.8)
[41–49]	216 (20.5)	90 (7.4)
>50	70 (6.6)	39 (3.2)
Household size		
Six people or more	50 (4.7)	171 (14.1)
Three to five people	606 (57.4)	976 (80.7)
Two people	265 (25.1)	52 (4.3)
One person	135 (12.8)	11 (0.9)
Education level		
Primary school and below	5 (0.5)	10 (0.8)
Junior high school	32 (3.0)	55 (4.6)
High school	249 (23.6)	81 (6.7)
University (Bachelor, Master, Doctorate)	770 (72.9)	1,064 (87.9)
Employment status		
Student	88 (8.3)	639 (52.8)
Unemployed	47 (4.5)	67 (5.5)
Farming	0 (0)	24 (2.0)
Retired	28 (2.7)	7 (0.6)
Employed	893 (84.5)	473 (39.1)
Marital status		
Married	586 (55.5)	925 (76.4)
Single	460 (43.6)	273 (22.6)
Divorced/Separated	0 (0)	9 (0.7)
Widowed	10 (0.9)	3 (0.3)

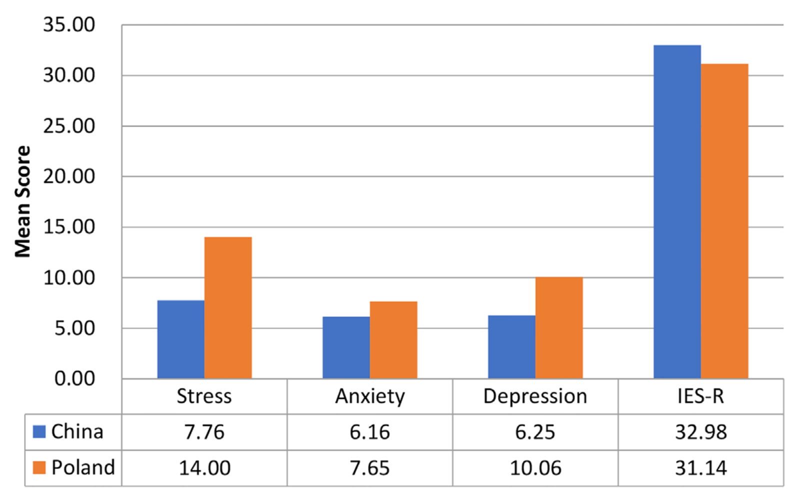

FIGURE 1 | Comparison of the mean scores of DASS-stress, anxiety, and depression subscales as well as IES-R scores between Polish and Chinese respondents (N = 2,266).

TABLE 2 | Association between demographic variables and the psychological impact of the 2019 coronavirus disease (COVID-19) outbreak as well as adverse mental health status between Polish and Chinese respondents during the epidemic (N = 2,266).

Demographic variables	Poland								China							
	Impact of event		Stress		Anxiety		Depression		Impact of event		Stress		Anxiety		Depression	
	B	*T*	*B*	*t*	*B*	*t*	*B*	*T*	*B*	*t*	*B*	*t*	*B*	*t*	*B*	*t*
Gender																
Male	–0.54	–6.23***	–0.50	–6.23***	–0.58	–5.77***	–0.31	–3.37**	–0.20	–2.56*	0.10	2.33*	0.19	2.64**	0.12	2.13*
Female	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Age (years)																
12–21.4	–0.35	–1.72	0.08	0.42	0.23	1.00	0.51	2.42*	0.21	1.00	0.08	0.65	0.10	0.51	0.06	0.39
21.4–30.8	–0.40	–2.39*	–0.02	–0.10	–0.21	–1.09	–0.04	–0.22	0.09	0.45	0.12	1.01	0.07	0.36	0.18	1.15
30.8–40.2	–0.25	–1.59	–0.02	–0.16	–0.18	–1.02	–0.20	–1.22	–0.17	–0.73	–0.07	–0.52	–0.16	–0.72	–0.06	–0.36
40.2–49.6	–0.26	–1.53	–0.10	–0.61	–0.27	–1.42	–0.21	–1.18	–0.16	–0.69	–0.12	–0.82	–0.23	–1.05	–0.16	–0.89
>49.6	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Marital status																
Single	–0.07	–0.19	–0.002	–0.01	0.29	0.65	–0.16	–0.40	–0.12	–0.33	0.02	0.10	0.38	1.11	0.12	0.44
Married	0.03	0.07	0.03	0.09	0.35	0.78	–0.32	–0.78	0.002	0.01	0.12	0.58	0.47	1.40	0.22	0.82
Widowed	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Household size																
Six people or more	0.06	0.31	0.08	0.41	0.29	1.23	0.08	0.38	0.38	0.97	–0.23	–0.99	–0.17	–0.46	–0.19	–0.67
Three to five people	0.12	1.03	0.06	0.59	0.16	1.17	0.10	0.83	0.25	0.65	–0.20	–0.88	–0.12	–0.35	–0.09	–0.31
Two people	0.14	1.04	0.05	0.44	0.18	1.18	0.13	0.96	0.41	0.99	–0.33	–1.35	–0.18	–0.46	–0.21	–0.69
One person	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Employment status																
Unemployed	0.51	2.79**	0.31	1.85	0.26	1.22	0.27	1.45	0.13	0.81	0.12	1.26	0.21	1.38	0.16	1.33
Retired	0.59	2.51*	–0.06	–0.29	0.13	0.48	0.16	0.66	–0.76	–1.60	–0.37	–1.34	–0.55	–1.24	–0.48	–1.36
Student	–0.04	–0.29	0.17	1.35	0.33	2.10*	0.74	5.23***	0.20	2.71**	0.11	2.40*	0.16	2.25*	0.08	1.46
Employed	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Education level																
Junior high school	–0.01	–0.02	–0.62	–1.14	–0.96	–1.42	–1.71	–2.79**	1.08	2.53*	0.14	0.54	0.26	0.64	0.10	0.31
High school	0.35	0.63	–0.37	–0.72	–0.59	–0.94	–1.70	–2.97**	0.88	2.11*	0.10	0.39	0.24	0.62	0.03	0.10
University (Bachelor, Master, Doctorate)	0.28	0.50	–0.38	–0.76	–0.84	–1.34	–1.91	–3.35**	1.04	2.64**	0.14	0.58	0.17	0.47	0.03	0.09
Primary school and below	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	

$^*P < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

the two countries. Recent consultation with a doctor and COVID-19 testing was significantly associated with higher DASS-21 anxiety scores in Poles only ($p < 0.01$). Close contact with confirmed case of COVID-19 infection was associated with depression in Chinese only ($p < 0.05$).

Precautionary Measures About COVID-19 and Its Association With Psychological Impact and Adverse Mental Health Status

Polish and Chinese respondents demonstrated significantly different precautionary measures (see **Table 5**). There were significantly more Chinese respondents who would cover their mouths when coughing and sneezing ($p < 0.001$), practice hand hygiene ($p < 0.05$), wear masks ($p < 0.001$), spent most of the time at home (20–24 h) ($p < 0.001$), and satisfied with health information ($p < 0.001$) than Poles.

Linear regression analysis showed that hand hygiene practice was associated with lower DASS-21 anxiety scores in Polish and Chinese respondents after adjustment for age, gender, and education levels ($p < 0.05$) (see **Table 6**). Use of face mask and satisfaction with health information were not associated with mental health parameters in Poles and Chinese ($p > 0.05$). For Poles, staying at home for 10–19 h was significantly associated with lower IES-R and DASS-21 stress scores ($p < 0.05$) as compared to home confinement for 20–24 h. This association was not found in Chinese, suggesting that the daily duration of home quarantine might not have an adverse effect on mental health in Chinese.

DISCUSSION

To our best knowledge, this is the first study that compared the psychological impact and mental health Poland and China that adopted very different precautionary measures during the COVID-19 pandemic. For the first hypothesis, the proportion of Chinese respondents who used face masks was significantly higher than Poles. For the second hypothesis, the proportion of Polish respondents who report physical symptoms resembling COVID-19 infection, recent medical consultation, recent COVID-19 testing and hospitalization were higher than Chinese and these could be predisposing factors for anxiety, depression, and stress in Poles. The Chinese respondents had significantly higher IES-R scores than Poles. It is important to note that the Cronbach's alpha value of Chinese version of IES-R was higher than 0.90 and it might suggest redundancy of items (41, 42).

TABLE 3 | Comparison of physical health status in the past 14 days of the 2019 coronavirus disease (COVID-19) outbreak between Polish and Chinese respondents during the epidemic (N = 2,266).

Variable	Poland (N = 1,056) N(%)	China (N = 1,210) N(%)	Chi-square (χ^2)	p-value
Persistent fever (>38°C for at least one day)				
Yes	39 (3.7)	6 (0.5)	29.615	p < 0.001***
No	1,017 (96.3)	1,204 (99.5)		
Chills				
Yes	30 (2.8)	42 (3.5)	0.728	p = 0.394
No	1,026 (97.2)	1,168 (96.5)		
Myalgia				
Yes	71 (6.7)	95 (7.9)	1.056	p = 0.304
No	985 (93.3)	1,115 (92.1)		
Cough				
Yes	163 (15.4)	168 (13.9)	1.088	p = 0.297
No	893 (84.6)	1,042 (86.1)		
Breathing difficulty				
Yes	35 (3.3)	5 (0.4)	27.370	p < 0.001***
No	1,021 (96.7)	1,205 (99.6)		
Coryza				
Yes	265 (25.1)	205 (16.9)	22.798	p < 0.001***
No	791 (74.9)	1,005 (83.1)		
Sore throat				
Yes	203 (19.2)	139 (11.5)	26.333	p < 0.001***
No	853 (80.8)	1,071 (88.5)		
Consultation with a doctor in the last 14 days				
Yes	243 (23.0)	42 (3.5)	195.813	p < 0.001***
No	813 (77.0)	1,168 (96.5)		
Current self-rating of health status				
Poor or very poor	11 (1.0)	11 (1.0)	150.042	p < 0.001***
Average	103 (9.8)	372 (30.7)		
Good or very good	942 (89.2)	827 (68.3)		
Chronic illness				
Yes	223 (21.1)	78 (6.4)	105.368	p < 0.001***
No	833 (78.9)	1,132 (93.6)		
Recent testing for COVID-19 in the last 14 days				
Yes	243 (23.0)	11 (0.9)	276.772	p < 0.001***
No	813 (77.0)	1,199 (99.1)		
Recent hospitalization in the past 14 days				
Yes	17 (1.6)	4 (0.3)	10.051	p < 0.01**
No	1039 (98.4)	1,206 (99.7)		
Recent quarantine in the last 14 days				
Yes	6 (0.6)	26 (2.1)	10.118	p < 0.01**
No	1,050 (99.4)	1,184 (97.9)		
Close contact with an individual with confirmed infection with COVID-19				
Yes	6 (0.6)	4 (0.3)	NA	NA
No	1,050 (99.4)	1,206 (99.7)		
Indirect contact with an individual with confirmed infection with COVID-19				
Yes	14 (1.3)	6 (0.5)	4.439	p = 0.035*
No	1,042 (98.7)	1,204 (99.5)		
Contact with infected material by COVID-19				
Yes	164 (15.5)	12 (1.0)	166.377	p < 0.001***
No	892 (84.5)	1,198 (99.0)		
Concerns about other family members contracting COVID-19				
Yes	893 (84.6)	909 (75.2)		
No	163(15.4)	291 (24.0)	NA	NA
No other family members	0 (0)	10 (0.8)		

(Continued)

TABLE 3 | Continued

**p < 0.05, **p <0.01, ** p <0.001.*

Prior to the COVID-19 pandemic, the two countries had similar age standardized prevalence of depression and anxiety (18). In 2017, the age-standardized prevalence of depression in China and Poland were 3.4% and 2.3%, respectively. The age-standardized prevalence of anxiety in China and Poland were 3 and 3.4% (18). From 2005–2008 to 2016–2018, Poland and China had similar levels of increase in happiness scores (Poland: 0.445; China: 0.426) (43). For the third hypothesis, the factors associated with adverse mental health were different for Polish and Chinese respondents. For Polish respondents, male gender, and high level of education were protective factors while unemployment, retirement, physical symptoms resembling COVID-19 infection, recent medical consultation or COVID-19 testing, and long daily duration of home confinement (20–24 h) were risk factors for PTSD symptoms, anxiety, depression, or stress. In contrast, for Chinese respondents, male gender, student status, high education level, and physical symptoms resembling COVID-19 infection were risk factors. Polish respondents reported significantly higher levels of anxiety, depression, and stress as compared to the Chinese respondents. This could be due to the number of COVID cases and death per 1 million population was higher in Poland as compared with China during the recruitment periods (Poland: 32 COVID cases/1 million people; 0.42 deaths/1 million people on 26 March 2020; China: 12 COVID cases/1 million people; 0.25 deaths/1 million people on 2 February 2020) and different precautionary measures.

When the differences in mental health findings between the two countries were taken into considerations, this would provide important information about the effects of different precautionary

TABLE 4 | Association between physical health status in the past 14 days and contact history, and the psychological impact of 2019 coronavirus disease outbreak (COVID-19) as well as adverse mental health status between Polish and Chinese respondents during the epidemic with adjustment for age, gender, and education levels (N = 2266).

Variables	Poland								China							
	Impact of Event		Stress		Anxiety		Depression		Impact of Event		Stress		Anxiety		Depression	
	B	*t*	*B*	*T*	*B*	*t*	*B*	*t*	*B*	*t*	*B*	*T*	*B*	*t*	*B*	*t*
Persistent Fever (>38°C for at least one day)																
Yes	0.27	1.35	0.12	0.64	0.27	1.19	0.05	0.23	−0.23	−0.44	0.40	1.34	1.23	2.60*	0.98	2.57*
No	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Chills																
Yes	0.63	2.80**	0.81	3.90***	0.63	2.44*	0.53	2.23*	0.46	2.34*	0.44	3.84***	0.60	3.31**	0.41	2.84**
No	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Myalgia																
Yes	0.31	2.07*	0.56	4.06***	0.49	2.86**	0.52	3.31**	0.63	4.77***	0.43	5.60***	0.69	5.61***	0.50	5.08***
No	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Cough																
Yes	0.20	1.96	0.31	3.22**	0.48	4.02***	0.39	3.59***	0.33	3.23**	0.19	3.11**	0.29	2.97**	0.21	2.70**
No	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Breathing difficulty																
Yes	0.48	2.26*	0.60	3.14**	1.01	4.24***	0.82	3.74***	0.88	1.58	0.57	1.74	1.63	3.15**	1.28	3.08**
No	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Coryza																
Yes	0.02	0.28	0.12	1.44	0.16	1.60	0.09	0.96	0.39	4.11***	0.25	4.46***	0.46	5.18***	0.33	4.70***
No	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Sore throat																
Yes	0.21	2.22*	0.25	2.84**	0.38	3.52***	0.19	1.94	0.34	2.99**	0.16	2.45*	0.35	3.35**	0.17	2.08*
No	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Consultation with doctor in the clinic in the last 14 days																
Yes	0.14	1.58	0.11	1.37	0.27	2.61**	0.16	1.68	−0.06	−0.31	0.17	1.47	0.38	2.08*	0.22	1.48
No	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Recent hospitalization in the past 14 days																
Yes	0.05	0.15	−0.08	−0.28	0.28	0.81	0.47	1.49	0.78	1.25	0.32	0.87	1.23	2.12*	−0.28	−0.60
No	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Recent testing for COVID-19 in the past 14 days																
Yes	0.14	1.58	0.11	1.37	0.27	2.61**	0.16	1.68	−0.18	−0.48	−0.07	−0.31	0.22	0.64	0.02	0.06
No	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Recent quarantine in the past 14 days																
Yes	−0.15	−0.30	−0.18	−0.40	−0.36	−0.62	−0.12	−0.23	0.32	1.30	−0.01	−0.06	0.03	0.13	−0.11	−0.59
No	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Current self-rating of health status																
Very poor	0.75	2.04*	0.86	2.56*	1.16	2.76**	1.58	4.16***	1.39	1.13	3.63	5.03***	3.35	2.94**	3.56	3.88***
Poor									1.69	1.77	0.13	0.57	0.65	1.81	0.36	1.23
Average	0.50	3.92***	0.56	4.76***	0.75	5.26***	0.66	5.08***	0.37	4.73***	0.19	4.28***	0.41	5.70***	0.26	4.63***
Good or very good	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Chronic illness																
Yes	0.27	2.91**	0.22	2.53*	0.35	3.32**	0.08	0.85	0.30	2.02*	0.24	2.77**	0.48	3.58***	0.38	3.51***
No	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Close contact with an individual with confirmed infection with COVID-19																
Yes	0.35	0.70	0.15	0.33	−0.02	−0.04	−0.29	−0.55	0.53	0.84	0.32	0.87	0.98	1.68	0.97	2.10*
No	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Indirect contact with an individual with confirmed infection with COVID-19																
Yes	−0.35	−1.05	−0.38	−1.25	−0.24	−0.63	−0.39	−1.13	−0.06	−0.11	-0.27	-0.89	-0.28	-0.59	-0.37	-0.96

(Continued)

TABLE 4 | Continued

Variables	Poland								China							
	Impact of Event		Stress		Anxiety		Depression		Impact of Event		Stress		Anxiety		Depression	
	B	*t*	*B*	*T*	*B*	*t*	*B*	*t*	*B*	*t*	*B*	*T*	*B*	*t*	*B*	*t*
No	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Contact with infected material by COVID-19																
Yes	0.17	1.64	0.21	2.15*	0.24	2.04*	0.17	1.57	0.36	1.00	0.41	1.91	0.98	2.93**	0.81	3.02**
No	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Concerns about other family members contracting COVID-19																
Yes	0.27	2.57*	0.17	1.76	0.23	1.91	0.10	0.90	0.34	4.15***	0.06	1.19	0.10	1.28	0.04	0.68
No	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	

**p<0.05, **p<0.01, ***p<0.001.*

TABLE 5 | Comparison of precautionary measures in the past 14 days of the 2019 coronavirus disease (COVID-19) outbreak between Polish and Chinese respondents during the epidemic (N = 2,266).

Variables	Poland (N = 1,056) N (%)	China (N = 1,210) N (%)	Chi-square (χ^2)	p-value
Covering mouth when coughing or sneezing				
Yes	786 (74.4)	1,159 (95.8)	211.453	p < 0.001***
No	270 (25.6)	51 (4.2)		
Washing hands with soap and water				
Yes	1,009 (95.5)	1,177 (97.3)	4.918	p = 0.027*
No	47 (4.5)	33 (2.7)		
Wearing mask or protective gloves regardless of presence or absence of symptoms				
Yes	370 (35.0)	1,171 (96.8)	987.842	p < 0.001***
No	686 (65.0)	39 (3.2)		
Average number of hours staying at home per day to avoid COVID-19				
[0–9]	90 (8.5)	29 (2.4)	230.918	p < 0.001***
[10–19]	277 (26.2)	77 (6.4)		
[20–24]	689 (65.3)	1,104 (91.2)		
Satisfaction with the amount of health information available about COVID-19				
Satisfied	466 (44.1)	908 (75.0)		
Not satisfied	200 (19.0)	251 (20.8)	399.926	p < 0.001***
Do not know	390 (36.9)	51 (4.2)		

**p < 0.05, ***p < 0.001.*

measures. Chinese respondents were significantly more likely to wear face masks. The infrequent use of face mask but more knowledge about COVID-19 from other countries could be the underlying reasons for significantly more physical symptoms and more frequent consultation with a doctor, COVID-19 testing and hospitalization reported by Polish respondents. The proper use of face masks could be due to good public health education as Chinese respondents were more satisfied with health information in this study. Zhai (14) provided four benefits of wearing face masks (14). Firstly, from the view of air quality and ventilation, COVID-19 transmission through respiratory droplets produced by an infected person should also be treated as airborne (44). Case series in China showed that surface contact with infected materials might not be the main route for COVID-19 spread (14). Secondly, face masks are more efficient in preventing virus spread from asymptomatic patients. Third, there is no evidence of false sense of security and improper use of face masks that outweigh its benefits. Fourth, in view of shortage of face masks, China actively enhances the production of facemasks rather than discouraging its use. This could have instilled confidence, showing fewer COVID-19 cases and reduced the risk of adverse mental health among the Chinese. In April, 2020, it was clear that countries or cities with higher proportion citizens that used face masks had lower COVID-19 cases and controlled the epidemic much earlier than countries or cities that discouraged the use of face masks (45). The rising in number of COVID-19 cases and deaths in some countries have worsened the mental health of their citizens (46). The world opinion shifted in favour of face masks including the U.S. (47). During the recruitment period, the China government made it mandatory to wear face masks in public areas along with other

TABLE 6 | Comparison between associations of precautionary measures in the past 14 days, health information and the psychological impact of the 2019 coronavirus disease (COVID-19) outbreak, as well as adverse mental health status between Polish and Chinese respondents during the epidemic with adjustment for age, gender, and education (N = 2,266).

Variables	Poland								China							
	Impact of Event		Stress		Anxiety		Depression		Impact of Event		Stress		Anxiety		Depression	
	B	***T***	***B***	***T***	***B***	***t***	***B***	***t***	***B***	***t***	***B***	***t***	***B***	***t***	***B***	***t***
Covering mouth when coughing or sneezing																
Yes	−0.01	−0.14	−0.11	−1.43	−0.04	−0.37	−0.17	−1.91	0.10	0.57	0.04	0.40	−0.15	−0.90	−0.06	−0.46
No	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Washing hands with soap and water																
Yes	−0.27	−1.49	−0.32	−1.89	−0.49	−2.35*	−0.33	−1.74	−0.25	−1.15	−0.30	−2.35*	−0.45	−2.19*	−0.33	−2.00*
No	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Wearing mask or protective gloves regardless of presence or absence of symptoms																
Yes	0.12	1.41	0.09	1.22	0.02	0.18	−0.03	−0.32	−0.05	−0.23	−0.16	−1.36	−0.36	−1.92	−0.29	−1.92
No	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Average number of hours staying at home per day to avoid COVID-19																
0–9 h	0.04	0.28	0.04	0.29	−0.15	−0.98	0.01	0.04	−0.35	−1.49	−0.27	−1.94	−0.41	−1.87	−0.30	−1.71
10–19 h	−0.23	−2.60*	−0.23	−2.93**	−0.10	−1.01	−0.13	−1.50	0.09	0.62	−0.01	−0.12	0.05	0.34	−0.03	−0.30
20–24 h	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	
Satisfaction with the amount of health information available about COVID-19																
Satisfied	−0.10	−1.13	−0.02	−0.20	−0.07	−0.72	0.03	0.36	0.12	0.65	−0.03	−0.31	−0.12	−0.69	−0.06	−0.47
Not satisfied	−0.09	−0.88	−0.02	−0.16	−0.22	−1.78	0.07	0.67	0.37	1.92	0.12	1.09	0.11	0.59	0.13	0.93
Do not know	Reference		Reference		Reference		Reference		Reference		Reference		Reference		Reference	

precautionary measures throughout all regions in China. After the completion of recruitment of this study in Poland, the Polish government made it mandatory to wear face masks in public places on April 16 2020 (48). On May 30 2020, the Polish government decided to revoke the necessity of wearing face masks if the social distance of 2 m was preserved. This rule applied to both open and closed areas, various services (e.g., indoor restaurants and hair salons). Using face masks was still mandatory in public transport, stores, theaters, and churches (49). Since August 8 2020, due to the growing number of COVID-19 cases, Poland was divided into three zones with different level of restrictions and requirement to wear face masks in public spaces and the prohibition of organizing mass events [the red zones, with 9 counties of Silesia, Greater Poland, Lesser Poland, and Łódź Voivodships, where the restrictions are strictest and urgent, the yellow zones, with 10 counties of Silesia, Lesser Poland, Greater Poland, Subcarpatian, Swietokrzyskie, Łódź Voivodships, with intermediate levels of restrictions, and the green zones with the lowest levels of restriction and no urgent change in precaution (50)]. Polish researchers advocated for general public education campaigns on the proper use of face masks (51). Nevertheless, Polish held ambivalent views toward face masks with due to cultural reasons. It is generally difficult for Poles to accept the need to use them. This also applies to anti-smog and dust masks used to protect people employed in mining and industry. Before the outbreak of the COVID-19 pandemic, wearing protective masks was not a constant Polish practice as for the residents of many Chinese cities, whose awareness of the importance of wearing masks and the responsibility associated with the need to protect their own health and health of others are higher. The Chinese are more collectivistic than Poles, attached to social conformity and collective order (52). Therefore, it is easier for Chinese to accept wearing masks. From the social perspective, Poles perceive wearing masks as a sign of sickness and vulnerability. From the anthropological perspective, Poles believe that face mask is designed to make a person unreal and hide the identity (53). Our findings suggest that there is a need of health education for the adoption of the precautionary measures or promotion of the importance of the precautionary measures.

Besides precautionary measures, other risk and protective factors warrant further discussion. For Poles, female gender was associated with poor mental health and previous Polish study also found women were at higher risk of developing anxiety and depression (54). Nevertheless, previous study found that Polish men were less likely to consult general physicians about their psychiatric problems due to masculine issues (55). For Chinese respondents, male gender was associated with higher levels of anxiety, depression and stress. This finding corresponds to a recent study that found that higher percentage of Chinese males endured different degrees of depression (56). The deterioration of Chinese males' depression during COVID-19 might be partly attributed to their negative attitude toward emotional openness and reluctance to consult mental health professionals (56), although mental health services were disrupted (27).

Unemployed Poles, especially those who had not earned minimum national wage before the COVID-19 pandemic and retired Poles worried that they would receive less allowance due to tight budget of the government. From cultural viewpoints, Poles enjoyed freedom and independence (57) and a long duration of home confinement affected their mental health. As Polish respondents were less satisfied with health information, more educated Poles were capable to research and analyze different sources of health and led to better mental health. In contrast, Poles with lower education were more likely to break precautionary measures, facing high risk of COVID-19 infection and adverse mental health (58). In contrast, Chinese respondents were satisfied with health information in general. COVID-19 could have more impact on Chinese students as compared to Polish students due to differences in the education system. Every year, millions of Chinese students have prepared for years for the national university entrance exam (*gaokao*) that have a significant impact on their future studies and career. Rarely, this high-stake exam was postponed due to COVID-19 (59), and the disruption in academic plans led to higher levels of anxiety and stress among Chinese students.

Limitations

One major limitation is the cross-sectional nature of this study and it would be very interesting if researchers could follow-up Polish citizens since the Polish government made mandatory the use of face masks. Although we found Polish respondents demonstrated significantly higher DASS-21 subscale scores during the COVID-19 pandemic, we did not record demographic data regarding preexisting mental illness of the respondents. Poles could suffer from higher levels of psychiatric morbidity before the COVID-19 pandemic. The worry, stress, and anxiety in Polish respondents might exist prior to this study because of the information provided through the media especially since the pandemic had affected other European countries. Poles faced higher levels of social stigmatization of mental illness (60, 61) and underfunding of hospital treatment of depression (55). There is a potential risk of sampling bias because we could not reach out to potential respondents without Internet access in both countries. The respondent sampling method also compromised the representativeness of samples. Respondent Sampling Technique depends on existing study participants recruiting new participants from their acquaintances (snowballing). By virtue of the non-probabilistic nature of this technique, the sample is not representative of the underlying population. Both samples in China and in Poland were recruited in the same way, but distribution of demographic variables in both samples was different. Yet, these demographic differences between both samples could in part compensated through the use of stratified analysis and adjustment for confounders. The study population had different sociodemographic characteristics as compared to the general population. For Chinese, the male to female gender ratio in 2018 was 1.04:1 (62) but 67.3% of Chinese respondents were female. The proportion of study population with university education was higher than the general population. In addition, 72.9% of Chinese respondents in this study had university education while 17% of the Chinese general population had university education (63). Similarly, 87.9% of Polish respondents in this study had university education while 27% of the Polish general population had university education (63). We need to consider the above socio-demographic differences when interpreting the results of this study. Another limitation is that self-reported levels of psychological impact, anxiety, depression, and stress may not always be aligned with objective assessment by mental health professionals. Nevertheless, psychological impact, anxiety, depression, and stress are based on personal feelings, and self-reporting was paramount during the COVID-19 pandemic. Lastly, we could not calculate the response rate. For potential respondents who were not keen to participate the online survey, they would not provide any response and we cannot collect any information from them.

Conclusion

During the COVID-19 pandemic, this cross-country study found that the proportion of Polish respondents who used masks were significantly less than Chinese. The infrequent use of face mask could be the contributing cause for significantly more physical symptoms and more frequent medical consultation, COVID-19 testing, and hospitalization reported by Polish respondents. Poles had significantly higher levels of anxiety, depression, and stress as compared to Chinese. Besides precautionary measures, unemployment, retirement, physical symptoms resembling COVID-19 infection, recent medical consultation or COVID-19 testing and long daily duration of home confinement were risk factors for PTSD symptoms, anxiety, depression, or stress for Polish respondents. There is a need of health education with scientific information from Polish health authority on the proper use of a face masks and reduce social stigma. However, this study was limited by the respondent sampling method that has compromised the representativeness of samples and the demographic differences between both samples.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Institutional Review Boards of SWPS University (Poland) and Huaibei Normal University (China). Written informed consent to participate in this study was provided.

AUTHOR CONTRIBUTIONS

CW and AC-C contributed equally to the paper and are co-first authors. CW, AC-C, DG, KA, MH, RP, and RH led the conception and design of the survey. CW, RP, and LX supported the training and supervision of data collection teams in China. AC-C, DG, KA, and MH supported the training and supervision of data collection teams in Poland. CW and RP led the data analysis with support from XW, YT, and JQ. LX conducted separate analysis of all data to ensure consistency. CW, AC-C, DG, RP, CH, RM, and RH conducted careful reviews of all analysis. AO-G, AC-C, DG, KA, and MH provided further information on cultural perspectives. CW, AC-C, RP, DG, KA, MH, RM, CH, and RH performed critical review of the manuscript. All authors contributed to the article and approved the submitted version.

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Factors Influencing Mental Health of Medical Workers During the COVID-19 Outbreak

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Background: Since the outbreak of COVID-19, physical and psychological harm has been spreading across the global population alongside the spread of the virus. Currently, the novel coronavirus has spread to most countries in the world, and its impact on the public is also increasing. As a high-risk group in direct contact with the virus, medical workers should be monitored, and their mental health deserves extensive attention. The aim of this study was to explore the mental health of medical workers facing the novel coronavirus and the main factors affecting it.

Methods: The present cross-sectional study including 2,100 eligible individuals from 1,050 hospitals in China was conducted through the network platform powered by www.wjx.cn, a platform providing functions equivalent to Amazon Mechanical Turk. We used a self-designed questionnaire to collect demographic information and data on mental states, including gender, age (years), educational level, job rank, body and mind reaction, cognition of risk, and the judgment of the epidemic situation. Independent samples t-tests and one-way (ANOVA) analysis were carried out to compare the differences in the mental reactions according to the demographic and psychological states of the participants.

Results: There were 502 males (23.9%) and 1,598 females (76.1%). The participants reported feeling calm (39.1%), tense (63.0%), scared (31.4%), angry (18.8%), sad (49.0%), afraid (34.7%), optimistic (5.1%), impressed (65.0%), and confident (31.1%) during the epidemic. At the same time, the psychological stress responses of medical staff were significantly different according to the levels of exposure in their environments, duration and personal experience.

Conclusions: Prolonged exposure to the virus and intense work are detrimental to the mental health of medical care personnel. It is necessary to adjust work conditions and intensity according to workers' mental state flexibly and systematically.

Keywords: COVID-19, epidemic, mental health, medical worker, factors

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INTRODUCTION

At the end of 2019, a large outbreak of disease that was widespread with a high speed and a large number of infected people broke out in Wuhan (1, 2), Hubei Province, China. It spread quickly over a short period of time (3, 4), and it has been a serious threat not only to physical health (5) but also to mental health issues throughout the population (6). Since April, there have been no additional diagnoses for many days outside of Hubei, China (7), and the number of additional infections in Hubei has been largely in the double-digits, as if the Chinese epidemic were about to end. However, since the outbreak of the global epidemic (8–10), the number of imported cases has been increasing continuously, making the slightly calmer mood tense once again. If the control of imported potential patients is not adequately strong to prevent the epidemic from spreading again, previous efforts could be in vain. According to the latest real-time statistics of Johns Hopkins University, as of 08:33 Beijing time on March 16th, the cumulative number of confirmed cases of coronary pneumonia worldwide was more than 160,000, and the cumulative number of confirmed cases outside China exceeded 86,435. Studying the novel coronavirus is not only a matter of fighting COVID-19 in China but also an international public health crisis that needs to be fought by the whole world.

Since the outbreak of the epidemic, tension, anxiety and other negative emotions have spread throughout China on a large scale, so much so that people have fallen into a series of psychological crises (6). Medical care personnel, as the backbone of the front line of epidemic prevention and control, have been taking on heavy work tasks with a high risk of infection and great work pressure (11). Health-care workers, especially those in hospitals who take care of confirmed or suspected patients, are more vulnerable than the general population, experience a high risk of infection and negative emotional stress, and further risk spreading the virus to their family, friends or colleagues (6). Moreover, dangerous and susceptible environments as well as traumatic experiences caused by high exposure can all have a certain impact on an individual's emotional state and induce emotional stress responses (12) as well as severe anxiety and depressive disorders and posttraumatic stress disorder (PTSD, posttraumatic stress disorder) (11, 13). A psychological survey published in *The Lancet· Psychiatry* showed that the prevalence of depression, anxiety, insomnia and stress among medical staff involved in the prevention and control of the epidemic were as high as 50.7, 44.7, 36.1, and 73.4%, respectively (14).

Until now, despite the rudimentary principal notice issued by the China National Health Commission in January regarding the emergency psychological crisis intervention measures for COVID-19 pneumonia, no one has been able to provide timely and effective psychological intervention measures for medical staff.

Therefore, it is urgent and important for psychological researchers to focus on the mental health problems of medical workers during the epidemic, explore the main factors affecting their psychological stability and health, and try to prevent long-term irreversible psychological trauma to medical workers. Some scholars (15, 16) in environmental psychology have studied the effects of the environment on the individual, especially in the face of danger. According to ecological theory, the individual behavior and environment are part of an interactive ecosystem, and individual behavior has a temporal and spatial background; that is to say, there is an integrated behavioral situation (17). For the same environmental phenomenon, arousal theory argues that the influence of the same spatial and temporal background on individuals is determined by the degree of arousal experienced by any particular individual (18). The level of arousal experienced by individuals is closely related to personal experience. Inspired by this theory, this study attempted to investigate whether differences in the exposure environment, personal experience, and exposure duration of medical care personnel would lead to differences in their psychological responses, and advice and assistance were provided to personnel to prevent the development of mental health issues.

MATERIALS AND METHODS

Participants

The questionnaire was designed for medical workers from all provinces in China. In the formal test, 2,100 medical workers were selected from 1,050 hospitals in 31 provinces to fill out the questionnaire, including 659 in Wuhan and 1,441 outside of Wuhan; 502 males and 1,598 females were included. Among them, 2.3% were under 25 years of age, 19.5% were aged 25–30, 39.5% were aged 31–40, 29.0% were aged 41–50 and 9.7% were over 50 years of age.

Procedures

The study was designed in accordance with the tenets of the Declaration of Helsinki. Approval from the ethical authority of the School of Educational Science, Huazhong University of Science and Technology, was granted. Confidentiality and the statement confirming informed consent were managed by anonymous coding of the self-report questionnaires.

This survey used WeChat, online questionnaires and other online surveys to investigate the emotional and psychological stress states of medical staff. We used a self-designed questionnaire to collect demographics and mental state data including factors such as gender, age (years), educational level, job rank, body and mind reaction, cognition of risk, and the judgment of the epidemic situation, which was started in the third week after the outbreak, and the specific time is from February 12 to February 21, 2020. Our team sent out questionnaires through the Internet platform powered by www.wjx.cn, a platform providing functions equivalent to Amazon Mechanical Turk. Participants filled in the questionnaire on the web page through mobile phone or computer.

Development of Psychological Stress Questionnaire

First, information was collected through small-scale interviews; next, we compiled a stress response questionnaire and determined the questionnaire topics and factors through exploratory factor analysis (EFA). Data from 312 subjects were collected as preliminary test through a web questionnaire with

TABLE 1 | Item loadings, eigenvalues and variances of the questionnaire according to PCA.

Factor	Item	*N*	Loading	Eigenvalue	% of variance
Cognition of danger (CD)	Risk of infection	Q1	0.73	2.17	24.10
	Worried about getting infected	Q6	0.66		
	The possibility of infection	Q3	0.63		
	Worried about family	Q2	0.60		
	Cognition of the current epidemic severity	Q8	0.60		
Judgment of the situation (JS)	Confidence in anti-epidemic efforts	Q9	0.84	1.38	15.38
	Fear of epidemic prevention	Q4	0.67		
Stress reaction (SR)	Sleep quality	Q5	0.74	1.28	14.21
	Need for psychological counsel	Q7	0.57		

TABLE 2 | Fitting index for confirmatory factor analysis.

Index	χ^2	df	χ^2/df	RMSEA	GFI	NFI	IFI	TLI	CFI
Value	70.426***	24	2.934	0.067	0.967	0.873	0.913	0.866	0.911

***$P < 0.001$.

TABLE 3 | Correlation analysis of each dimension of the questionnaire.

Factor	CD	JS	SR
CD	1.00	0.28**	0.27**
JS	0.27**	1.00	0.30**
SR	0.28**	0.30**	1.00

**$P < 0.01$.

15 items, including 79 in Wuhan and 233 outside Wuhan, 80 males and 232 females. Before the exploratory factor analysis, the results showed that the KMO (Kaiser–Meyer–Olkin) Measure of Sampling Adequacy was 0.765 (Chi-Square = 801.389, df = 91, $p < 0.001$), and the Bartlett's Test of Sphericity indicated that the correlation matrices on which the PCA was based were suitable for analysis. According to the factor load matrix after the rotation axis, the analysis process of the items was as follows. First, delete three items with insufficient load and which are difficult to name on each factor; next, compare the load of each item on each factor, and delete three items with small load and similar load on different factors; third, analyze each factor, and delete the items with poor division and which are difficult to explain. As per the above principles, all nine items were retained and three factors were confirmed as the result, and the total variance was 55.90%. The factors, which were named in turn, were cognition of danger (CD), reflecting the evaluation of the environmental risk of the subjects; judgment of the situation (JS), reflecting the confidence in successfully combating the epidemic and the psychology of the anti-epidemic work; and the stress reaction (SR), reflecting the physical and mental stress response produced by the subjects' current environment. See **Table 1**.

After constructing a stress reaction questionnaire with good reliability and validity, we used confirmatory factors analysis (CFA) to confirm the validity of the questionnaire to provide a questionnaire that reflected the ideal standard. Data from 432 subjects were collected as CFA, including 118 in Wuhan and 314 outside Wuhan, 118 males and 314 females, and the fitting index tables and model diagrams drawn through Amos software of CFA are shown in **Table 2** and **Figure 1**; finally, we conducted a wide range of formal tests.

The Internal Consistency Reliability (Cronbach α coefficient), partial reliability and the correlation between each factor score and the total score of the questionnaire were calculated by SPSS 23.0, and the results showed that the overall internal consistency and reliability and the overall parity factor for both was 0.67. See **Table 3**.

Data Analysis

All data analysis was carried out using SPSS 23.0 (SPSS Inc, Chicago, Illinois), and a two-tailed probability value of < 0.05 was considered to be statistically significant. Descriptive statistics for the demographic and psychological states of the medical staff were shown as the mean, standard deviation (SD), number (n), and percentage. Independent samples *t*-tests and one-way (ANOVA) analysis were carried out to compare the differences in the mental reactions according to the demographic and psychological states of the participants.

RESULTS

Demographic and Emotional Status

Among the 2,100 subjects who filled in the questionnaire, the distribution was not uniform, and 85.3% were doctors (1,792). According to the statistical distribution of the education level, 61.2% (1,286) of the subjects had a bachelor's degree, 19.1% (402) had a master's degree, and 5.5% (116) had a doctoral degree. Among them, there were 502 males (23.9%) and 1,598 females (76.1%). The participants primarily felt calm (39.1%), tense (63.0%), scared (31.4%), angry (18.8%), sad (49.0%), afraid (34.7%), optimistic (5.1%), impressed (65.0%) and confident (31.1%) during the epidemic.

Differences in the Exposure Environment

In this study, the differences in the health care workers' environmental exposure were demonstrated mainly by whether they participated in the COVID-19 resistance front and had direct contact with confirmed patients. There were significant

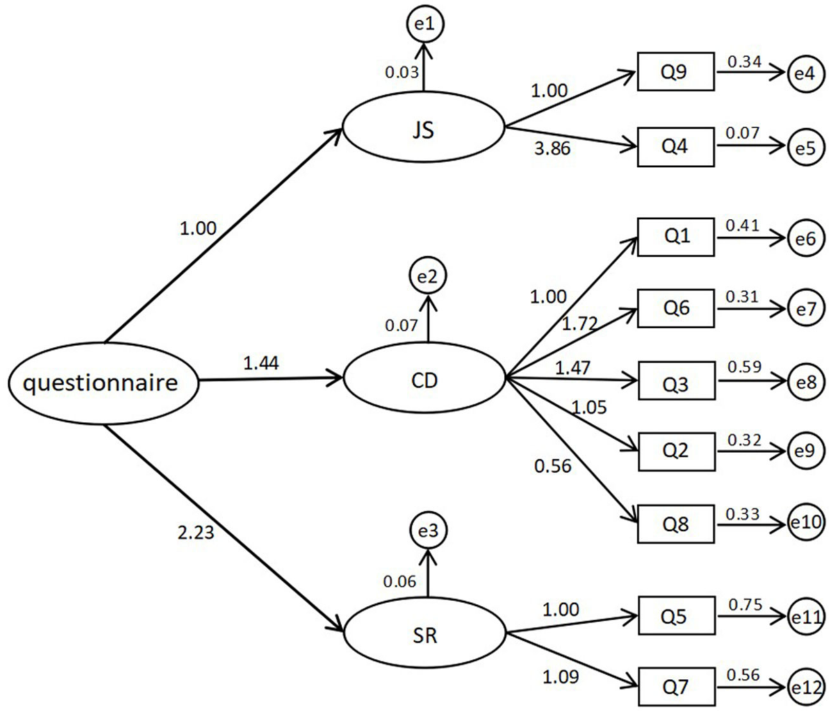

FIGURE 1 | The confirmatory factors analysis (CFA) of the questionnaire.

differences in the level of cognition about danger, judgment of their situation and stress reaction to the exposure environment. Specific statistical results for the medical care personnel and group comparisons are displayed in **Table 4**. The results show that those involved in the first-line response believed they were at greater risk of exposure to infection in the workplace(t = 4.872, $p < 0.001$), and they had more anxiety about infection (t = 2.943, $p = 0.003$), thought they were more likely to get sick ($t = 4.295$, $p < 0.001$), worried more about family infection (t = 1.982, $p = 0.048$), had lower confidence in obtaining victory over the epidemic ($t = 2.339$, $p = 0.019$), had poor sleep quality ($t = 2.559$, $p < 0.001$) and had a higher demand for psychological counseling ($t = 3.491$, $p < 0.001$). However, there were no significant differences for the cognition of the current epidemic severity and the fear of epidemic prevention.

Differences in Personal Experience

The differences in health care workers' personal experiences were affected mainly by whether they had experienced SARS or another epidemic. There were significant differences in the levels of cognition of danger, judgment of their situation and stress reactions to personal experiences. Specific statistical results for the medical care personnel and group comparisons are displayed in **Table 5**, which shows that medical staff involved in SARS prevention believed they had a greater risk of exposure to infection in the workplace ($t = 2.220$, $P = 0.027$), were more likely to be infected ($t = 2.057$, $p = 0.040$), had more confidence in the success in epidemic prevention and control ($t = -2.895$, $p = 0.004$), less fear of fighting the epidemic ($t = -3.167$, $p =$ 0.002), and poor sleep quality ($t = 2.848$, $p = 0.004$). However, there were no significant differences for the items regarding being worried about getting infected, the cognition of the current epidemic severity and the need for psychological counseling.

Differences in Exposure Duration

Since the outbreak of the epidemic, medical workers have been stressed and made to work for long periods of time, with little time for rest. The difference in exposure duration was reflected mainly by the number of continuous working days. This study compared the differences in the duration of the participants' operational time in medical care work and divided the working hours into four levels for horizontal comparison, which found that the longer the working hours were, the more likely the participants believed they would be infected ($F = 5.868$, $P <$ 0.001), the more worried they were about family members being infected ($F = 2.870$, $P < 0.035$), and the poorer their sleep-quality was ($F = 18.403$, $P < 0.001$). However, the fear of epidemic prevention was lower ($F = 6.052$, $P < 0.001$). Furthermore, there were significant fluctuations in two dimensions, cognition of the current epidemic severity ($F = 2.676$, $P = 0.046$) and confidence in anti-epidemic measures ($F = 11.275$, $P < 0.001$), caused by the increase in working hours, which at first declined a certain degree, then increased significantly. See **Table 6**.

TABLE 4 | Differences in participation in first-line rescue.

Factor	Item	Group (whether they participated in the front line)	*N*	M ± SD	*t*	*P*
CD	Risk of infection	Yes	877	4.31 ± 0.679	4.872	<0.001
		No	1,223	4.15 ± 0.716		
	Worried about getting infected	Yes	877	4.23 ± 0.769	2.943	0.003
		No	1,223	4.12 ± 0.837		
	The possibility of infection	Yes	877	3.66 ± 0.946	4.295	<0.001
		No	1,223	3.48 ± 0.964		
	Worried about family	Yes	877	4.67 ± 0.603	1.982	0.048
		No	1,223	4.62 ± 0.658		
	Cognition of the current epidemic severity	Yes	877	4.51 ± 0.626	0.936	0.349
		No	1,223	4.49 ± 0.600		
JS	Confidence in anti-epidemic efforts	Yes	877	1.52 ± 0.653	2.339	0.019
		No	1,223	1.45 ± 0.607		
	Fear of epidemic prevention	Yes	877	2.96 ± 0.903	0.188	0.851
		No	1,223	2.95 ± 0.905		
SR	Sleep quality	Yes	877	2.71 ± 1.023	3.559	<0.001
		No	1,223	2.56 ± 0.935		
	Need for psychological counsel	Yes	877	2.27 ± 0.914	3.491	<0.001
		No	1,223	2.13 ± 0.896		

TABLE 5 | Differences in experience with SARS or other outbreaks.

Factor	Item	Group (whether experienced SARS or other outbreaks)	*N*	M ± SD	*t*	*P*
CD	Risk of infection	Yes	1,202	4.25 ± 0.716	2.220	0.027
		No	898	4.18 ± 0.687		
	Worried about getting infected	Yes	1,02	4.17 ± 0.818	0.199	0.842
		No	898	4.16 ± 0.802		
	The possibility of infection	Yes	1,202	3.59 ± 0.974	2.057	0.040
		No	898	3.50 ± 0.940		
	Worried about family	Yes	1,202	4.66 ± 0.627	1.526	0.127
		No	898	4.62 ± 0.648		
	Cognition of the current epidemic severity	Yes	1,202	4.52 ± 0.601	1.920	0.055
		No	898	4.47 ± 0.623		
JS	Confidence in anti-epidemic measures	Yes	1,202	1.44 ± 0.604	−2.895	0.004
		No	898	1.52 ± 0.654		
	Fear of epidemic prevention	Yes	1,202	2.90 ± 0.923	−3.167	0.002
		No	898	3.03 ± 0.873		
SR	Sleep quality	Yes	1,202	2.68 ± 1.007	2.848	0.004
		No	898	2.56 ± 0.928		
	Need for psychological counsel	Yes	1,202	2.19 ± 0.926	0.086	0.932
		No	898	2.19 ± 0.879		

DISCUSSION

Since the emergence of the new coronavirus pneumonia in Wuhan at the end of December 2019, numerous medical staff have been working intensively for nearly 3 months and will continue to do so in the future. The results showed that the current mental health status of health care workers was not stable, with a general mean of more than 3.5 in terms of the cognition of danger, and most of the mean values were above 4 (according to Richter's five-point score, which gradually declined from 1 to 5). Regarding the dimensions of the judgment of the situation and the stress reaction, the medical staff were optimistic, and there was no obvious negative somatization phenomenon. It was found that the exposure environment, personal experience, and exposure duration had significant effects on the psychological stress and emotional responses of medical staff.

TABLE 6 | Differences in the length of work.

Factor	Item	Group (work time)	*N*	M ± SD	*F*	*P*
CD	Risk of infection	Within 3 days	222	4.18 ± 0.811	1.910	0.126
		4–7 days	502	4.17 ± 0.670		
		8–14 days	709	4.22 ± 0.684		
		More than 15 days	667	4.26 ± 0.712		
		total	2,100	4.22 ± 0.704		
	Worried about getting infected	Within 3 days	222	4.14 ± 0.839	1.225	0.299
		4-7 days	502	4.23 ± 0.686		
		8–14 days	709	4.16 ± 0.814		
		More than 15 days	667	4.14 ± 0.881		
		total	2,100	4.17 ± 0.811		
	The possibility of infection	Within 3 days	222	3.37 ± 1.037	5.868	<0.001
		4–7 days	502	3.52 ± 0.0.900		
		8–14 days	709	3.53 ± 0.0.935		
		More than 15 days	667	3.66 ± 0.994		
		total	2,100	3.55 ± 0.960		
	Worried about family	Within 3 days	222	4.59 ± 0.692	2.870	0.035
		4–7 days	502	4.65 ± 0.619		
		8–14 days	709	4.60 ± 0.674		
		More than 15 days	667	4.69 ± 0.583		
		total	2,100	4.64 ± 0.636		
	Cognition of the current epidemic severity	Within 3 days	222	4.57 ± 0.548	2.676	0.046
		4–7 days	502	4.51 ± 0.595		
		8–14 days	709	4.45 ± 0.646		
		More than 15 days	667	4.52 ± 0.601		
		total	2,100	4.50 ± 0.611		
JS	Confidence in anti-epidemic measures	Within 3 days	222	1.48 ± 0.622	11.275	<0.001
		4–7 days	502	1.58 ± 0.684		
		8–14 days	709	1.50 ± 0.624		
		More than 15 days	667	1.37 ± 0.572		
		total	2,100	1.48 ± 0.627		
	Fear of epidemic prevention	Within 3 days	222	3.07 ± 0.858	16.052	<0.001
		4–7 days	502	3.11 ± 0.819		
		8–14 days	709	2.99 ± 0.882		
		More than 15 days	667	2.77 ± 0.970		
		total	2,100	2.96 ± 0.904		
SR	Sleep quality	Within 3 days	222	2.28 ± 0.925	18.403	<0.001
		4–7 days	502	2.52 ± 0.947		
		8–14 days	709	2.65 ± 0.934		
		More than 15 days	667	2.80 ± 1.018		
		total	2,100	2.63 ± 0.976		
	Need for psychological counsel	Within 3 days	222	2.14 ± 0.897	0.385	0.764
		4–7 days	502	2.21 ± 0.883		
		8–14 days	709	2.19 ± 0.874		
		More than 15 days	667	2.19 ± 0.959		
		total	2,100	2.19 ± 0.906		

Medical workers involved in the front-line of prevention were affected to different degrees in these three dimensions, and the statistical level was significantly different. This may be due to direct exposure to close contact with the virus and negative tension in their environment as well as the fear of threats to their own lives. Additionally, the medical work environment is infested with patients' senses of grief and panic, resulting in a constant psychological burden for front-line medical workers. At the same time, there is no clear and targeted cure for the novel coronavirus infection. Doctors and nurses are not in a position to cope with the suffering of infected patients, which is further increasing their psychological burden.

The influence of medical workers who have experienced SARS and other epidemic diseases was not synchronized in these three dimensions. In the dimension of the cognition of danger, employees with experience of SARS and other epidemic prevention situations felt more serious psychological pressure, while for the dimension of the judgment of the situation, they had more confidence about overcoming this epidemic. This may be explained by the success of the prevention and control of infectious diseases like SARS, which has enhanced the collective sense of the efficacy of health care groups in the face of similar diseases, thus enhancing their confidence. However, the difficulties of living through that process and the negative emotions experienced are difficult to describe, and the impact has not gradually disappeared over time. The outbreak of the epidemic quickly awakened the former unhappy memory, so the iteration and development of risk cognition were derived from a certain preexisting foundation. This is also a wake-up call for psychological workers to remind us to do a good job of psychological intervention and health care even after illness.

As the time of exposure to the virus increases, the mental state of the medical staff deteriorates. Regarding the factor of risk cognition, the negative psychological state of the medical staff gradually intensifies with the passage of time, whereas the optimistic hope dimension presents the inverted U curve change. In the physical and mental response dimension, the sleep-quality of the medical staff is generally poor, but the difference in the level of demand for psychological counseling is not significant. This may be because, in the early days of the outbreak, a large number of patients poured into hospital emergency rooms and fever outpatient departments, increasing the already heavy workload and responsibility of all medical staff. Meanwhile, the high intensity of work continued without rest, there were inadequate protective supplies and protective isolation measures, the outpatient procedure organization became cluttered, and other phenomena have continually aggravated the psychological burden of medical staff, reducing the confidence of medical workers in prevention and control. As the epidemic situation gradually comes under control, medical work tends to stabilize, so the confidence in prevention and control has been steadily recovered. However, the negative feelings of health care workers have not been effectively vented, such as the grievances, fears, and powerlessness of medical staff in the face of dissatisfaction from patients and their families because of the lack of timely treatment. The inner suffering cannot slowly dissipate over time. By contrast, it is highly likely that the backlog of negative emotions causes some mental health issues, especially PTSD, requiring the attention of psychological workers.

Suggestion and Contribution

PTSD usually occurs within a few weeks of traumatic events but can also appear after a few months or even a few years, and the duration is usually half a year or more (19–21), depending on the severity of the event and the individual state of mind (22, 23). The current trend of the epidemic situation in China has been obviously controlled, and the tension of the medical staff can be relaxed in stages, which is the best time for online psychological guidance. Moreover, the outbreak of foreign epidemics is rapid, and many countries lack the experience of prevention and control. China plans to send some supportive medical workers to countries where the epidemic is ongoing. The relief of tension is about to face new challenges, and it is essential to effectively perform psychological intervention and regulation for medical staff. Both Chinese and international mental health workers must pay attention to this problem and stabilize psychological security (24, 25).

This study found that the psychological state of medical workers was significantly affected by the high-risk environment of direct contact infection, long working hours, and personal experiences. However, the only factors that can be controlled are the working environment and working hours. The authors suggests the establishment of a matching system between the psychological state and the working intensity of medical staff; after all, only upon a foundation of psychological security can the work be completed efficiently. The psychological security work needs to be carried out in a systematic and hierarchical manner from the local level to a more general investigation by utilizing close attention to ensure that every corner of the mental health of medical staff is explored. First, based on the overall comprehensive investigation, a medical staff psychological state tracking system should be established. Second, all mental state files should be classified into attention levels, such as core, focus, general attention, etc. Meanwhile, each health worker will be assigned a psychologist who is responsible for paying regular attention to their mental health problems. Psychological workers need to evaluate whether the medical staff's work schedule matches their psychological status and periodically review their appropriate work intensity level. Finally, specific psychological interventions need to be carried out for all health workers who are marked as working at a certain level of focus and above by recording any incidents in their mental state file.

CONCLUSION

By investigating the emotional and psychological stress responses of medical staff during the prevention and control of the new coronary pneumonia, it was found that the high intensity of medical work had a variety of negative effects on their risk cognition, confidence in overcoming the epidemic situation and physical and mental reactions, all of which are detrimental to the mental health of medical staff. In addition, the exposed environment, personal experiences and differences in the length of their work hours played important roles. To maintain the mental health and stability of medical staff and avoid the influence of mental health issues like PTSD, psychological workers need to take targeted measures to systematically solve the mental health problems of medical workers in the face of major infectious disease crises.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

Approval from the ethical authority of the School of Educational Science, Huazhong University of Science and Technology, was granted. Confidentiality and the statement confirming informed consent were managed by anonymous coding of the self-report questionnaires. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

YZ, PW, and LZ conceived and designed the questionnaire. LZ recruitment and payment of participants. SX, GW, XC, YB, FH, NL, ML, and QX analyzed the data. SX wrote and revised the paper. All the authors have approved the manuscript and agreed with submission to your esteemed journal.

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COVID Feel Good—An Easy Self-Help Virtual Reality Protocol to Overcome the Psychological Burden of Coronavirus

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Background: Living in the time of the COVID-19 means experiencing not only a global health emergency but also extreme psychological stress with potential emotional side effects such as sadness, grief, irritability, and mood swings. Crucially, lockdown and confinement measures isolate people who become the first and the only ones in charge of their own mental health: people are left alone facing a novel and potentially lethal situation, and, at the same time, they need to develop adaptive strategies to face it, at home. In this view, easy-to-use, inexpensive, and scientifically validated self-help solutions aiming to reduce the psychological burden of coronavirus are extremely necessary.

Aims: This pragmatic trial aims to provide the evidence that a weekly self-help virtual reality (VR) protocol can help overcome the psychological burden of the Coronavirus by relieving anxiety, improving well-being, and reinforcing social connectedness. The protocol will be based on the "Secret Garden" 360 VR video online (www.covidfeelgood.com) which simulates a natural environment aiming to promote relaxation and self-reflection. Three hundred sixty–degree or spherical videos allow the user to control the viewing direction. In this way, the user can explore the content from any angle like a panorama and experience presence and immersion. The "Secret Garden" video is combined with daily exercises that are designed to be experienced with another person (not necessarily physically together), to facilitate a process of critical examination and eventual revision of core assumptions and beliefs related to personal identity, relationships, and goals.

Methods: This is a multicentric, pragmatic pilot randomized controlled trial involving individuals who experienced the COVID-19 pandemic and underwent a lockdown and quarantine procedures. The trial is approved by the Ethics Committee of the Istituto Auxologico Italiano. Each research group in all the countries joining the pragmatic trial, aims at enrolling at least 30 individuals in the experimental group experiencing the self-help protocol, and 30 in the control group, over a period of 3 months to verify the feasibility of the intervention.

Conclusion: The goal of this protocol is for VR to become the "surgical mask" of mental health treatment. Although surgical masks do not provide the wearer with a reliable level of protection against the coronavirus compared with FFP2 or FFP3 masks, surgical masks are very effective in protecting others from the wearer's respiratory emissions. The goal of the VR protocol is the same: not necessarily to solve complex mental health problems but rather to improve well-being and preserve social connectedness through the beneficial social effects generated by positive emotions.

Keywords: COVID, virtual reality, self-help, stress, emotion regulation, mental health

INTRODUCTION

Background

Living in the time of the COVID-19 means experiencing not only a global health emergency but also extreme psychological stress that puts a strain on our identity and our relationships. Coronavirus and the associated isolation and quarantine require people to manage three different psychological dilemmas simultaneously (1).

i. the stress due to the disease,
ii. the inaccessibility to physical places,
iii. and the sense of community crisis.

The core stress of the disease comes from the worry and concerns about personal health and the health of friends and family members. This stress can be exacerbated both among general public and medical staff *via* the vicarious traumatization effect (2) when empathizing with those suffering, resulting in fatigue, physical decline, sleep disorder, irritability, inattention, fear, and despair (3).

The traumatic effects are further aggravated by living in quarantine and its restrictions on movement and social interaction. In fact, evidence has shown that quarantine causes significant psychological effects including post-traumatic stress symptoms, confusion, and anger (4).

The inaccessibility to physical places is one of the first clear negative effects of quarantine. A conflict arises that is provoked by losing access to physical places where people can meet and that we feel belongs to us. A "place" can be understood as any space delimited by borders and that gives identity to individuals and represents a space to be. Related to place is the concept of place attachment (5) which is the bonding of people to places. This bond includes cognitive and emotional components and is a common phenomenon observed across cultures with significant psychological benefits (6). However, quarantine disrupts place attachment, and therefore, has negative implications. As noted by Scannel and Gilford (6), separation from one's significant place can be devastating: "broken or stretched place bonds are associated with physical health problems, lower grades, sadness, longing alienation, and disorientation" (pp. 256–257). Women tend to report stronger place attachment than men (6) and, therefore, the disruption of place attachment provoked by the quarantine may have stronger psychological effects in women.

Å crisis of the sense of community is caused by disconnect from the places where communities are born (7), and provide significant negative effect on subjective well-being (8, 9). The disruption of places produced by the quarantine also affects the communities that use these places to meet and interact. Without everyday places to meet at—such as the workplace and the classroom—friends and acquaintances are more difficult to reach and to interact with. This weakens social bonds and declines the social significance of the local community in terms of social capital and interpersonal support.

These negative psychological effects may be aggravated by other stressors such as having inadequate basic supplies (e.g., food, etc.), insufficient clear guidelines about actions to take and the prolonged duration of quarantine, the interruption of professional activities and the subsequent financial loss (4).

In this view, any strategy that aims to reduce the psychological burden of coronavirus is extremely necessary (10). As recently underlined by Holmes and colleagues (10): "There is an urgent need for the discovery, evaluation, and refinement of mechanistically driven interventions to address the psychological, social, and neuroscientific aspects of this pandemic. This includes bespoke psychological interventions to boost wellbeing and minimize mental health risks across society." (p. 10). Crucially, given the mandatory loneliness resulting from lockdown measures, easy-to-use, inexpensive, and scientifically validated self-help solutions could be the key (11–16).

Aims

This pragmatic trial seeks to provide the evidence that a weekly self-help protocol based on a virtual reality experience —"The Secret Garden", available in the www.covidfeelgood.com website—can help to overcome the psychological burden of the Coronavirus.

It is important to underline that the goal of the self-help protocol is not to provide a full structured psychological intervention, but to build the "surgical mask" of mental health support. Surgical Masks do not provide the wearer with a reliable level of protection against coronavirus (20%) versus the 95/99% of FFP2 and FFP3 masks. However, they are very effective in protecting others from the wearer's respiratory emissions, and their use is significantly better than wearing a scarf.

The self-help VR protocol assessed in the trial aims to do the same. The goal is not to solve complex mental health problems, but rather to reduce the burden of the coronavirus: Specifically, the protocol aims at relieving anxiety and stress and improving well-being and social connectedness through these two assets:

i. The potential of (also) simulated nature for improving people' wellbeing, health and ameliorating anxiety and depressive feelings (17–19) with or without a direct interaction with it (20). Crucially, simulated nature can ameliorate negative moods in the short-term, and besides individual preferences towards nature (20);
ii. The potential of all types of VR formats, including 360° videos, to resemble even distant, complex, even paradoxical scenarios in a realistic, immersive and engaging way, thus providing the illusion of being really "there", in the simulated place (21–23).

This last asset provided by VR is the pathway to the *transformation* of people's experiences in a several and profound ways (24–26). For instance, immersive experiences can enhance individuals' personal efficacy and self-reflectiveness through the manipulation of the sense of presence, flow, and emotional engagement (27, 28). Moreover, VR's unique ability to evoke complex emotions, which are drivers of people' health, wellbeing and sense of social connection (29, 30), would allow designing unique experiences leading to long-terms benefits.

The protocol will be based on the same 10-min 360° VR video ("The Secret Garden") used by Chirico and colleagues (29, 30).

"The Secret Garden" VR video has been developed through an integrated process involving psychologists, 3D artists, musicians, storytellers and designers (**Figure 1**). This immersive experience storyboard has been:

- written by well-being psychologists to mimic the structure and the experience of walking in a Japanese garden (31) providing the visual (i.e., the flow of water) and auditory (i.e., the sound of running water) natural elements available outdoors.
- converted in a VR experience by 3D specialists using the Unreal Engine 4 technology.
- dubbed by a professional dubber in the different languages used in the trial using the back-translation method. In all languages a a slow, calm, clear voice provides a relaxation induction structured following the principles of Compassion Focused Therapy (32, 33). Specifically, the induction aims at deactivating the human threat protection system and activating the soothing system (with a mindset attended to giving and receiving care, affecting, and nurturance).

We decided to use a computer-graphic 360° video (artificial) instead of a video-recorded format (natural) for the following reasons. First, we selected a video whose efficacy in positive emotional induction was already validated in a previous study. Second, using computer-graphic it is easier to manipulate specific features of the natural environment aimed at improving positive affect (i.e., the extreme blossoming of the peach trees presented in the VR experience) that are more difficult to achieve using a real natural environment. Third, during lockdown was impossible access to real natural places.

Three hundred sixty–degree videos have the power to virtually transport users, immersing them in the video recording, allowing them to actively explore its content and experience the video from any angle. With this regard, as shown by Robertson and colleagues the neural representations of the part of the 360° video presented in VR (the scene within the current field of view) prime the associated representations of the full panoramic environment (34). In other words, 360° videos generate a dynamic interplay between memory and perception that can be used to improve the features of these cognitive processes and to update their content.

To anchor the generated update to the autobiographical memory of the user, at end of the VR exposure the subjects will be asked to perform together different tasks related to personal identity and interpersonal relationships (35). These tasks, are an adaptation of the different "emotional prescriptions" designed by the psychologist Guy Winch (35) to react to personal experiences that generate emotional pain: loneliness, rejection, or rumination. The tasks want to achieve the following goals: a) to pay attention and recognize emotional pain; b) work to treat it before it feels all-encompassing; c) monitor and protect self-esteem; d) find meaning even in difficult times. The full description of the tasks is provided in **Table 1**.

Hypotheses

The study has the following hypotheses:

1. The use of the weekly VR self-help protocol will reduce the level of depression, anxiety, perceived stress, and hopelessness;
2. The use of the weekly VR self-help protocol will promote the relaxation and social connectedness of the participants.

TABLE 1 | Descriptions of the daily exercises.

Day 1: Fight Rumination
- **The Problem:** Reflecting on the coronavirus and its consequences and dwelling on them in one's mind is natural. However, to prevent them from becoming a fixation, one must learn to control them.
- **The Goal:** To do this, start by changing your point of view. For example, try to imagine that you are a different person—a doctor who has to treat a patient, a politician who has to decide what to do, a nurse who has to support the patient in the last moments of life—and describe in writing the emotions that occur and what you would do. Then, try to describe in writing how you would vent the anger, feelings of helplessness, and/or other difficult emotions these situations can generate.
- **Social Experience:** If you want, you can discuss your feelings with your partner and compare them with his/hers to understand the similarities and differences.

Day 2: Awaken your Self Esteem
- **The Problem:** Quarantine, by forcing us to always repeat the same things with the same people in the same physical space, can make us apathetic and reduce our self-esteem.
- **The Goal:** To awaken it, list in writing the five aspects of your character and your personality that you own and appreciate, put them in order of importance, and discuss the following two points for each: why is it important and how does it influence your life and relationships?
- **Social Experience:** If you want, you can discuss them with your partner and check whether he/she shares the same vision or not and why.

Day 3: Awaken your Autobiographical Memory
- **The Problem:** The lack of places weakens our autobiographical memory, leading us to remember always the same days and making us lose the memory of who we are and what we want.
- **The Goal:** To awaken it, list in writing four moments and/or events in your life that have helped you to be who you are and a moment of the coronavirus emergency that you particularly remember. For each, discuss the following points: why are they important, what emotions did they elicit in me, and when have I experienced similar emotions?
- **Social Experience:** If you want, you can discuss them with your partner and compare them with his/hers to understand similarities and differences.

Day 4. Awaken your Sense of Community
- **The Problem:** The weakening of the sense of community can increase our sense of loneliness.
- **The Goal:** To awaken the sense of community, list the five most significant people in your relationships. For each, discuss the following points: why are they important, are you also important to them, and why?
- **Social Experience:** If you want, you can discuss them with your partner and compare them with his/her choices to understand similarities and differences.

Day 5. Awaken your Goals and/or Dreams
- **The Problem:** The continuous sense of anxiety generated by the coronavirus emergency can lead to the halting of our daily activities, making us lose sight of our goals and aspirations.
- **The Goal:** To awaken them, list in writing three concrete goals and two dreams/aspirations that you would like to achieve after the quarantine. For each, discuss the following points: why are they important to you, what do you miss to reach them, and what can you do now?
- **Social Experience:** If you want, you can discuss them with your partner to understand similarities and differences.

Day 6. Boost your Empathy
- **The Problem:** All relationships always involve a giving and receiving. But to effectively "give" we must be able to "receive" the other's point of view.
- **The Goal:** To do this, think about the last significant interaction you had with each of the five people you indicated on day 4 and try to describe in writing the emotions that you think they felt at that time.
- **Social Experience:** Again, you can discuss your emotions with your partner and compare them to understand similarities and differences.

Day 7. Plan your change
- **The Problem:** Coronavirus, willingly or unwillingly, forces us to change and manage new situations such as quarantine, close coexistence with children and spouse, lack of relationships, and so on.
- **The Goal:** You can try using this period to try to improve your life. Start by identifying in writing three aspects of your life with which you are dissatisfied. Then, on a first sheet describe the possible solutions by placing them in order of probability of success and cost/opportunity. On a second sheet, identify potential problems and their impact. Finally, on the third sheet, identify the tools and/or information that you are lacking but which can help you reach the possible solutions.
- **Social Experience:** Finally, tear off the problems sheet and use the other two sheets to plan strategies that can move you closer to solving your problems with the support of your partner.

METHODS AND ANALYSIS

Study Design

This will be a multicentric pragmatic pilot randomized controlled trial involving individuals who have experienced the isolation and quarantine associated to the Coronavirus pandemic. In contrast to explanatory trials that often include highly selected, "ideal" patients, pragmatic trials adopt broader eligibility criteria that reflect the diversity of patients who are treated in routine situations (36). In accordance with the real-life approach of our study, we expect a heterogeneous patient population, which is the goal of pragmatic trials. The trial overall will show results that pertain to the heterogeneous population, including subgroups representative of the target population. Potential participants will be contacted through web, e-mail, or social media postings. Individuals who will express interest in participating to the trials will be contacted to verify if they meet the inclusion criteria (below). Each eligible participant will provide written informed consent for study participation.

After signing the informed consent, participants will be randomly assigned to the experimental (VR) or control

FIGURE 1 | A screenshot of the "Secret Garden" VR experience.

(Waiting-list) conditions (Two-Group Random Assignment Pretest–Posttest Design). Baseline measures of anxiety, depression, perceived stress, general wellbeing, and relaxation will be collected at the baseline (Day 7), before the starting of the protocol (Day 0), at the end of the protocol (Day 7) and after a 2-week follow-up (Day 21). State measures of anxiety, perceived stress, and relaxation will be collected each day of the protocol after the experimental condition, from Day 1 to Day 7.

Randomization

Randomization will be done by a computer algorithm written in SAS (37). Participants will be randomly allocated in a 1:1 ratio, and using randomly chosen block sizes (37).

Sample

Each research group in all the countries joining the trial (at the moment Italy, Spain, and USA) will recruit two samples of at least 30 subjects. The experimental group will experience the VR protocol described below.

Inclusion criteria will be:

a. adult patients (≥18 years);
b. of mother tongue of the country where they will be enrolled;
c. have experienced at least two months of quarantine or isolation related to the coronavirus pandemic;
d. give full, written, informed consent;
e. have the availability of a smartphone and a cardboard VR headset;
f. availability and agreement of a partner for conducting the self-help component of the treatment.

To reflect routine, everyday practice, subjects will not excluded if they have other medical conditions, or are taking medication (38).

Exclusion criteria, assessed through an interview with the participants will be:

a. Visual of ear impairments that can limit the participation to the protocol.
b. Participants reporting vestibular and/or balance disorders.

Psychological Measures

Participants will complete two series of questionnaires.

The ***baseline, post intervention, and follow-up measures*** are a series of semi-trait questionnaires that will assess how the participants felt in the previous week. These instruments will assess perceived stress, depression and anxiety, hopelessness, social connectedness, fear of coronavirus, and social contacts interactions. The compilation will require approximately 20 min.

The ***state measures*** are a series of questionnaires and scales that assess how participants feel after the experimental procedure. They will be collected daily (from Day 1 to Day 7) immediately after the protocol and will assess state anxiety, self-reported stress, and relaxation. The compilation will require approximately 5–10 min.

Baseline, Post Intervention, and Follow Up Measures Collected at Day 0 and at Day 7

- **Perceived Stress Scale (PSS):** The PSS (39) is a widely used instrument for measuring individuals' perceived stress. It assesses how much our daily situations are perceived as stressful, unpredictable, and ultimately overloading. Moreover, the PSS also assess the current level of perceived stress directly, providing a reliable and robust instrument for stress assessment. Items in the PSS assess feelings and thoughts the last month, however the scale will be adapted to assess perceived stress in the last week. The instrument is composed by 10 items on a 5-point Likert A composite score of the 10 items provide a general measure of perceived stress.

- **Depression Anxiety Stress Scale (DASS-21):** The DASS-21 (40) is a short version of the original instrument developed by Lovibond and it is composed of 21 items divided into 3 subscales that measure anxiety, depression, and perceived stress. The scale assesses how the participants felt in the previous 7 days on a 4-point Likert. Scores are computed individually for each subscale. A composite score of general distress is obtained by computing all the three subscale scores together.
- **Beck Hopelessness Scale (BHS):** The BHS (41) is a self-report instrument that measures pessimistic tendencies or negative attitude towards the future within three major aspects of hopelessness: feelings about the future, loss of motivation, and expectations. The scale is composed of 20 items with a True/False response.
- **Social Connectedness Scale (SCS):** The SCS (42) is composed of 8-items and aims at measuring how much the individual feels connected to other persons or to the social context. The scale asks to evaluate agreement or disagreement to several contextual statements on a 6-point Likert scale. Higher scores represent a higher sense of social connectedness.
- **Fear of Coronavirus (FCOR):** FCOR is a series of statements presented in (43) to measure the level of fear toward the COVID-19 pandemic. FCOR is composed of 8 items that explore different components of fear such as the personal experience of concern regarding the current situation, avoidance behaviors and attention bias. Each statement is evaluated on a 5-point Likert.
- **Online and offline contact (COO):** COO is a series of questions (44) to measure the number and quality of online and offline contacts during the COVID-19 pandemic. Individuals are asked to report the number of online contacts in the past week evaluating on a 5-point likert scale how close they felt to those contacts. The same two questions are repeated for offline contacts.

State Measures Collected From Day 1 to Day 7

- **Smith Relaxation State Inventory 3 (SRSI3):** The SRSI3 (45) is the revised form of the original Smith Relaxation State inventory and it measures both relaxation and perceived stresses. Individuals rate their agreement to several statements on a 6-point Likert scale. The scale is composed of 38 items; however, it is divided into several subscales that can be selected independently. For this protocol, the following subscales have been selected, for a total of 20 items: rest/refresh, energized, physical relaxation, at ease/peace, joy, mental quiet, aware, somatic stress, emotional stress, and cognitive stress.
- **Subjective Units of Distress Scale (SUDS):** The SUDS (46) is simple numeric rating scale from 0 to 100 that measures the level of distress perceived by the individual. It is a reliable measure of state distress, commonly used in cognitive behavioral therapy.

Post Intervention Measure Collected at Day 7

- **Negative Effects Questionnaire (NEQ):** The self-report measure consists of three parts for a total of 32 items (47). First, respondents endorse specific items in case they have occurred or not during treatment, yes/no (dummy coded as a variable: 1/0). Second, the respondents rate how negatively the negative effect was on four-point Likert-scale, ranging from "Not at all" to "Extremely", 0–4 ("0" being minimum and "4" being maximum). Third, the respondents attribute the negative effect to "The treatment I received" (1) or "Other circumstances" (0) (dummy coded as a variable: 1/0).
- **Simulation Sickness Questionnaire (SSQ):** The self-report measure is composed by 16 items used to users' level of sickness symptoms after a VR experience (48).
- **Final Interview:** This final interview aims at collecting any additional information related to practical challenges of using the VR app and coordinating the self-help social task.

Study Period

The enrolment is planned to start from June 2020 and will last until the planned number of enrolled patients has been met.

Outcomes

Considering the presented hypotheses, the primary outcomes expected for the group that will perform the experimental VR procedure compared to the control group are:

- A reduction in anxiety, depression, perceived stress, and hopelessness, as measured by DASS-21, PSS, and BHS.
- A reduction in state anxiety and subjective distress, as measured by SUDS.
- And an increase in relaxation, as measured by SRSI3.

Secondary outcomes of the protocol are

- a decrease in fear of the coronavirus, as measured by FCOR;
- an increase in social connectedness, as measured by SCS;
- an increase in feelings of closeness to online and offline contacts, as measured by COO.

Description of the Intervention

The 10-min "Secret Garden" 360° VR experience available on the www.covidfeelgood.com website will be used for one week, once per day. To experience the "Secret Garden" the sample will need:

- any Android of iOS smartphone with installed the YouTube App;
- any VR headset compatible with the Cardboard format. These headsets are easily available in online stores for a price ranging between 10 and 50 US$.

Each individual will involve a partner in the process who will share the VR exposure, to discuss the emotions and reflections induced by it. Specifically, at the end of the VR exposure the subjects will be asked to perform together different tasks related to personal identity and interpersonal relationships (35). The full description of the tasks is provided in **Table 1**.

STATISTICAL ANALYSIS

Categorical variables will be compared using Fisher or chi-square tests and continuous variables using t test or Mann-Whitney tests, as appropriate. Groups will be compared for variables such as sex, age, education, geographic area, stage of disease, type of proposed treatment, and other available data. To assess the effectiveness of the intervention, groups will be compared with a 2 × 2 repeated measure mixed ANOVA for the pre and post measures (factor Group X factor Time: pre and post). Analysis will be performed for all the relevant variables: perceive stress, anxiety, depression, hopelessness, fear of the coronavirus, and social contacts. A repeated measures ANOVA (factor Group × factor Time: day of the week) will compare treatment effects within the seven-day intervention, for all the relevant measures: relaxation, perceived stress, and state anxiety. Tests of statistical significance and confidence intervals will be two-sided; a $p < 0.05$ will be considered to be statistically significant. Statistical computations and data analysis will be performed using R, a multi-platform (Windows, UNIX, Mac OS), free software environment for statistical computing and graphics.

POWER SIZE CALCULATION

Power size calculation was performed with GPower 3.1. Considering an anticipated effect size (f) of.25, an alpha set at.05, 2 groups, and a.95 statistical power, the total sample size required is N = 54.

DISCUSSION

Living in the time of the coronavirus means experiencing not only a global health emergency but also extreme psychological stress that puts a strain on our identity and our relationships. The fears about personal health and the health of friends and family members, and the effects of the quarantine generate significant psychological effects including post-traumatic stress symptoms, depression confusion, and anger. These negative psychological effects may be enhanced by other stressors such as having inadequate basic supplies (i.e., food, masks, etc.), insufficient clear guidelines about actions to take and the duration of quarantine, the interruption of professional activities and the related financial loss (4). In this view, any strategy that aims to reduce the psychological burden of the coronavirus is extremely necessary (10). In particular, the outbreak of coronavirus is rapidly changing stakeholders' attitudes towards e-mental health, and this should be harnessed given the fact that many technological solutions are not only cost-effective but nowadays the only possible intervention that confined individuals can receive (49). Despite the undoubted negative consequences of this context, it can be also conceived as an opportunity to achieve *an implementable revolution in digital mental health* (50).

This pragmatic pilot trial seeks to understand if and how a weekly self-help protocol—The Secret Garden—can help overcome the psychological burden of the coronavirus. To reach this goal, the protocol will use virtual reality (24) to provide a transformative experience (27, 51, 52) by offering a natural digital place in which subjects can relax and reflect. This effect will be enhanced by different daily social tasks aiming at facilitating a process of critical examination and eventually revision of core assumptions and beliefs. It is important to underline that the goal of the self-help protocol is not to provide a full structured psychological intervention, but to build the "surgical mask" of mental health support. Its goal is not to solve complex mental health problems, but rather to reduce the coronavirus of the by relieving anxiety and stress and improving interpersonal relationships: when a user is positive and healthy, he/she generates a positive social effect that contributes to the well-being of the community. If the present pragmatic pilot trial will support the feasibility of the approach, further actions to promote the dissemination and the use of the self-help protocol will be encouraged.

ETHICS STATEMENT

The trial is approved by the Ethics Committee of the Istituto Auxologico Italiano.

AUTHOR CONTRIBUTIONS

GR conceived the original idea, designed the study and the original protocol. GR, AC, AO, DL, BW and MB wrote the paper. LB and FS developed the "Secret Garden" VR environment used in the study. BW supervised the clinical framework of the study. BW, JG-M, AO, LM, NF-P, MM, KF, DP, and UH contributed to the translations of the protocol in different languages. All authors contributed to the article and approved the submitted version.

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Transitioning Between Online Gambling Modalities and Decrease in Total Gambling Activity, but No Indication of Increase in Problematic Online Gambling Intensity During the First Phase of the COVID-19 Outbreak in Sweden: A Time Series Forecast Study

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Introduction: The COVID-19 outbreak will likely have a public health impact beyond immediate disease transmission. Little is known about whether social distancing and other societal changes has provoked an increase in gambling, whether decreased betting opportunities due to paused sports events spurred gamblers to transition to online casino gambling, or whether any of these factors have had an impact on problem gambling.

Methods: Data on lookup queries against the Swedish Gambling Paus registry, logging all initiated gambling sessions by all licensed gambling providers, from 2019-01-01 (start of registry) to 2020-04-08 (well into the first phase of the outbreak) were analyzed using TBATS time series forecasting to estimate trends after the first domestic COVID-19 death. Obfuscated data on daily total wagered and deposited amounts, split by modality (casino or betting, and low and high intensity, respectively) for the equivalent period were supplied by a licensed online gambling provider.

Results: Total gambling activity decreased by 13.29% during the first phase of the outbreak compared to forecast. Analyses of online gambling data revealed that although betting decreased substantially in synchrony with a slight increase in online casino gambling, there was no increase in likely problematic, high-intensity gambling and neither did total online gambling increase.

Conclusions: This first, preliminary study revealed no increase in Swedish gambling activity, total or specifically online, in the first phase of the COVID-19 outbreak. Future research should examine whether pandemic-induced transitioning between gambling modalities and/or increased participation in gambling, leads to long-term effects on prevalence of problem gambling.

Keywords: gambling, pandemic (COVID-19), total consumption model, online gambling, time series

INTRODUCTION

The ongoing COVID-19 pandemic (1) is estimated to have claimed over 600,000 lives, including over 5,600 lives in Sweden at time of writing in late July (2), and led to unprecedented global societal changes. With no pharmacological treatment or vaccine currently available, many countries have implemented regional or national quarantine procedures or encouraged other forms of social distancing strategies to curb the continued spread of the virus (3). Although burgeoning research supports the efficacy of social distancing strategies in combatting this pandemic (4–7), such measures are likely to also have a public mental health impact beyond the immediate effects on SARS-CoV-2 transmission (8).

In Sweden, public concerns were raised at an early stage of the outbreak that social distancing has increased gambling activity and possibly the prevalence of problem gambling (9), inciting the Swedish government to introduce temporary legislation (a decree, 2020:495) to the Swedish gambling market that includes a deposit limit on online casinos of 5,000 SEK per week (per gambling provider) and obligatory duration limits. Similar actions were taken in other countries with regards to gambling (10). The exact rationale and supporting evidence for this new Swedish legislation was not publicly disclosed and gambling providers reacted by raising the concern that these measures may disturb the delicate balance on the Swedish gambling market by channeling problem gamblers from licensed providers with responsible gambling obligations, to non-licensed providers lacking such obligations. At the time of this political decision, there was no published study on the effects of the COVID-19 outbreak on gambling. The extant literature did show that both anxiety (11) and boredom (12) are associated with problem gambling, both of which can be expected to increase during uncertain and threatening times (13) and in connection with social distancing procedures introduced to curb disease transmission (8). Previous research on the impact of economic recessions (burgeoning cases of which can already be seen following COVID-19 outbreaks) on gambling does however suggest a more complex association such that gambling may increase (particularly amongst those economically affected) but not necessarily gambling problems (14, 15). Moreover, specific to pandemics, the same social distancing phenomena that may increase some types of gambling likely have opposite effects on other types: pausing sport events means that there are fewer possibilities for betting, and closing physical casinos, bingo halls, and restaurants and clubs with slot machines, obviously reduces these types of gambling. Beyond investigating change in total gambling activity, studying such transition effects is another important research question since it is well-established that different gambling modalities are associated with different risks for developing gambling problems, both empirically (16, 17) and theoretically (18).

At time of writing, four studies have examined the impact of the COVID-19 outbreak on gambling: three cross-sectional survey studies (10, 19, 20) and one using aggregated time series from a multinational gambling provider (21). Two deserve special mention in the context of the current study. The time series study used behavior tracking data from gamblers in Sweden, Germany, Finland, and Norway (not taking different pandemic development courses into account) and found not only the expected substantial decrease in betting activity during the first phase of the COVID-19 pandemic, but also that the percentage of previously active betters who also played casino games decreased from pre-pandemic levels, i.e., no evidence of gamblers transitioning between modalities (21). A population survey study conducted in Sweden found that only 4% of gamblers reported gambling more during the COVID-19 crisis, 51% reported no difference and seven percent reported gambling less (the remaining percentage did not gamble), only a few percentages of whom transitioned to other gambling modalities. Gamblers who reported increased gambling, and those who transitioned to other modalities were, however, more likely to have gambling problems (10). Importantly, without longitudinal data, or reliable and applicable stability estimates, one cannot say that the proportion who reported an increase or decrease in gambling is higher than what would be naturally expected. Further, the so called total consumption model (applicable to many regulated commodities) predicts a strong correlation between total population consumption and prevalence of excessive and problematic consumption (22), and there is robust evidence supporting the applicability of the total consumption model to the gambling field (23). Thus, the trend in total gambling activity following a pandemic remains a meaningful indicator and more research is needed to examine trends at both population- and subgroup-level, and split by gambling modality.

In the current study, we used two unique datasets to examine whether the first phase of the COVID-19 outbreak in Sweden was associated with an increase in overall gambling activity on a population level, whether high-intensity online gamblers were particularly affected, and whether online gamblers transitioned between gambling modalities. First, we used lookup-query data from the Swedish Gambling Authority's account database to estimate change in total gambling activity during the first phase of the outbreak. Since determining trends require a meaningful reference, several comparison trends were calculated to provide a robust measure of relative change, including from advanced time series forecasting with sliding-window sensitivity analysis. Second, aggregated data on daily amounts wagered and deposited at a large, licensed online gambling provider, split by gambling modality and gambling-intensity (respectively), allowed us to examine change in gambling patterns amongst high-intensity vs. low-intensity online gamblers, as well the extent of gamblers transitioning between gambling modalities.

METHODS AND MATERIALS

Ethics and Study Design

Since the current study uses only aggregated data sets and did not involve research on individually identified human participants (relying only on population aggregated data), this study falls outside the applicability of the Swedish Act concerning Ethical Review of Research Involving Humans, and no independent ethical review is thus required. One of the datasets is publicly available through a freedom of information request to the Swedish Gambling Authority, whilst the other was made available to the researchers on condition of anonymity to the public, and secrecy as extended by the Swedish Public Access to Information and Secrecy Act (SF 2009:400).

Setting and Data

Recent survey research suggests that around 0.6% of the Swedish population aged 16−87 are problem gamblers according to the PGSI definition and scoring interval (24), that an additional 3.6% present low-to moderate risk gambling, that online gamblers are overrepresented amongst problem gamblers, and that the prevalence of last-year online gambling increased slightly from 2015 to 2018, from 18 to 21% (25). Since 2018, Sweden has had a regulated gambling market with licensed gambling providers (26). Since January 1st 2019, there is a formal Gambling Pause registry (www.spelpaus.se), hosted by the Swedish Gambling Authority, available for anyone to use to exclude themselves from any type of licensed gambling for 1, 3, or 6 months, or until further notice. As a prerequisite for a license, gambling providers are required to have gamblers identify themselves to initiate any kind of gambling session, both online and on-site. On initiation of a gambling session, a lookup query is sent to the Gambling Pause registry, which returns information on whether or not the given individual is currently in the registry; a positive lookup excludes the gambler from any gambling activity.

For the current study, the Swedish Gambling Authority provided data on number of logged lookup queries (i.e., attempted initiated gambling sessions) per day, from 2019-01-01 to 2020-04-08. For reasons unknown, the entry from 1 day (2019-06-10, well-before the original outbreak) was missing and replaced using trend interpolation from nearest neighbors, for a total of $k = 464$ entries. See **Figure 1** for observed time series along with TBATS-derived components (27); see below for details. The data exhibited a strong weekly trend, with gambling activity at its highest on Saturdays, as in other time series on direct measures of gambling activity (21). The included monthly trend adequately captured the payday phenomenon (occurring on the 25th of each month, or closest weekday, for most working Swedes and those receiving any welfare benefits).

A second dataset covering the same period was provided to the researchers by one of the largest licensed gambling providers in Sweden. This dataset included four time series on daily total amount wagered or deposits, all obfuscated through division with a common, randomly selected number to preserve relative relationships between trends but rendering the absolute numbers non-meaningful. Data was split by two respective factors: total value of cash wagers in sports betting vs. online casino (traditional and live casino combined), and total value of deposits by high- vs. low-intensity players. There are many definitions of gambling intensity in the extant literature—in the current study, we used the same definition as in the new temporary gambling legislation introduced in Sweden following the COVID-19 outbreak, explicitly referred to within a responsible gambling context which as per the main legislation (2018:1138) aims to protect players from excessive gambling. For each individual player (account), deposits were aggregated on a (calendar) weekly level, and if the total deposited amounted exceeded 5,000 SEK (equivalent to roughly 480 Euro at time of writing), any deposited amount by that player that week was classified as high-intensity, otherwise as low-intensity. This aggregation was done by the gambling provider prior to data sharing. Of note, the limit of 5,000 SEK per week corresponds to roughly 83% of a Swedish median net income, and equals approximately twice the monthly limit mentioned in the Swedish Gambling Decree (2018:1475) for when a gambling provider is obligated to contact the gambler as a responsible gambling obligation.

Analyses

All analyses were conducted using the R 3.6.3 statistical environment. Reproducible code, along with the lookup-query data, can be found at an online repository (28).

Lookup-query data was used to examine change in total gambling activity in the first phase of the COVID-19 outbreak in Sweden. The point of reference is pivotal in determining directionality of any trend. In the current study, we calculate several such references. For our primary analysis on change in total gambling activity, we used automated TBATS time series analysis (27), as implemented in the R forecast package (29), to model trends in gambling activity leading up to the COVID-19 outbreak. Box-Cox transformation, trend inclusion (with or without dampening) and use of ARMA errors (if so, with back-transformed means) was determined automatically by best fit according to AIC.

The Swedish government's response to the COVID-19 outbreak has (thus far) been characterized by an emphasis on voluntary social distancing measures, along with some structural measures like closing high schools and colleges (moving all teaching online), and prohibiting public gatherings of more than 500 and later 50 people. This entails that there is no obvious candidate date for when to begin forecasting (i.e., for establishing a trend to compare observed and forecasted values). See **Table 1** for a timeline of events with a possible impact on registered gambling activity in Sweden; in brief, although

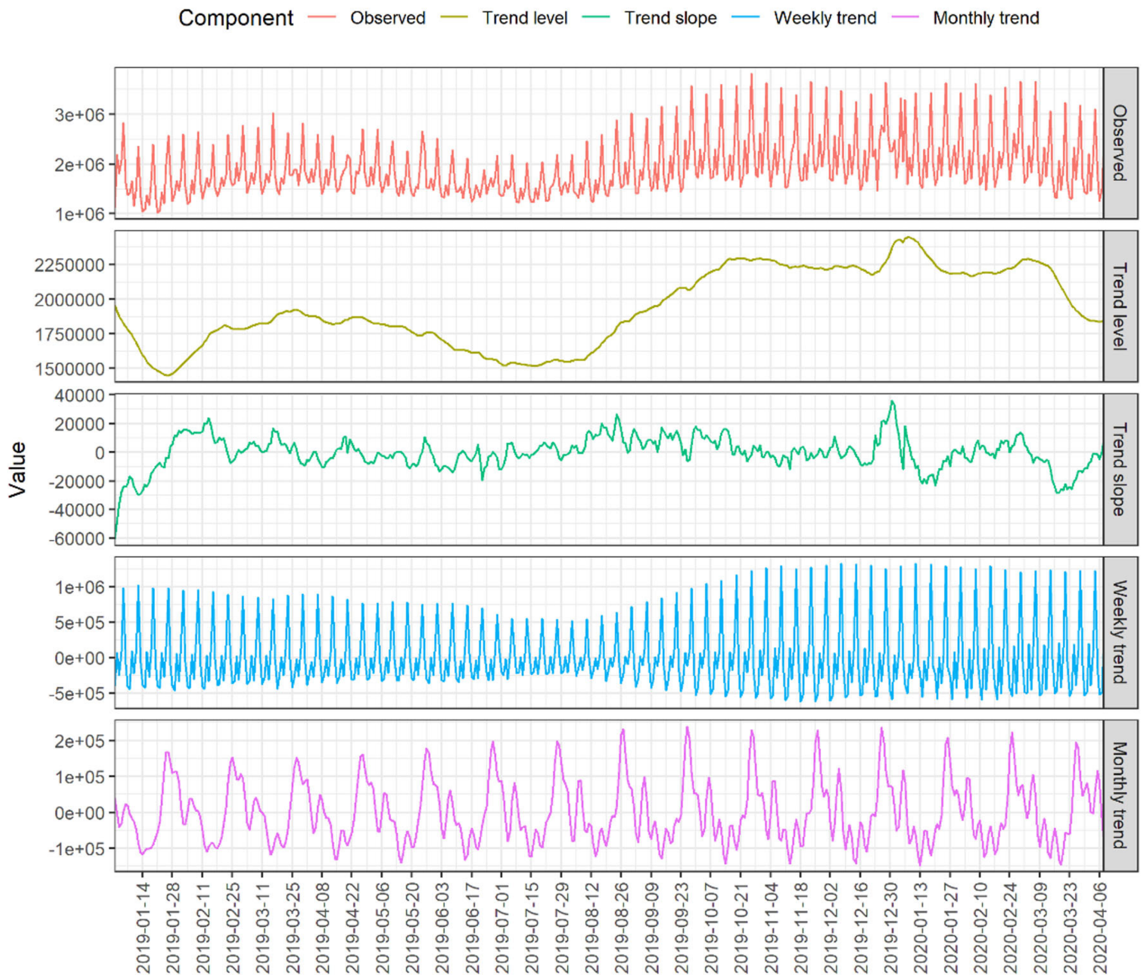

FIGURE 1 | Observed time series and TBATS-derived components. For visualization purposes, Box-Cox transformation was suppressed (in order to preserve raw numbers) and trend included manually. Actual forecast models used AIC to select best specification. Displayed dates grouped into 2-weeks periods.

the first COVID-19 case in Sweden was reported at the end of January, domestic disease transmission accelerated in early March and by mid-month, most major national and international sport leagues were paused. Although official domestic social distancing recommendations were issued during the second half of March, Google Mobility data (https://www.google.com/covid19/mobility/) suggests that voluntary social distancing had clearly begun before that. For the primary analysis on total gambling activity, we retained time series data up until 2020-03-11 (k = 436), the day of the first (highly publicized) death of a Swedish patient. Forecasts of the remaining k = 28 days were calculated using a TBATS model, and used as comparison references to determine trends in gambling activity following the COVID-19 outbreak. Mean percentage forecast error (difference between observed and forecast activity divided by forecast) during the period was calculated, with ordinary least-square regression used to calculate confidence intervals. In all but one analysis on forecast errors (including those described below), Durbin-Watson tests and ACF plots revealed no residual autocorrelation; in that case, a GLS model with AR1 correlation structure was used instead.

To determine model performance and assess sensitivity of forecast period threshold date, the same TBAT model was re-run systematically, varying the window of entry inclusion from t minus 100 to t plus 14. Average percentage difference between observed and predicted values across the first 14 days of the forecast were calculated and compared to assess model performance. An average forecast discrepancy prior to the outbreak close to and normally distributed around zero, would signal good model performance. Should the difference grow in any direction when moving closer to a unknown latent turning point, and then reverse direction upon passing it, this would suggest that the initial forecast difference trend is driven by consequences of the outbreak (which can be expected to be linearly increasing), yet as more and more entries after the latent turning point are included in the model, the underlying trend will be better captured by the model and thus the forecast difference will again approach zero. Using the same forecast model, we

TABLE 1 | Non-exclusive timeline of domestic and international events with a possible direct or indirect effect on gambling activity in Sweden.

Date	Event
2020-01-31	First COVID-19 case reported in Sweden. Public Health Agency requests COVID-19 be include in the Infectious Disease Act to allow legal action to curb the outbreak.
2020-03-06	First report of a COVID-19 case in Sweden requiring intensive care.
2020-03-09	Italian Serie A (popular betting event) pauses season.
2020-03-11	First Swedish casualty (made public same day). Public Health Agency recommends and government declares a limit on social gatherings to no more than 500 individuals, starting the next day.
2020-03-12	No audience allowed on-site during Swedish horse betting events, although racing and betting continues. American NHL pauses season.
2020-03-13	UK Premier League and German Bundesliga (popular betting events) to pause season.
2020-03-15	Swedish Hockey League (popular betting event) ends season prematurely.
2020-03-16	Public Health Agency recommends social distancing to individuals over 70 years old until further notice, and that people residing in Stockholm should work from home if possible.
2020-03-17	Public Health Agency recommends and government declares that secondary and tertiary education to be provided digitally across the country, starting the next day.
2020-03-24	Public Health Agency enacts regulation that restaurants, cafés and clubs (which may have slot machines) must take action to avoid crowding.
2020-03-27	Public Health Agency recommends and government declares a limit on social gatherings to no more than 50 individuals, starting the 2 days later.
2020-03-29	Swedish casinos close.
2020-04-01	Further advice issued by the Public Health Agency, including that everyone in the country keep a physical distance, that stores limit the number of simultaneous customers to avoid crowding, that employers allow employees to work from home if possible, and that risk groups avoid any social gathering.

also compared forecast discrepancies for the same last 2 weeks of the period regardless of window, expecting a similar overall pattern corresponding to the effect of period threshold date (i.e., sensitivity analysis). In addition to the forecast-derived reference, we also calculated three simpler, point-derived comparison references in the form of average activity in last 5, 10, or 25 same weekday prior to the outbreak, again with percentages against reference.

Data on daily deposited sums and wagers from the online gambling provider were used to examine differences in trends between high- and low-intensity gambling, and transitions between gambling modalities (betting and casino), respectively. First, TBATS models with the same primary forecast break of 2020-03-11 were run on each of the four time series and percentage forecast error calculated. Second, to provide comprehensible estimates of synchronization of trends in casino vs. betting activity, Loess time series decomposition (the mstl/msts functions in the forecast R package) with multiple seasonality (weeks and months) was used on each respective data set that included only the three preceding months (92 days) to isolate recent trends.

RESULTS

Total Gambling Activity

Comparing observed gambling activity 2020-03-12 to 2020-04-08 to TBATS forecast calculated using data preceding this period, revealed a consistent and statistically significant overall decrease of 13.29% (95% CI: 9.37 to −17.21% decrease) compared to forecast. See panel A of **Figure 2**. Model performance and sensitivity analyses revealed the expected pattern when varying the window of included data: the average initial 2-weeks forecast discrepancy was typically small (<5%) and approximately normally distributed in the preceding 100 days, indicating good model performance. There was a distinct drop in performance around Christmas and New Year, resulting in discrepancies around ±20%; such a period effect is not unexpected since the model included no yearly seasonality, as there were not two full years of data. Importantly, good model performance returned and was stable for a period of several weeks prior to the outbreak. Sensitivity analysis revealed that the overall decrease in gambling activity remained negative until including data up till the 2020-03-20, after an accumulated period of almost 3 weeks of decreased gambling, as suggested by slope from full-model TBATS (**Figure 1**). See panel B1 of **Figure 2** for period average forecast discrepancy in performance and sensitivity analyses, and panel B2 for all forecasted values across sliding window models.

Observed gambling activity post-outbreak was lower also when comparing to averaged point-estimates, with no obvious trend with increasing window of comparison. See panel C of **Figure 2**.

Online Gambling Activity

Total online gambling activity after 2020-03-12 was 3.7% (95% CI:−2.7 to −10%) higher than the TBATS forecast, which was not significantly different from zero ($p = 0.243$). However, splitting online gambling activity by modality revealed a significant 74.8% decrease in betting (95% CI_{AR1}:−84 to −65.6%) and a significant 8.63% (95% CI: 1.7 to −15.6%) increase in casino gambling. Plotting the decomposed trends revealed a synchronized increase and decrease for casino and betting activity respectively, beginning in late-February to early March, consistent with the trend in the lookup-query data and suggestive of transition effects. See **Figure 3**. However, TBATS modeling revealed no significant difference in low-intensity online gambling (95% CI:−7.9 to −5.2%, $p = 0.678$) compared to the TBATS forecast. High-intensity online gambling significantly decreased by 8.3% (95% CI:−14.3 to −2.3%, $p = 0.009$).

DISCUSSION

Using daily data on number of lookup queries against the national Swedish Gambling Pause registry—a high-quality measure of total licensed gambling activity—as well as data from an online gambling provider, the current study aimed to model trends in gambling during the first phase of the COVID-19 outbreak in Sweden. Comparisons against all references showed an overall decrease in total gambling activity in the range of 10–15%, estimated to have begun in early March, congruent with the

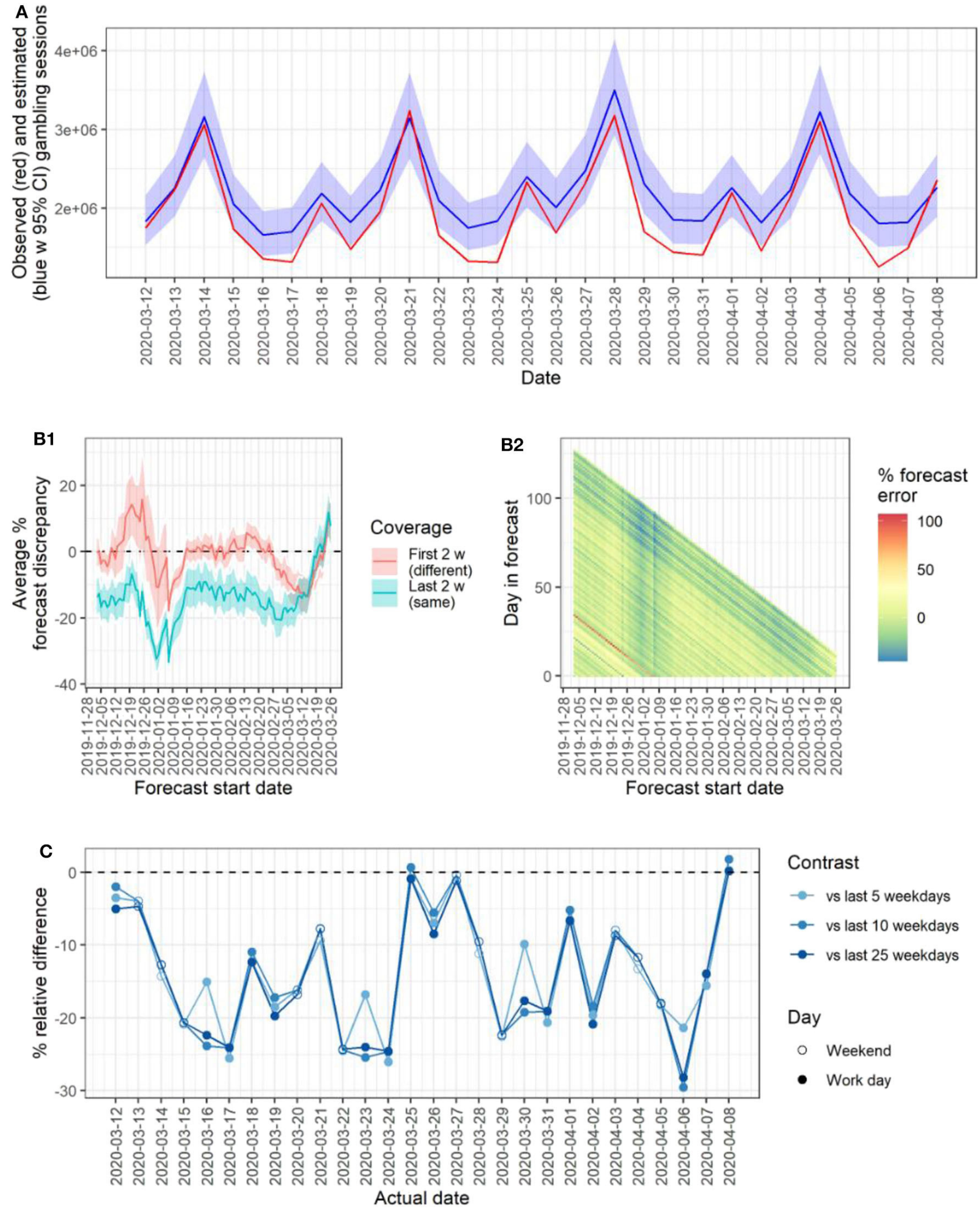

FIGURE 2 | Observed gambling activity vs. time series forecast reference and point-estimate references. **(A)** Time series of observed (red) and forecasted (blue, with 95% CI) gambling activity during the evaluation period following the first COVID-19 death in Sweden. **(B1)** Expanding window analysis indicating forecast performance and sensitivity (respectively) by plotting period-average forecast discrepancy (dates group by week). **(B2)** Plot of forecast discrepancy for all dates and expanding window models (dates grouped by week). **(C)** Decrease relative to references points drawn from 5, 10, and 25 weeks (respectively) of same weekdays prior to 2020-03-12 (primary outbreak threshold).

sliding window model showing growing forecast discrepancy around this time. Data on online gambling showed the expected pattern of a substantial decrease in betting and slight increase in casino activity—synchronized in time—with total gambling showing no significant differences from forecast. There was no increase in low-intensity online gambling activity (as per

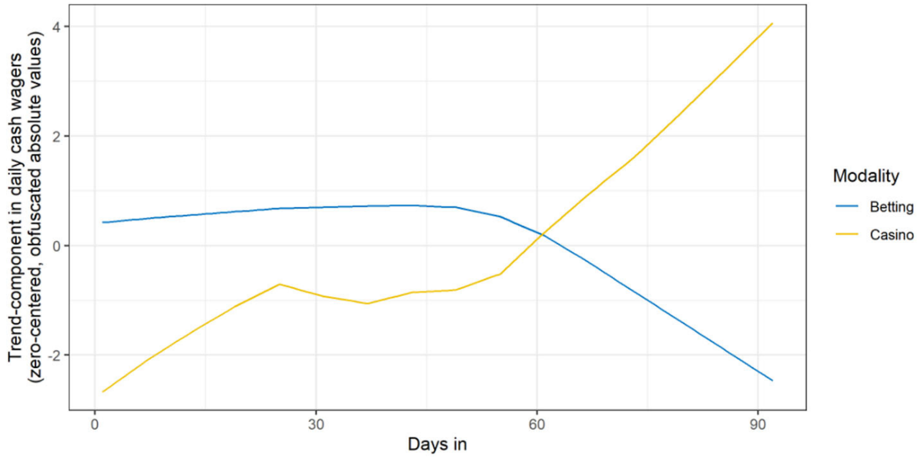

FIGURE 3 | Trends in online betting and casino activity. For visualization purposes, each time series was zero-centered by subtracting their respective mean, preserving absolute differences.

the definition used in the temporary legislation introduced in Sweden) against forecast, yet a significant decrease in high-intensity gambling.

Our findings are not unexpected given that the examined total activity measure covers all types of licensed gambling, including sports betting, horse race betting, casino visits, and slot machine playing at restaurants and clubs, all of which have been affected to some degree by the social distancing strategies recommended or enforced by Swedish Authorities beginning in early-mid March (see **Table 1** for timeline). Results are consistent with research showing a drop in overall gambling among adolescents in Norway following the banning of slot machines (30), a rapid supply reduction (31) similar to what was observed not only in Sweden but around the world as the COVID-19 pandemic began. Online casino gambling, the gambling modality most strongly associated with problem gambling (16, 17), remains naturally unaffected by the social distancing introduced to combat SARS-CoV-2 transmission, as does e.g. e-sports betting and to some degree horse race betting (which in Sweden continues but without an audience). To what extent online casino gambling would increase as betting and offline casino gambling decreased was unclear, with previous research suggesting no major transition effects (21) but that those that did transition were more likely to be problem gamblers (10).

Our combined findings suggest that although the expected transition between gambling modalities appears to have taken place, at least amongst users of a gambling provider that offers both online betting and casino games, this did not lead to an increase in problematic gambling as per the definition used in the new temporary Swedish legislation, or an increase in total online gambling indicative of increased problematic gambling. Further, under the assumption that the total consumption model is bi-directional, a decrease in total gambling activity should lead to a decrease of problem gambling, as cautiously supported by the current study (but see below). This is congruent with a survey finding that amongst Swedish gamblers who changed their gambling habits during the COVID-19 outbreak, it was twice as common to decrease rather than increase gambling; moreover, although problem gambling was relatively more common among those who gambled more, prevalence of problem gambling in absolute numbers was more than four times as common among those who did not gamble more (10). To what extent transitioning from online betting to casino playing, provoked by the COVID-19 situation, leads to long-term effects on prevalence of problem gambling (16–18) remains unknown and is an important topic for future research. Previous research shows that least amongst users of online gambling providers that offer both betting and casino games (as in the current study), there is likely to already be a great overlap such that a large proportion engage in both gambling types (21, 32), suggesting that most players who transitioned during the COVID-19 outbreak simply changed their proportion of betting vs. casino gambling. Importantly, our data does not allow us to distinguish between activity from transitions between gambling modalities amongst existing gamblers, from that of new gamblers who may have turned to gambling due to pandemic-related anxiety or boredom (11, 12). To what extent (new) gamblers that previously never wagered on online casinos, or gambled at all, begun doing so during the COVID-19 outbreak, should be investigated in future studies since this would arguably be a predictor of a long-term increase in population-level problem gambling. Whether online casino gambling decreases to pre-pandemic levels upon returning betting opportunities in the wake of lifted social distancing measures, will also be an important question for future research. Such research should also attempt to disentangle the unique effect of supply reduction in different types of offline gambling (e.g., physical casinos, restaurant slot machines).

An obvious limitation of the current study is that our proxy measure of problem gambling—high-intensity gambling, defined as depositing more than 5,000 SEK per week—rests on a high monetary threshold, equaling almost a net median Swedish income. Gambling habits may be problematic at much lower levels (33–36), which was also a prominent critique against the proposed legislation. Further, our population-level time series covered only a single metric (lookup-queries or wagered/deposited amounts). Future research using behavior tracking of individual accounts (37, 38) is needed to examine changes in gambling patterns in greater detail, also offering the possibility of examining subgroups of gamblers.

Some further limitations with regards to data and analysis should also be noted. First, while the official Gambling Pause registry provides high-quality data on total gambling activity, the fact that this registry has only existed since 2019-01-01 means that yearly trends cannot be reliably estimated, which could impact forecast performance and trend validity. However, expanding window analysis covering a period before the COVID-19 outbreak in Sweden, did suggest good forecast quality. Additionally, the data covers only gambling with licensed providers; recent survey findings however suggests that only 3% of gamblers gambled with an unlicensed provider last year (39). The Swedish Gambling Authority has raised concerns that the amount of login lookup-queries is higher than expected from estimates of gambling prevalence in Sweden, indicative of incorrect use of the API solution by the gambling providers. Although the Gambling Authority provides separate APIs for lookup-queries when the purpose is to check if someone is eligible for targeted advertisement, some gambling providers may incorrectly be using the login API also for this purpose, inflating the number of apparent logins and thereby total gambling activity. However, in order for this to be a confounding factor in the current study, the hypothetical percentage of incorrect API use would have to change in synchrony with the COVID-19 outbreak. Arguably, given the decrease in betting opportunities, it is more reasonable to expect an increase rather than decrease in advertisement activity during the COVID-19 outbreak, in which case the current study would have underestimated, not overestimated, the decrease in total gambling activity. Importantly, it should be noted that our two data sources revealed parsimonious trends, despite indexing different metrics and different populations, indicating robustness. Finally, the current study analyzed actual gambling data from a single online gambling provider that offers both casino games and betting, which likely increases the likelihood of users already being engaged in both types, decreasing the threshold for transitioning. Future research should therefore attempt to replicate these findings using independent datasets.

In conclusion, in contrast with publicly raised concerns (9), we found no indication of increased total gambling activity in the first phase of the COVID-19 outbreak in Sweden and the social distancing procedures introduced to combat it. Although betting decreased substantially in synchrony with a slight increase in online casino gambling, there was no increase in high-intensity, likely problematic gambling as per the Swedish government's own definition and neither did total online gambling increase. Future research is required to examine the impact of the outbreak over longer periods of time, on different types of gambling and on subgroups of gamblers, including problem gamblers, preferably using behavior tracking of individual gambling accounts.

DATA AVAILABILITY STATEMENT

One of the datasets is available at the referenced repository, and is also publicly available through a freedom of information request to the Swedish Gambling Authority. The other was made available to the researchers on condition of anonymity to the public, and secrecy (i.e. not publicly available), as extended by the Swedish Public Access to Information and Secrecy Act (SF 2009:400).

AUTHOR CONTRIBUTIONS

PL obtained data, performed analyses, and drafted manuscript. DF, JJ, AB, and PC made substantial contribution to the design of the study, analysis, interpretation of findings, and revised the manuscript for important intellectual content. All authors contributed to the article and approved the submitted version.

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Self-Perceived Stress During the Quarantine of COVID-19 Pandemic in Paraguay: An Exploratory Survey

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Introduction: Any viral pandemic is a global health and mental health issue. The World Health Organization and mental health associations have warned that the current COVID-19 pandemic will lead to a drastic increase of stress-related conditions and mental health issues globally.

Materials and Methods: An online web-based survey has been launched from 10 to 15 April 2020 in Paraguay in order to collect information regarding the stress related to the quarantine during the COVID-19 pandemic. It has been spread through social media ("*WhatsApp*," "*Twitter*," and "*Facebook*"). Two thousand two hundred and six Paraguayan citizens, over 18 years of age, completed the survey voluntarily. Socio-demographics as well as ratings at Self-perceived Stress Scale have been collected and analyzed.

Results: Two thousand two hundred and six subjects (74.12% men) aged between 18 and 75 with an average of 34 ± 11 years old completed the survey. 12.42% (276 subjects) of sample reported a preexisting diagnosis of mental disorder, and 175 participants (7.93%) reported an increase of preexisting symptoms with the onset of COVID-19 quarantine. 41.97% of them had anxiety and 54.38% did not receive any specific treatment. The general population rated 18.10 ± 5.99 at Self-perceived Stress Scale, which indicates a moderate level of self-perceived stress. Significant association was found between higher levels of stress and female sex, being single, or reporting preexisting mental disorder, above all anxiety and depression ($p < 0.01$). In fact, in 63.87% of mentally ill subjects ($n = 175$), the quarantine has worsened symptoms of preexisting mental disorders.

Conclusion: This study suggests a stressful impact of COVID-19 pandemic, with the majority of participants reporting a moderate level of self-perceived stress. We suggest mental health services to provide a phone-based or web-based support to the general population in order to contrast the psychological impact of the pandemic. This approach may improve the accessibility to mental healthcare services in Paraguay, especially in times of social distancing.

Keywords: COVID-19, pandemic, stress, perceived-stress, Paraguay, mental health

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INTRODUCTION

Any viral pandemic is a global health and mental health issue (1). The impact of a pandemic outbreak on the global health relies on the characteristics of the virus, evidence of rapid human-to-human transmission, the severity of the resulting disease, and the medical and non-medical resources available to control the impact of the virus (e.g., vaccines, treatment drugs, isolation protocols, economic resources to support the lockdown, etc.) (2). The Coronavirus SARS-CoV-2, causing the COVID-19 disease, has spread rapidly through several countries worldwide leading to a pandemic in March 2020 as recognized by the World Health Organization (WHO) (3, 4). In Paraguay, cases of infection have increased sharply in a few days as in the rest of the world (5). It has been argued that feelings of fear, uncertainty, loneliness as well as stress, anxiety, and depression have been reported in the general population worldwide after the outbreak of COVID-19 (6). Also, four potential stages of psychological response to the pandemic have been proposed: stress and fear, anxiety and panic, anger and denial, acceptance, and resolution (6–8). Also, isolation, quarantine and social distancing had a relevant impact on the subjective well-being and level of personal stress (8).

The World Health Organization as well as the international mental health associations have warned that the current COVID-19 pandemic will lead to a drastic increase of stress-related conditions and mental health issues globally (9). In fact, emerging reports have been documenting an increase of stress-related symptoms, anxiety and depression especially among vulnerable populations such as socially and economically disadvantaged people, chronically, and mentally ill populations (10, 11). Also, this condition may add severity to negative prognoses of physical as well as mental diseases with adjunctive difficulty in accessing health services (9, 12). For these reasons, psychological support and crisis interventions should be promoted to contrast the effects of the pandemic (10). Psychological support should be offered to vulnerable subjects, healthcare workers as well as to general population. Moreover, advices to the general population on how to cope with subjective stress during the pandemic may be helpful (10). Measures of stress in the epidemiological research may include three components: (a) *environmental*, including stressful life *events*; (b) *psychological*, which involves subjective experience and emotional response to stressors; and, (c) *biomedical*, which comprises the physiological systems involved in coping the stressful stimuli (13).

This survey aimed to investigate the level of stress perceived by the general population during the current COVID-19 global pandemic and quarantine in Paraguay (14). We expected to reveal a significant self-reported subjective stress on a large scale, above all among people reporting preexisting mental health problems. We employed The Perceived Stress Scale (PSS), a well-known and validated tool, originally developed in 1983, which scores the level of subjective perceived stress (e.g., feelings and thoughts; *psychological* component) related to conditions and stressful life events occurred in the last month (*environmental component*) Also, factors associated to higher perceived stress have been described.

MATERIALS AND METHODS

This was an observational, cross-sectional study, based on an online survey launched from 10 to 15 April 2020, one month after the implementation of preventive actions (quarantine) according to the Decree 3442/20 of the Presidency of the Republic of Paraguay (15). Two thousand two hundred and six Paraguayan citizens, of both sexes, over 18 years of age, voluntarily completed the survey, nationally spread through social media ("*WhatsApp*," "*Twitter*," and "*Facebook*"). All participants received complete information about the aim of the study, privacy and data—processing. No payment has been foreseen for completing the survey.

The Spanish version of the Perceived Stress Scale-10 (EEP-10), as used by Remor in a validation-study with adults in Spain (16), has been employed in this study. This rating scale measures the perception of psychological stress during the last month, and reports on situations of daily life which are considered as stressful (specified as the outbreak of COVID-19 and quarantine in this survey). Also, it explores the level of stress experienced over the last month on a 5-point scale (0–never, 1 = almost never, 2 = once in a while, 3 = often, 4 = very often). Six of the 10 items are worded and scored in the non-reversed direction (i.e., "how often have you felt that you were unable to control the important things in your life"). Four of the 10 items are worded and scored in the reversed direction (i.e., "how often have you felt that things were going your way") (17). The scale is easily understandable by the general population, independently of education level. Also, this scale shows an adequate reliability ($\alpha = 0.82$, test-retest, $r = 0.77$), validity, and sensitivity (16).

The scale total score ranges from 0 to 40. Scores ranging from 0–13 would be considered as low self-perceived stress. Scores ranging from 14–26 would be considered as moderate self-perceived stress. Finally, scores ranging from 27–40 would be considered as high self-perceived stress (17–19).

The study was approved by the Ethics Committee of the School of Medical Sciences at the National University of Caaguazú, Paraguay. Data were treated with confidentiality, equality, and justice, respecting the Helsinki principles. Participants who required a feedback from the questionnaire were invited to write down their email address and received information or specific helpful suggestions.

Data were stored in a Microsoft Office Excel 2013© file and processed with RStudio statistical package version 1.2.5033 for analysis. The results are expressed in tables of proportions. Associations were tested with Student's T distribution and ANOVA, as appropriate. Statistical significance was considered for $p \leq 0.05$.

RESULTS

Two thousand two hundred and six participants completed the web-based survey, 74.12% ($n = 1{,}635$) were men, aged from 18 to 75 with an average of 34 ± 11 years old. 49.77% ($n = 1{,}098$) were single and 77.24% ($n = 1{,}704$) reported an university education. 36.18% ($n = 935$) reported an independent work or working

TABLE 1 | Socio-demographic characteristics of the sample ($N = 2,206$).

Characteristic	*n*	Frequency (%)
Sex		
Man	1,635	74,12
Woman	563	25,52
I'd rather not say it,	8	0,36
Marital Status		
Single	1,098	49,77
Married	688	31,19
Stable union	258	11,70
Separate	81	3,67
Divorced	68	3,08
Widow	13	0,59
Education		
None	28	1,27
Primary	27	1,22
Secondary	231	10,47
University	1,704	77,24
Tertiary (non-university)	216	9,79
Urban area		
Asunción (capital city)	740	33,54
Central (surroundings of the capital)	653	29,60
Other cities	813	36,86
Employment		
Public sector	711	27,52
Independent/private	935	36,18
Unemployed	348	13,47
Undergraduate student	463	17,92
Graduate student	127	4,91

TABLE 2 | Mental health of participants: subjects reporting preexisting mental disorders ($n = 274$).

Characteristics	*n*	Frequency (%)
Diagnosis		
Generalized anxiety disorder	115	41,97
Anxiety and depression	65	23,72
Major depressive disorder	48	17,52
Panic disorder	24	8,76
Borderline personality disorder	10	3,65
Obsessive-compulsive disorder	4	1,46
Post-traumatic stress disorder	2	0,73
Bipolar disorder	2	0,73
Schizophrenia and other psychotic disorders	2	0,73
Impulse control disorder	1	0,36
Attention deficit and hyperactivity disorder	1	0,36
Treatment		
No, I am not receiving any treatment	149	54,38
Yes, psychological	37	13,50
Yes, psychotropics	52	18,98
Yes, psychotropics, and psychological	36	13,14

for a private enterprise. Socio-demographic characteristics of the sample are shown in **Table 1**.

Participants were invited to report on their mental health, providing an answer to the following questions: *Are you diagnosed with a mental disorder? If the answer is yes, could you indicate which one? Are you receiving any type of treatment? If the answer is yes, could you indicate what type?* 12.42% ($n = 274$) reported a preexisting diagnosis of mental disorder and 63.87% of them ($n = 175$) considered that their symptoms have worsened with the start of the quarantine. 41.97% ($n = 115/274$) of them reported anxiety and 54.38% ($n = 149$) were not under any specific treatment. The information about the mental health of the participants is summarized in **Table 2**.

Regarding the Self-Perceived Stress Scale, the internal consistency of ratings with the Cronbach alpha was 0.84. The mean score of the population was 18.10 ± 5.99 (moderate stress level). 67.49% of people without mental illness also reported a moderate level of self-perceived stress, as well 71.17% of people with mental illness ($p < 0.001$). Reported stress levels are detailed in **Table 3**.

The mean score of self-perceived stress among men was 16.82 ± 5.52 (moderate level) whereas women scored 18.54 ± 6.07 (also considered as a moderate level of self-perceived stress). Significant associations were found between stress scores and sex, marital status, reported preexisting mental disorders, and age (**Table 4**): women perceived more stress than men during the quarantine as well as single subjects and those self-reporting a preexisting mental illness (the size of the effect was based on a Cohen's d equal to 0.71). Lower age was significantly associated with higher SPS scores. In the bivariate comparison, the male-female pair was statistically significant with the Turkey test ($p < 0.0001$). Regarding marital status, all pairs were significant ($p < 0.05$) except for the married-widowed pair.

Mental health factors associated to higher levels of self-perceived stress included any preexisting diagnosis (**Table 5**), with a greater significant association for preexisting anxiety and depression ($p < 0.01$). In addition, 175 participants (7.93% of the whole sample or 63.87% of 274 mentally ill subjects) reported a subjective worsening of symptoms with the onset of COVID-19 quarantine.

DISCUSSION

Most of mentally ill subjects (63.87%) reported that COVID-19 quarantine has been worsening symptoms of preexisting mental disorders. As expected and warned by WHO (9), isolation and restrictions may exacerbate feelings of anxiety, fear and anger, especially among subjects suffering from preexisting mental distress (6, 20, 21). They also may be at higher risk of developing additional symptoms of post-traumatic stress disorder (20). Patients suffering from mental health disorders, because of the adjunctive perceived stress during the quarantine, need specific interventions in order to reduce the negative impact of infection and isolation on their own clinical outcome and quality of life (22). In addition, in our sample, there were no significant different levels of perceived stress among subjects

TABLE 3 | Self-Perceived stress levels in the sample.

Self-Perceived stress level	Without mental illness ($n = 1,932$)		With mental illness ($n = 274$)		Total sample ($N = 2,206$)	
	n	Frequency (%)	*n*	Frequency (%)	*n*	Frequency (%)
Low stress	473	24.48	17	6.20	490	22,21
Moderate stress	1,304	67.49	195	71.17	1,499	67,95
High stress	155	8.02	62	22.63	217	9,84

TABLE 4 | Factors associated to self-perceived stress in the sample ($N = 2,206$).

Factors	Self- Perceived stress		*p*-value
	Mean ± Standard deviation		
Sex			$p < 0.0001$
Women	18,53	5,52	
Men	16,81	6,07	
I would rather not say	19,12	7,60	
Marital Status			$p < 0.0001$
Single	19,38	6,06	
Married	16,08	5,23	
Stable union	17,84	6,07	
Separate	18,14	6,07	
Divorced	18,67	6,15	
Widow	17,84	4,02	
Education			0.126
None	19,53	6,03	
Primary	19,33	4,28	
Secondary	18,77	6,06	
Tertiary (non-university)	17,66	6,10	
University	18,02	5,98	
Urban Area			0.446
Asuncion (capital city)	18,01	5,89	
Central (surroundings of the capital)	18,34	6,18	
Other cities	17,98	5,91	
Psychiatric diagnosis			$p < 0.0001$
Yes	21,74	5,78	
No	17,58	5,83	
Age			$p < 0.001$

TABLE 5 | Mental health factors associated to Self-perceived stress in mentally ill subjects ($n = 274$).

Factors	Self- Perceived stress		*p*-value
	Mean ± Standard deviation		
Diagnosis			0.00679
Generalized anxiety disorder	20,72	5,73	
Anxiety and depression	24,01	5,03	
Major depressive disorder	21,52	5,81	
Panic disorder	22,45	6,32	
Borderline personality disorder	23	4,13	
Obsessive-compulsive disorder	17	3,83	
Post-traumatic stress disorder	23	14,14	
Bipolar disorder	16	1,41	
Schizophrenia and other psychotic disorders	13,5	7,77	
Impulse control disorder	18		
Attention deficit and hyperactivity disorder	21		
Treatment			0.336
No, I am not receiving any treatment	21,49	5,44	
Yes, psychological	23,19	6,06	
Yes, psychotropic	21,13	5,92	
Yes, psychotropic, and psychological	22,19	6,59	

with preexisting mental illness receiving or not- receiving any treatment (psychological or pharmacological).

Emerging symptoms among people without preexisting conditions, after the exposure to collective stressful events, such as depressive symptoms, irritability, insomnia, anxiety as well as functional neurological symptoms have been reported (23, 24). Our study confirmed significant levels of stress, even if different, among subjects with and without mental health conditions. Also, in the sample, greater stress has been perceived as associated to anxious and depressive symptoms, according to some previous studies on quarantine (25).

In 2015, during a quarantine in Korea and Ebola viral epidemic in Sierra Leone, greater stress was associated with the female sex, university education level (25, 26). In our survey, the association with female sex has been confirmed whereas no significant association was found with the education level: this may be due to a selection bias since most of participants (1,704; 77.24%) reported to be graduated. This may suggest that people (77.24% of sample) with higher level of education, as well as more accessibility to internet, completed the survey more easily than those with lower level of education.

The internal consistency of ratings found in this study was greater than those found in studies conducted in Colombia or Korea with a Cronbach alpha value of 0.65 and 0.70, respectively (27, 28). In fact, the internal consistency value (0.84) is relevant especially for a complex construct (such as perceived stress) measured in large heterogeneous sample (2,206 subjects from the general population) (29).

This survey was designed to measure the short term (10–15 April 2020) perceived stress following the first wave of COVID-19 and lockdown in the general population in Paraguay, it does not aim to measure the perceived stress among subjects with mental disorders specifically: the instrument used for the survey is adequate for this purpose. The survey was launched through some social networks and apps, as this allowed to reach a large part of general population in a short period of time, considering that in-person assessment would have been impossible due to the lockdown and social distancing measures imposed in the country. Questions regarding preexisting conditions were included in order to determine whether their presence could affect the perceived stress in the general population. Further research will be needed to determine the perceived stress in patients with mental disorders.

Limitations of the survey may include the absence of specific data on psychological or pharmacological interventions for subjects under treatment, as well as the lack of a comparison between the subjects with mental disorders and the general population: our numbers did not allow for any matched comparison. Another limitation of the design is the difficulty to separate the impact of the quarantine and the fear of the virus itself, there may be different factors that could be better measured with different designs. The use of social media to distribute the screening tool could negatively impact the ability to reach people with mental illness, and to reach the general population of Paraguay. The bias of the educational level could be attributed to a "self-selection" of people interested in joining the study and their level of access to social networks: considering the increased availability of internet for people with higher levels of education.

In conclusion, the general score of perceived stress during the quarantine period was 18.10 ± 5.99 (moderate self-perceived stress level). Significant associations were found between stress, female sex, and being single. It may be also understandable that social restrictions may worse loneliness among single subjects.

Considering the findings of this study, we suggest mental health services to provide a phone-based or web-based psychological support to the general population, when required by the general practitioner, and additional regular phone-based or web-based follow-up to all their users to contrast the effect of pandemic on preexisting mental disorders and prevent relapses or suicide (30, 31). This approach may improve the accessibility to mental healthcare services in Paraguay, especially in times of social distancing. It is of note that this may only be accomplished by an effort by public and/or private organizations in order to provide necessary equipment and resources to reach all levels of general population.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics Committee, National University of Caaguazú. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

JT, CR-G, IB, MO'H, OG, and AV conceptualized the structure and design of the manuscript. JT, MO'H, IB, OG, IG, and JC-M wrote the first draft of the manuscript. CR-G and IB designed the first draft of the survey questionnaire. IB, JT, IG, JC-M, and AV analyzed the data. All authors provided critical intellectual contribution to the manuscript, reviewed, and approved the final version of the manuscript.

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Stress, Burnout, and Coping Strategies of Frontline Nurses During the COVID-19 Epidemic in Wuhan and Shanghai, China

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Background: Nurses at the frontline of caring for COVID-19 patients might experience mental health challenges and supportive coping strategies are needed to reduce their stress and burnout. The aim of this study was to identify stressors and burnout among frontline nurses caring for COVID-19 patients in Wuhan and Shanghai and to explore perceived effective morale support strategies.

Method: A cross-sectional survey was conducted in March 2020 among 110 nurses from Zhongshan Hospital, Shanghai, who were deployed at COVID-19 units in Wuhan and Shanghai. A COVID-19 questionnaire was adapted from the previous developed "psychological impacts of SARS" questionnaire and included stressors (31 items), coping strategies (17 items), and effective support measures (16 items). Burnout was measured with the Maslach Burnout Inventory.

Results: Totally, 107 (97%) nurses responded. Participants mean age was 30.28 years and 90.7% were females. Homesickness was most frequently reported as a stressor (96.3%). Seven of the 17 items related to coping strategies were undertaken by all participants. Burnout was observed in the emotional exhaustion and depersonalization subscales, with 78.5 and 92.5% of participants presenting mild levels of burnout, respectively. However, 52 (48.6%) participants experienced a severe lack of personal accomplishment. Participants with longer working hours in COVID-19 quarantine units presented higher emotional exhaustion (OR = 2.72, 95% CI 0.02–5.42; $p = 0.049$) and depersonalization (OR = 1.14, 95% CI 0.10–2.19; $p = 0.033$). Participants with younger age experienced higher emotional exhaustion (OR = 2.96, 95% CI 0.11–5.82; $p = 0.042$) and less personal accomplishment (OR = 3.80, 95% CI 0.47–7.13; $p = 0.033$).

Conclusions: Nurses in this study experienced considerable stress and the most frequently reported stressors were related to families. Nurses who were younger and those working longer shift-time tended to present higher burnout levels. Psychological support strategies need to be organized and implemented to improve mental health among nurses during the COVID-19 pandemic.

Keywords: COVID-19, stress, burnout, coping strategy, nurses, mental health, psychology, psychiatry

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INTRODUCTION

COVID-19, a novel coronavirus featuring human-to-human transmission (1) and has spread throughout the world since its outbreak in December 2019 with thousands of new cases emerging daily during its peaks (2). The world has experienced several pandemics of contagious diseases in the past two decades such as SARS in 2003, H1N1 in 2009, Ebola, Zika, and MERS in 2014∼2016 (3). High levels of psychological stress have been documented among nurses who cared for infected patients during these disease outbreaks (4–6).

Frontline nursing and medical staff, especially in the early stages of epidemics, have suffered from anxiety and depression due to high workload, insufficient personal protective equipment, lack of knowledge of the pathogen and direct contact with patients (7–10). Consequently, nurses have commonly reported to experience a greater decline of morale and decreased job satisfaction due to the nature of the profession (11). Therefore, mental health initiatives are important to support nurses and doctors during an unprecedented health crisis of a pandemic (12, 13).

Burnout syndrome, a state of emotional exhaustion, is prevalent among nurses working in critical care areas across the world. A review and meta-analysis of 13 included studies using the Maslach Burnout Inventory (MBI) with a total sample of 1,566 emergency nurses revealed that burnout prevalence is high (14). Around 30% of the included nurses showed burnout in each of the three subscales of the MBI with the highest affected levels in the Depersonalization subscale followed by the Emotional Exhaustion and Personal Accomplishment subscales (14). A study among 3,100 nurses and 992 physicians working in 159 Asian intensive care units documented that nurses and physicians had high levels of burnout, 52 and 50.3%, respectively (15).

Studies revealed that the factors related to working environment, shift work, and workloads can lead to the burnout among clinical nurses (16). Consequently, this can negatively impact the quality and safety of patient care. The emergent infection disease outbreaks expose nurses to risks of infection and may trigger or aggravate burnout levels among frontline nurses. A study investigating factors of burnout among nurses working at the frontline during the SARS outbreak identified that nurses who were single and having been quarantined during the outbreak had higher level of depressive symptoms (17). Subsequently, 3 years later, this group of nurses who also had been exposed other traumatic events experienced ongoing high level of depression symptoms (17).

During the outbreak of COVID-19 in China, medical teams nationwide have been assigned to support local health workers in Wuhan, Hubei Province, the area that has been worst affected by the pandemic. Zhongshan Hospital of Fudan University, a tertiary teaching hospital in Shanghai, organized a medical team consisting of 30 physicians and 104 nurses to support hospitals in Wuhan (18). Additionally, another six nurses were deployed to the Shanghai Public Health Medical Center, a COVID-19-designated hospital (19). Theses nurses had at least 3 year work experience in emergency, critical care, respiratory and infection departments. The frontline nurses took over two intensive care units with 34-beds, respectively. They left their families and lived in the designated hotels. Additionally, they cared for COVID-19 infected patients with new colleagues in a new working environment. All of these were exposed to an extremely stressful environment.

The unknown and uncertain hospital environment with COVID-19 patients may aggravate burden and increase stress among nurses while fighting the epidemic. To address these mental health challenges and well-being of nurses who work in the frontline of the COVID-19 pandemic, psychological support should be provided by hospital management and organizations that meet the needs of these vulnerable group of nurses. Therefore, the aim of this study was to identify stressors and burnout among nurses who cared for COVID-19 patients during their stay in the frontline and to explore coping strategies and perceived effective support factors to address stressors.

MATERIALS AND METHODS

Design and Procedure

A prospective observational survey design was adopted for this study. The guideline "The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies" was used to report the study (20). A total of 110 nurses were eligible to participate, including 104 nurses in Wuhan Renmin hospital and six nurses in Shanghai Public Health Medical Center. The two designated hospitals both admitted COVID-19 patients only. The study and questionnaires were designed in 25–29 February and was conducted using an online survey platform between 10 and 14 March 2020. At that time, participants had worked on the frontline for more than 1 month, and all participants cared for severe and critically ill COVID-19 patients.

Measures

Sociodemographic variables were collected. These included age (≤30 years or >30 years), gender, marital status, family composition (number of children), education degree, nursing degree, work experience (≤8 years or >8 years), work environments (quarantine, semi-quarantine or COVID-19 free units), and working hours per week of those working in quarantine areas.

A self-administered COVID-19 questionnaire was adapted from a survey designed and used during the SARS epidemic measuring the psychological impacts of SARS of frontline nurses (21). Several items were modified and added through an online panel discussion and consultation with five frontline nurses. The content validity index (CVI) of the revised questionnaires was 9.4. A pilot study with 23 nurses confirmed the acceptability of the final version of the COVID-19 questionnaire. The final COVID-19 questionnaire included three subscales: (1) Stressor subscale including 31 items with a 4-point answer option scale (0 = not at all; 1 = slightly; 2 = moderately; 3 = very much); (2) Coping strategies subscale including 17 items with a 4-point answer option scale (0 = almost never; 1 = sometimes; 2 = often; 3 = almost always); and (3) Effective support subscale including

16 items with a 4-point answer option scale (0 = not effective; 1 = mildly effective; 2 = moderately effective; 3 = very effective).

Burnout was measured using the 22-item Maslach Burnout Inventory (MBI), developed and validated by Maslach and Jackson, and is divided into three subscales: Emotional Exhaustion (EE, 9 items), Depersonalization (DP, 5 items) and Lack of Personal Accomplishment (PA, 8 items) (22, 23). The EE subscale measures feelings of being emotionally strained and exhaustion by own work. The DP subscale measures an unfeeling and impersonal response toward the recipients of care. Higher mean scores relate to a higher degree of experiencing burnout. The items in the PA subscale measure feelings of competence and successful achievements. Scores of this subscale are revered and lower mean scores indicate a higher degree of experienced burnout. Each item of the MBI is scores on a 7-point scale ranging from 0 (never) to 6 (every day). The range of the subscales scores are; EE = 0–54, DP = 0–30, and PA = 0–48 (reversed).

Data Analysis

The analyses were performed using IBM-SPSS version 22.0 (IBM, New York, NY, USA) and R statistical software (R, version 3.5.1; R Project). Normally distributed measurement data are presented as mean and standard deviation, and categorical data are presented as frequency (percentage). Normally distributed continuous variables were compared using one-way analysis of variance. The Pearson $\chi 2$ test was applied to all categorical variables. A restricted cubic spline was employed to estimate the relation between age and working time in quarantine areas and burnout level. The internal consistency of the two questionnaires on subscale level was calculated by Cronbach's alpha. All significance tests were two-sided, and $P < 0.05$ was considered statistically significant.

Ethics

The study was approved by the Research Ethics Committee of Zhongshan Hospital, Fudan University (B2020-075). The study was conducted in accordance with the International Council for Harmonization and Good Clinical Practice principles. The study adhered to the ethical principles stated in the Declaration of Helsinki (24). Informed consent was obtained from each participant before data collection. Participants could withdraw from the study at any time without providing a reason. The survey was anonymous, and confidentiality of information was assured.

RESULTS

Demographic Characteristic

A total of 107 (97%) participants responded to the questionnaires. Participants had a mean age of 30.28 (SD 5.49) years, and 66.36% of the nurses were under 30 years old. Most frontline nurses were female (90.65%), 42.06% were married, and 30.84% had children. The mean work experience was 8.63 (SD 6.45) years, and 67.29% had worked for<8 years. Among the 107 participants, 91.59% have worked in quarantine areas (**Table 1**).

TABLE 1 | Characteristics of participants (n = 107).

Characteristics	*n* (%)
AGE	
≤30 years	71 (66.36)
>30 years	36 (33.64)
Female	97 (90.65)
Married	45 (42.06)
Have Children	33 (30.84)
EDUCATION DEGREE	
College	32 (29.91)
Bachelor and above	75 (70.09)
NURSING DEGREE	
RN	86 (80.37)
APN or head nurse	21 (19.63)
WORK EXPERIENCE	
≤8 years	72 (67.29)
>8 years	35 (32.71)
WORKING ENVIRONMENTS AND WORK HOURS	
Quarantine areas	98 (91.59)
≤10 h per week	31 (31.63)
10–20 h per week	58 (59.18)
>20 h per week	9 (9.19)
Semi-quarantine areas	44 (41.12)
COVID-19 free areas	27 (25.23)

RN, registered nurse; APN, advanced practice nursing.

COVID-19 Questionnaire

The COVID-19 questionnaire with the three subscales revealed adequate internal consistency measures. The Cronbach's α of three subscales were: Stressors, α 0.90; Coping Strategies, α 0.77; Effective Support, α 0.84.

Among the 31 items of the subscale Stressors in the COVID-19 questionnaire, the stressors that ranked and scored highest were homesickness (96.3%, mean 1.97), followed by uncertainty how long the current working status will last (85.0%, mean 1.19), worrying I might get infected myself (84.1%, mean 1.05), prolonged wearing of protective equipment will damage my skin (75.7%, mean 1.11), and discomfort caused by protective equipment (75.7%, mean 1.07) (**Table 2**).

In the subscale Coping Strategies, the top 5 common strategies indicated by participants to cope with stress were: Taking preventive measures; Actively learning about COVID-19; Actively learning professional knowledge; Adjusting attitude and facing the COVID-19 epidemic positively; and Chatting with family and friends (**Table 3**). Seven of the 17 coping items were performed by all study participants (**Table 3**).

All 16 items listed in the subscale Effective Support were regarded as effective measures by most frontline nurses. Seven items were rated as an effective support measure by all participants. The top five ranked most effective support measures to reduce stress as perceived by the study participants were: Support from supervisors; Sufficient material supply; Allowance provided by government; Clear instruction on treatment procedures; and Adequate knowledge of COVID-19 (**Table 4**).

TABLE 2 | Stressors and stress severity ($n = 107$).

Items	*n* (%)[a]	Mean (SD)[b]
Homesickness	103 (96.3)	1.97 (0.926)
Unsure how long the current working status will last	91 (85.0)	1.19 (0.791)
Worrying I might get infected myself	90 (84.1)	1.05 (0.664)
Prolonged wearing of protective equipment will damage my skin.	81 (75.7)	1.11 (0.850)
Discomfort caused by protective equipment	81 (75.7)	1.07 (0.832)
Uncertainty about when the epidemic will mitigate	81 (75.7)	1.01 (0.771)
Non-nursing tasks (cleaning, collecting garbage, make tea, etc.)	80 (74.8)	1.44 (1.100)
The epidemic may endanger my family members	80 (74.8)	0.98 (0.777)
Hearing about hospital workers who were infected or died	79 (73.8)	0.94 (0.750)
I might endanger co-workers due to my carelessness	75 (70.1)	0.94 (0.822)
Concerns of inadequate knowledge and capability to handle tasks	71 (66.4)	0.74 (0.604)
I might pass the virus to my family because of my occupation.	68 (63.6)	0.90 (0.879)
Emotional reactions of patients	65 (60.7)	0.71 (0.659)
I might put burden on colleagues due to my physical insufficiency	63 (58.9)	0.64 (0.635)
Patients' condition worsening	59 (55.1)	0.71 (0.659)
Fear of nosocomial transmission of virus	58 (54.2)	0.65 (0.715)
Delivering suboptimal nursing care because of inconvenience associated with wearing protective equipment	55 (51.4)	0.64 (0.756)
I might endanger patients due to my carelessness	53 (49.5)	0.62 (0.748)
The conflict between nursing responsibility and personal safety	50 (46.7)	0.51 (0.589)
I might not work well with new colleagues (nurses and doctors)	41 (38.3)	0.42 (0.567)
Lacking proper work environment	40 (37.4)	0.45 (0.662)
Emotional reactions of patients' family	34 (31.8)	0.36 (0.554)
Emotional instability of colleagues	33 (30.8)	0.35 (0.568)
Unfamiliar with infection control regulations	33 (30.8)	0.34 (0.531)
Concerns over insufficient manpower	29 (27.1)	0.34 (0.629)
Lack of protective material supply	29 (27.1)	0.30 (0.518)
Unclear documentation and reporting policy	26 (24.3)	0.25 (0.458)
Criticism or blame from supervisors	23 (21.5)	0.21 (0.413)
Confusion of responsibilities between physicians and nurses	17 (15.9)	0.17 (0.400)
Presenting COVID-19-like symptoms myself	16 (15.0)	0.18 (0.472)
Colleagues presenting COVID-19-like symptoms	15 (14.0)	0.17 (0.468)

[a]Number and proportion of a score≥1 for each item; [b]Severity was rated on a 4-points scale (0 = not at all; 1 = slightly; 2 = moderately; 3 = very much), score of severity calculated as mean (SD).

Burnout Inventory

The Cronbach's α coefficients for the subscales Emotional Exhaustion, Depersonalization, and Lack of Personal Accomplishment were 0.88, 0.80, and 0.75, respectively. The results retrieved from the MBI questionnaire of our frontline nurses are presented in **Table 5**. The overall mean score in the subscale Emotional Exhaustion was 12.27 (SD 7.14) with most of the scores being mild (n = 84, 78.5%) among the participants. The Depersonalization subscale revealed only mild burnout score with most of the participants having a score $\leq$ 16 (overall subscale mean score: 2.07; SD 2.78). However, 52 (48.6%) participants experienced a severe lack of personal accomplishment.

Associated Factors of Burnout Level

Subgroup analysis was conducted to explore the burnout level in different subgroups. Participants with younger age, less working experience and longer working time in quarantine areas presented higher burnout levels in the subscale Emotional Exhaustion. A higher level of burnout in the subscale Depersonalization was observed among participants in the subgroup with longer working time in quarantine areas. Participants with younger age, lower degrees and longer work experience showed less burnout in the subscale Lack of Personal Accomplishment (**Supplementary Material 1**). Burnout levels related to Emotional Exhaustion and Depersonalization decreased with increasing age and working time in quarantine areas (**Figure 1**).

DISCUSSION

This study aimed to explore the main stressors and burnout and investigated how nurses release their stress. This information may provide evidence for hospitals to offer appropriate support to frontline nurses during their stay on the frontline.

TABLE 3 | Coping strategies ($n = 107$).

Items	*n* (%)[a]	Mean (SD)[b]
Taking preventive measures (handwashing, wearing face masks, taking the temperature, etc.)	107 (100.0)	2.99 (0.097)
Actively learning about COVID-19 (symptoms, route of transmission)	107 (100.0)	2.87 (0.391)
Actively learning professional knowledge (including ECMO, ventilator, etc.)	107 (100.0)	2.82 (0.472)
Adjusting the attitude and facing the COVID-19 epidemic positively	107 (100.0)	2.79 (0.450)
Chatting with families and friends	107 (100.0)	2.76 (0.511)
Recreational activities (music, sports, safari, etc.)	107 (100.0)	2.75 (0.497)
Engaging in health-promoting activities (proper rest, exercise, balanced diet)	107 (100.0)	2.71 (0.550)
Seeking psychological support from colleagues	92 (86.0)	1.65 (1.047)
Seeking information regarding mental health	91 (85.0)	1.52 (1.040)
Participating Balint groups	88 (82.2)	1.13 (0.802)
Practicing relaxation methods (meditation, yoga, Taiji, etc.)	74 (69.2)	1.11 (1.022)
Expressing concerns and needs to supervisors	72 (67.8)	0.81 (0.715)
Limiting myself watching news related to COVID-19	40 (37.4)	0.59 (0.921)
Keeping myself busy to refrain from thinking about the epidemic	48 (44.9)	0.55 (0.704)
Taking adjuvant medication (sleep helper, etc.)	21 (19.6)	0.26 (0.588)
Releasing emotions by crying, screaming or throwing items	12 (11.2)	0.14 (0.444)

[a]Number and proportion of a score≥1 for each item; [b]Frequency of measures was rated on a four-point scale (0 = almost never; 1 = sometimes; 2 = often; 3 = almost always), frequency of coping strategies calculated as mean ± SD.

TABLE 4 | Effective support measures ($n = 107$).

Items	*n* (%)[a]	Mean (SD)[b]
Support from team leaders	107 (100.0)	2.94 (0.269)
Sufficient material supply	107 (100.0)	2.93 (0.315)
Allowance provided by government	107 (100.0)	2.91 (0.351)
Clear instruction on treatment procedures	107 (100.0)	2.91 (0.351)
Adequate knowledge of COVID-19 (transmission route, treatment, etc.)	107 (100.0)	2.82 (0.472)
Priority in career promotion	107 (100.0)	2.80 (0.522)
Senior staff sharing experience	107 (100.0)	2.71 (0.614)
Strict infection control procedures within the institution	106 (99.1)	2.84 (0.517)
Educational and training programs in the hospital	105 (98.1)	2.62 (0.722)
Appropriate schedule of shift	104 (97.2)	2.90 (0.387)
Enough rest time	104 (97.2)	2.88 (0.405)
Nutrition supplement from the organization	100 (93.5)	2.23 (0.957)
Encouragement from colleagues	99 (92.5)	2.67 (0.611)
Psychological services	96 (89.7)	1.86 (1.041)

[a]Number and proportion of a score≥1 for each item; [b]Effectiveness of measures was rated on a four-point scale (0 = not effective; 1 = mildly effective; 2 = moderately effective; 3 = very effective), score of perceived effectiveness calculated as mean (SD).

Participants in our study were relatively young and less experienced, however, were motivated to work on the frontline. Consistent with previous findings, our study showed that a significant proportion of participants reported multifaceted stress of various severities. Loneliness has been recognized in other studies as a major stressor among nurses working in quarantine areas during epidemic outbreaks (25, 26). This issue is undoubtedly magnified among our study participants since they had to separate from their families and stay at designated hospitals during their placements. Stressors related to families, "homesickness," "the epidemic may endanger my family members," and "I might pass the virus to my family because of my occupation," ranked high among our study participants. Organizations should provide support to their families to help frontline nurses feel assured. Our hospital union arranged home visits and provided necessary assistance to relieve nurses' concerns. Correspondingly, family support is highly valued by frontline nurses during these stressful periods (27).

Most nurses worked in quarantine areas and cared for critically ill COVID-19 patients while wearing personal protective equipment. As a consequence, several stressors were related to the personal protective equipment, including "prolonged wearing of protective equipment will damage my skin," "discomfort caused by protective equipment," and "delivering suboptimal nursing care because of inconvenience associated with wearing protective equipment," which has been confirmed by FitzGerald and colleagues during the H1N1 Influenza 2009 epidemic (4). Skin protectors could be offered to key-workers to relieve the pressure and discomfort associated with protective equipment.

The human-to-human transmission characteristics of COVID-19 expose health workers at high risk. As expected, the stressor of "worrying I might get infected myself" ranked high which is echoed in other previous studies (28, 29), while "hearing about hospital workers who were infected or died" also aggravated the concern about being infected. During the SARS outbreak in Hong Kong in 2003, staff who noticed that co-workers were infected found this as the most distressing experience evoking fear about their own personal vulnerability (5).

It is encouraging to notice that nurses on the frontline positively taking measures to cope with stress. Khalid et al. 19 noted that strict protection is essential in helping hospital staff through the epidemic (30). All participants in our study undertook preventive measures in the working areas. Nurses' concern about inadequate expertise in handling challenging tasks was noted in previous epidemic outbreaks (17, 28) and is also common among the frontline nurses in our study. All nurses have been actively obtaining new knowledge about COVID-19 to build their confidence in providing care.

Only a small proportion of participants reported the need to see a psychiatrist, indicating that most nurses managed to adapt to the situation by themselves, which was similar to the results of another COVID-19 study on mental health issues among medical staff (31). In previous studies involving nurses with first-hand experience caring for patients during a disease outbreak, 19% had alcohol abuse/dependence (32), 8.8% experienced severe depression (30). Several studies showed 10–33% nurses had posttraumatic stress disorder symptoms (27, 32, 33). Moreover, previous studies also demonstrated nurses continued to experience a degree of psychological impact after the pandemic had receded (34, 35). In our study, a small number of participants who had a negative response to stress might be at high-risk for mental health disorders. Continuous attention should be paid to these groups, and psychological intervention should be applied in a timely manner.

TABLE 5 | Burnout inventory of participants ($n = 107$).

Dimension	*n* (%)
Emotional Exhaustion, mean (SD)	**12.27 (7.14)**
Mild (scores ≤ 16)	84 (78.5)
Moderate (scores 17–26)	17 (15.9)
Severe (scores ≥ 27)	6 (5.6)
Depersonalization, mean (SD)	**2.07 (2.78)**
Mild (scores ≤ 6)	99 (92.5)
Moderate (scores 7–12)	6 (5.6)
Severe (scores ≥ 13)	2 (1.9)
Lack of Personal Accomplishment*, mean (SD)	**16.44 (8.36)**
Mild (scores ≤ 9)	20 (18.7)
Moderate (scores 10–16)	35 (32.4)
Severe (≥17)	52 (48.6)

**Lack of Personal Accomplishment reversed score (max score is 48).*

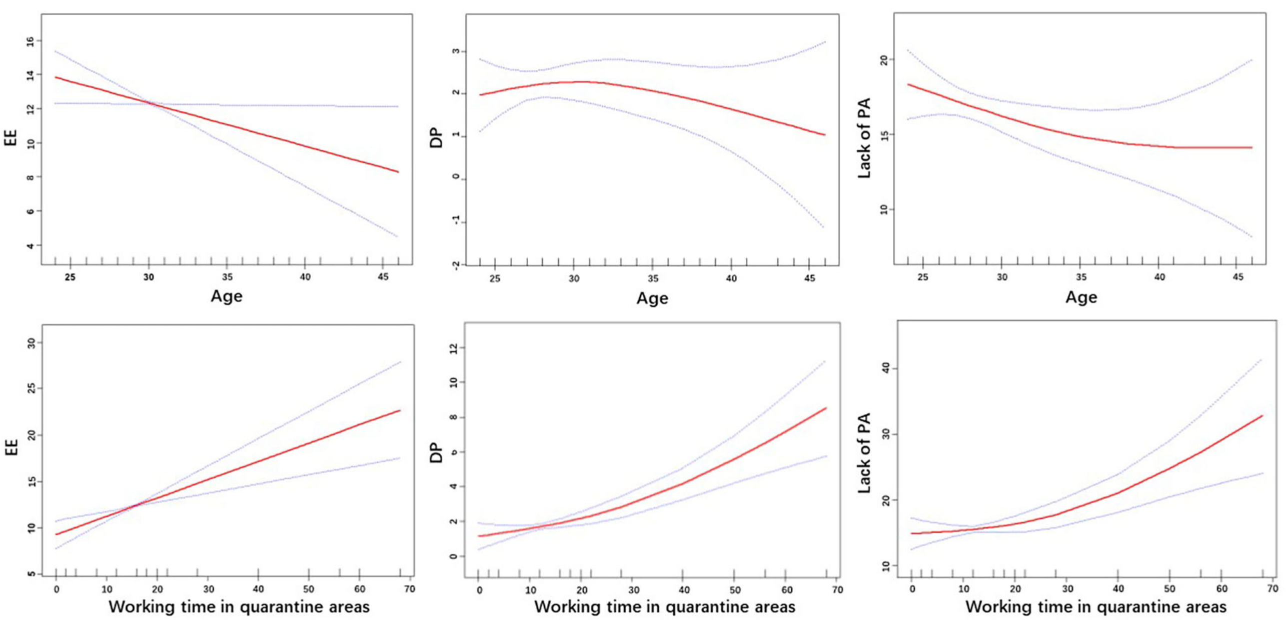

FIGURE 1 | Relationship between age, working time in quarantine areas, and three subscales of burnout. EE, Emotional Exhaustion; DP, Depersonalization; PA, Lack of Personal Accomplishment.

We also investigated the burnout level of participants to explore emotional reactions to stressors. Fortunately, most participants reported normal mental health conditions comparable with nurses in regular working environments (36, 37). A few participants showed moderate to severe emotional exhaustion and depersonalization after 1 month working on the COVID-19 frontline. We noted that nearly half of the participants presented a severe lack of personal accomplishment. We speculate that this might be associated with the severity and rapid progression of COVID-19 infections. There is no effective treatment for the disease so far. Although various supportive measures have been applied, numerous patients rapidly deteriorate to critical conditions and die. This might decrease nurses' confidence and feeling of personal accomplishment. In the subgroup analysis of factors associated with burnout level, we found that participants with younger age and longer working time in quarantine areas showed higher levels of burnout. This might be related to the inexperience of young nurses. Their lack of opportunities to witness critical occasions might make them more vulnerable when facing death of patients due to COVID-19. Continuous attention and psychological assistance should be offered to these vulnerable group of nurses.

In our study, most explored support measures were reported to be effective by participants. Support from team leaders and sufficient material supply were considered the most important measures. Additionally, benefits such as an allowance, career promotion and nutrition supply should be provided to encourage frontline nurses. Adequate understanding of COVID-19 could increase nurses' confidence and sufficient training should be offered. Experience from senior staff and encouragement from colleagues were also considered effective. Several morale supportive interventions for nurses working in highly stressful environments have been identified in previous studies, including positive attitudes in the workplace and acknowledgment of their efforts (29, 37), social and family support (37), clear communication of directives (34), and support from supervisors and hospitals (27, 28, 38). Nurses especially appreciate the offering of counseling/psychiatric services (5, 21, 26) and financial compensation (5, 39) from the organization.

This study has several limitations. Firstly, our participants were from a single hospital in Shanghai, and the generalizability of the findings to other populations remains to be verified. Secondly, the questionnaire originated from a previous study and was revised by our study team. Further verification based on a larger sample should be considered. Thirdly, we recognize the disadvantages of self-administered questionnaires which may limit the depth of the experiences (40, 41). Adding open-ended questions or interviews with nurses might contribute to a better understanding of the impact of COVID-19 in clinical practice. Finally, this study was a cross-sectional observational study. Follow-up on the short-term and long-term psychological impacts of epidemics need to be investigated in future studies.

In conclusion, nurses who cared for COVID-19 patients in this study experienced considerable stress, and the most frequently reported and serious stressors were related to families. Most frontline nurses positively undertook strategies to cope with stress. Nurses who were younger and who worked longer time in quarantine areas tended to present higher burnout levels. Morale support interventions, including management support, material support and allowances, should be considered to support frontline nurses in their social and psychological well-being.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Research Ethics Committee of Zhongshan Hospital, Fudan University, Shanghai, China. Reference number: B2020-075. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

YZ, JML, and CZ initiated the study. YZ, SC, JG, XH, and JML contributed to the design of the study. CW, WP, and JZ contributed to the data collection. JG, SC, and YZ contributed to the data analysis and interpretation. YZ, SC, and JML drafted the first manuscript. All authors contributed to manuscript revisions, read, and approved the final version of the manuscript and agreed to be accountable for the content of the work. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2020.565520/full#supplementary-material

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COVID-19 and Mental Health—What Do We Know So Far?

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The coronavirus disease 2019 pandemic brought several worldwide health, social, and economic disturbances—particularly associated with the imposed confinement measures—that raised concerns about an emerging public mental health crisis. Studies investigating the early mental health impact of the pandemic on general population and vulnerable groups, such as healthcare workers, revealed a high prevalence of stress, anxiety, and depression symptoms, among others, and found several risk and protective factors. Along with these findings, the risk of substance use, suicide, domestic violence, and complicated grief may increase. We further discuss interventions that can be applied at a governmental, institutional, and individual level to minimize the mental health consequences of the pandemic, such as using telehealth to provide remote support or practicing self-care. These interventions should be maintained after the initial outbreak, as current disturbances may impact long-term well-being. We encourage the development of longitudinal studies to assess long-term adaptive responses.

Keywords: COVID-19, mental health, depression, anxiety, health services

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INTRODUCTION

Coronavirus disease 2019 (COVID-19) is a highly transmissible disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), a novel coronavirus discovered in Wuhan, Hubei Province, China, in the end of 2019 (1). The severity of SARS-CoV-2 infection ranges from mild or no symptoms to severe pneumonia associated with intensive care unit admission and high mortality (2).

On March 11, 2020, COVID-19 had already spread over the five continents and was officially declared a pandemic (3); as of April 23, 2020, 2.5 million confirmed cases were reported (4), while health systems were overburdening worldwide.

Without any available cure or vaccine so far, community mitigation strategies have become essential to limit the spread of the disease and reduce the load on healthcare facilities. These strategies promote social distancing and include home quarantine, telecommuting, closure of schools and nonessential services, cancellation of events, and travel restrictions (5).

The uncertainties around the transmission pattern and incubation period of COVID-19 and its potentially serious complications—along with the social confinement measures imposed by governments, the disruption of world economies, and the overabundance of information (including false rumors) in the media—raised concerns about an emerging public mental health crisis (6).

Every day, we are confronted with new information about the current pandemic; mental health in the context of COVID-19 is being widely discussed in scientific literature and among world organizations. When discussing public mental health, it is important not only to evaluate the impact of the disease, but also to develop protocols to better handle its negative consequences. Therefore, this short narrative review aims to summarize and present relevant information on both topics; on the one hand, we review the negative psychosocial effect observed on the general population and on healthcare workers and the potential impact this pandemic could have on other vulnerable groups—people affected by COVID-19, older adults, people with mental illness, people experiencing homelessness, women suffering gender violence, racial and ethnic minorities, migrants, and sexual minorities; on the other hand, we discuss mental health interventions that can be helpful in controlling both the immediate and the long-term impact of the pandemic.

MENTAL HEALTH IMPACT OF COVID-19 PANDEMIC

On the General Population

Several Chinese institutions and research groups started investigating the generalized negative psychological effect of the pandemic early in the year. A detailed online survey conducted in the beginning of the outbreak in China found that around half of the respondents were experiencing moderate or severe psychological impact; 28.8% of respondents reported moderate to severe anxiety symptoms, 16.5% reported moderate to severe depressive symptoms, and 8.1% reported moderate to severe stress levels (7). Another cross-sectional study concluded that the prevalence of posttraumatic stress symptoms in China's province of Hubei a month after the outbreak was 7% and higher in women and in participants with poor sleep quality (8). A third study analyzed posts from Weibo, a popular Chinese social media platform, using machine-learning predictive models and found that negative emotions (e.g., anxiety, depression, indignation) and sensitivity to social risks increased after the announcement of COVID-19 on January 20, 2020, while positive emotions and life satisfaction decreased (9).

Across the world, similar results were found. A worldwide study conducted from March 29 to April 14, 2020, found a high prevalence of general psychological disturbance and posttraumatic stress and depression symptoms, with 16.2% of the participants reporting suicidal ideation (10). Three to four weeks after lockdown measures were established in Italy, the Italian population reported high levels of posttraumatic stress, depression, anxiety, insomnia, perceived stress, and adjustment disorder symptoms. In this study, several risk factors were associated with poorer mental health outcomes: being a woman, being younger, being under quarantine, having a loved one deceased by COVID-19, and experiencing stressful events (i.e., work, financial, relationship, or housing problems) related to the pandemic or lockdown measures (11). A Portuguese study also identified female sex and lower age as significant risk factors, as well as lower education levels, previously diagnosed psychological or physical conditions, and interruption of psychological support during the pandemic. Additionally, this research suggests, in line with other studies, that maintaining work, exercising, having a garden at home, and spending less time consuming COVID-19-related information in the media are protective factors against psychological symptoms (12). Optimism and social support were also found to be important resilience factors (10).

Canadian researchers have also warned us of both the protective and detrimental effect of health anxiety, which may result in either health-promoting behaviors or erratic and dangerous decisions (13).

The socioeconomic impact of the pandemic plays a key role in psychological distress. Combined with social isolation and loneliness, the resulting economic crisis, having compromised millions of jobs and income sources, is expected to increase substance use (14) and suicide rates (15, 16). The imposed lockdown has also altered family dynamics, creating challenges in sustaining the household harmony. According to UNESCO, most governments have temporarily closed educational institutions (17), and many parents are struggling with keeping their children entertained at home (18). Children's psychological well-being may be affected by the adverse consequences of school closures, including interrupted learning, lack of in-person contact with classmates and teachers, poor nutrition (children faced with economic difficulties often rely on the affordable meals provided at school), and increased exposure to violence in an abusive home (19). Reports of domestic abuse are rising worldwide (20)—stress, the disruption of social and protective networks, and decreased access to services can exacerbate the risk of violence, especially for women and children (21). Finally, with hospitals not allowing visits to admitted patients and gatherings in funerals being restricted, the occurrence of complicated grief may become more likely (22).

On Healthcare Workers

With the increasing pressure on healthcare systems, medical workers around the world have been facing persistent psychological challenges, including high risk of infection (often derived from the lack of inadequate protection equipment), frustration, exhaustion, discrimination, isolation from their loved ones (23) or worry about infecting them (24), moral injury (25), and vicarious traumatization (26). Additionally, healthcare workers in Italy reported the emotional burden of communicating with relatives, especially when delivering bad news, as they became the only bridge between isolated patients and their families (27).

Several studies were conducted during the outbreak in China to assess the mental health of the medical staff: one study determined that several healthcare workers from a tertiary hospital were experiencing depressive symptoms and that there were no significant differences between staff in COVID-19 departments and other departments (28); a second study, also concerning medical staff from a tertiary hospital, found that the incidence of anxiety was 23.04%, the incidence of posttraumatic stress disorder was 27.39%, and that they were both higher in women and nurses (29); a third study led in multiple regions of China showed depression, anxiety, insomnia, and distress symptoms among medical workers, especially in women, nurses, and frontline workers (30); a fourth study found that the frontline medical staff were twice more likely to suffer from anxiety and depression than the nonclinical staff (31). Also, a previous review looking into the impact of the three coronavirus outbreaks on posttraumatic stress disorder symptoms in healthcare workers has identified several risk factors such as the rapidly increasing flow of critical patients requiring increased medical attention, the decision-making burden and high daily fatality rates, and the constant updates of hospital procedures following advances in knowledge about the disease, among others (32).

The psychological distress evidenced in healthcare professionals working against COVID-19 may influence their job performance, affecting their attention and decision-making ability, and may also disrupt their long-term mental health (23).

On Other Vulnerable Groups

There are some specific groups within the general population to which we should pay particular attention.

Depressive (33) and posttraumatic stress (34) symptoms are emerging among people affected by COVID-19, who may experience additional fear of the disease's consequences, loneliness, anger (35), and social stigma (36).

Older adults, being particularly affected by the fast spread and high mortality rate of the disease, are required to be more isolated from their families and social contacts, increasing the risk of developing or worsening psychiatric symptoms and further impairing their daily functioning and cognition (37).

People with underlying mental disorders may relapse or see their preexisting condition getting worse, especially with the current difficulties in attending regular outpatient appointments and treatments. Furthermore, cognitive impairment, lower personal protection and risk awareness, and confined conditions in psychiatric wards put these patients in higher risk of SARS-CoV-2 transmission (38).

Other vulnerable groups, including people experiencing homelessness (39), women suffering gender violence (40), racial and ethnic minorities (41), migrants (42), and sexual minorities (43), may also be at higher risk of suffering from psychological distress and psychiatric disorders during the pandemic.

STRATEGIES AND RECOMMENDATIONS

The abovementioned findings reflect the negative psychosocial impact of the COVID-19 outbreak and the importance of developing efficient mental health interventions at a governmental, institutional, and individual level to minimize the long-term consequences.

Governmental Action

Along with the measures taken to prevent SARS-CoV-2 transmission, it is fundamental for governments to develop and implement well-organized, coordinated, and structured nationwide interventions to mitigate the worrying public mental health impact of COVID-19, with the support of international health authorities and the research community (6).

First, it is crucial to provide the population with accurate, transparent, and up-to-date information about the pandemic situation and related decision-making, in order to increase public awareness, to reduce stress responses and indignation (9), and to counter the spread of misinformation.

Second, governments' mental health support strategy should include integration of hospital and community facilities and systematic identification of groups at risk of psychological distress to offer them early intervention, as seen in Singapore. Timely diagnosis and intervention can be better accomplished by sensitizing and educating nonpsychiatric medical teams toward mental health assessment and techniques (44). Suicide prevention services should be reinforced to provide phone or digital assessment and interventions to those who are at risk.

Third, as suggested in recent literature (15), additional measures are vital to prevent social instability and further psychological morbidity: financial and social support should be provided for those who have lost their income sources and are facing economic difficulties; community support should be established and encouraged; governments and educational institutions should create remote alternatives to in-person classroom teaching in order to prevent the interruption of the school year; and public health authorities should develop awareness campaigns against domestic violence and substance misuse. For countries that have implemented mandatory quarantine, this decision must be regularly assessed and not be maintained for longer than is strictly necessary (45).

The Use of Telehealth

Mental health services and practitioners are required to adapt to the new circumstances by developing ways of providing remote care to isolated patients. Nowadays, with technology, that task becomes easier. Through e-mail, phone, and video consultations, and even smartphone or online applications, telehealth can make psychological interventions widely available to the public (46, 47). Evidence shows that telemental health is particularly effective in the treatment of depression, anxiety, and posttraumatic stress disorder (47). In China, several online mental health services were developed, such as online counseling and self-help intervention systems and artificial intelligence programs (48).

Despite the huge increase of digital psychiatry during the COVID-19 pandemic, there are some concerns that should be highlighted: the use of technologies can be particularly challenging for older adults, who often lack smartphones, internet access or even the skills to reach those services (37); the number of evidence-based online interventions and applications is highly limited and there is a high risk of bias in available randomized controlled studies (49); and online interventions seem to not successfully replace face-to-face appointments (50).

The integration of technologies in psychiatry practice was significantly increased by the pandemic and hybrid interventions (combining face-to-face and online interventions) could be of critical interest in the future.

Self-Care Practices

The role of mental health practitioners includes providing psychoeducation to their patients, informing them about common and natural stress responses and teaching them some self-care practices (51). A Nature Career Column article points out seven self-care tips to help preserve our well-being during the COVID-19 pandemic: (a) managing expectations and learning to accept that low levels of concentration, motivation, and productivity during this time are normal; (b) practicing good sleep hygiene, eating healthy, and exercising; (c) identifying negative thoughts, feelings, sensations, and actions (e.g., constantly checking the latest COVID news and data) that may contribute to distress and overwhelm; (d) creating a daily routine, separating work time from leisure time; (e) being compassionate with ourselves and others; (f) maintain social contacts, using phone and video calls; and (g) focusing on the present and on things one can control—mindfulness and meditation can be useful (52).

As previously mentioned, research showed that regular physical activity is associated with better psychological outcomes during the COVID-19 outbreak (10, 12). Simple exercises can be performed at home during daily tasks (e.g., walking in the house and to the grocery store, lifting groceries, climbing stairs), with the guidance of internet videos, TV, or mobile apps (e.g., yoga, Pilates, toning workout) or even without external tools (e.g., sit-ups, push-ups, squats) (53).

Support for Healthcare Workers

Finally, there is an urgent need to address healthcare workers' mental health with early and adequate support measures, particularly from their peers, team leaders, and managers (25), such as normalizing stress and emotions, communicating clearly, fulfilling basic needs (including regular meals and proper rest), making working hours more flexible enabling sufficient work breaks, and providing psychological help (23, 24, 54).

Micropractices using mindfulness techniques in short periods during the work day contribute to self-awareness and can be a great tool to manage challenging emotions and thoughts in a busy environment, helping to prevent burnout. These micropractices include wellness self-checking, gratitude exercises, and diaphragmatic breathing (55).

DISCUSSION AND FINAL REMARKS

As the disease escalates, the fear of the unknown persists and holds its own negative consequences. Coupled with the imposed socioeconomic changes, the world population—particularly healthcare professionals and other vulnerable groups—is facing increased levels of stress, anxiety, depression, and other mental health disturbances that may impact long-term well-being, as some related conditions may even only arise later. Therefore, interventions for mental health assessment and support are essential during the current COVID-19 outbreak and also throughout the following months and even years: continued care and monitoring must be provided.

We depend on high-quality research to guide us in this battle against an unprecedented enemy and to teach us what could be done better in the future. As a final remark, we encourage researchers to gather quality data about the impact of COVID-19 and develop not only cross-sectional studies measuring immediate effects, but also longitudinal studies to assess long-term stress responses and to understand how the world is adapting.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

MP-P and PM designed the work. CS performed the literature review and wrote the first draft. All authors contributed to the article and approved the submitted version.

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BRIEF RESEARCH REPORT
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"Now It's Just Old Habits and Misery"–Understanding the Impact of the Covid-19 Pandemic on People With Current or Life-Time Eating Disorders: A Qualitative Study

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Background: Many aspects of the Covid-19 pandemic may make living with or recovery from an eating disorder (ED) particularly challenging. Understanding the processes which underlie the psychological and behavioral responses of people with EDs during this time are key to ensure tailored support in these unprecedented circumstances.

Methods: People with lifetime EDs ($n = 32$) were recruited through social media from May to June 2020 during a period of strict infection control measures in the United Kingdom (i.e., "lockdown," "social distancing"). They completed open-ended questions in an online anonymous questionnaire that invited them to reflect on how various aspects of their lives have been affected by the Covid-19 pandemic, including ED symptoms and coping strategies. Responses were analyzed using thematic analysis.

Results: Most respondents reported that their ED worsened or resurfaced. Isolation, low mood, anxiety, lack of structure, disruption to routines, and media/social media messages around weight and exercise seemed to contribute to this. There was a clear sense that individuals struggled with which aspects of psychological distress to prioritize, i.e., mood vs. ED cognitions and behaviors, particularly as attempts to cope with one often exacerbated the other. Nonetheless, some participants reported "silver linings" of the pandemic.

Conclusions: In this self-selected sample, deterioration or recurrence of ED symptoms were the norm. This has implications for the provision of treatment and care for people with EDs both in the immediate short-term and in potential future waves of the pandemic, with a significant surge of new and re-referrals expected.

Keywords: eating disorders, COVID-19, coronavirus, recovery, anorexia nervosa, social isolation

INTRODUCTION

The coronavirus (Covid-19) pandemic has had a universal impact on mental health (1, 2), with a general increase in psychological distress, anxiety, and poor sleep (3). For those with pre-existing mental health conditions, such as eating disorders (EDs), the effects may be particularly profound (4). Responses to the pandemic at both the governmental and public level may make living with or recovery from an ED particularly challenging, and there has been much discussion about potential impacts on those with EDs (5–9). Hypothesized risk factors specific to these individuals include social isolation, changes in access to food, media messages around weight, limits on exercise, and reduced access to healthcare (10). High levels of worry, rumination and difficulties tolerating uncertainty, previously reported in those with EDs [e.g., (11–13)], may also play a role at a time when general population anxiety is higher (14).

Initial evidence suggests the Covid-19 pandemic is exacerbating symptoms for 15–69% of those with EDs (15, 16). A study in recently treated patients with severe anorexia nervosa reported reduced access to services, change in community activities, and heightened ED symptoms as key factors underlying this deterioration (17). However, an in-depth understanding of the experiences and perspectives, including the perceived mechanisms underlying any symptom changes, of people with EDs in the community across diagnoses and at different stages of recovery is needed. As we move toward easing of restrictions, it will be important to fully understand how people have been affected, what this means for life after lockdown, and how to better prepare to mitigate the impact of potential future pandemic control measures. Therefore, using an online survey, this study investigated the unique experiences and perceptions of people with past or present EDs living in the UK during the Covid-19 pandemic and associated lockdown restrictions.

TABLE 1 | Participant demographics and clinical characteristics reported for the whole sample and also subdivided into those with a current eating disorder and those who identified as being in recovery/recovered.

	Whole sample (*n* = 32)	**Current ED (*n* = 14)**	**In recovery/ recovered (*n* = 18)**
Age (years) (*M* ± *SD*)	35.2 ± 10.3	36.5 ± 10.8	34.1 ± 10.2
Diagnosis (*n*, %)			
AN	23 (71.9)	9 (64.3)	13 (72.2)
BN	3 (9.4)	2 (14.3)	2 (11.1)
BED	1 (3.1)	1 (7.1)	-
Other	5 (15.6)	2 (14.3)	3 (16.7)
Duration of illness (years) (*M* ± *SD*)	15.3 ± 10.3	16.0 ± 12.5	14.7 ± 8.2
Gender (*n*, %)			
Female	30 (93.6)	13 (92.9)	17 (94.4)
Male	1 (3.1)	1 (7.1)	-
Prefer not to say	1 (3.1)	-	1 (5.6)
Ethnicity (*n*, %)			
White	32 (100)	14 (100)	18 (100)
Living arrangement (*n*, %)			
Alone	9 (28.1)	2 (14.3)	7 (38.9)
With others	23 (71.9)	12 (85.7)	11 (61.1)
Country (*n*, %)			
England	27 (84.4)	10 (71.4)	17 (94.4)
Wales	1 (3.1)	1 (7.1)	-
Scotland	3 (9.4)	2 (14.3)	1 (5.6)
Northern Ireland	1 (3.1)	1 (7.1)	-
EDE-Q Global score (*M* ± *SD*)	3.3 ± 1.5	4.2 ± 1.2	2.7 ± 1.3
DASS-21 Total score (*M* ± *SD*)	32.4 ± 16.8	41.6 ± 14.5	25.2 ± 15.1

ED, eating disorder; M, mean; SD, standard deviation; n, number; AN, anorexia nervosa; BN, bulimia nervosa; BED, binge eating disorder; EDE-Q, Eating Disorder Examination Questionnaire; DASS-21, Depression Anxiety and Stress Scales—Version 21.

MATERIALS AND METHODS

Ethical approval was granted by the King's College London Psychiatry, Nursing and Midwifery Research Ethics Subcommittees (Reference: LRS-19/20-18225).

Participants

Adults (≥17 years) based in the UK and with a current or previous ED were eligible to take part. Participants were invited via posts on Twitter that contained a hyperlink to the anonymous survey. Responses were collected between 7th May and 12th June 2020. In total, 77 people accessed the survey. Of these, 75 were eligible, 53 of whom provided informed consent, and 49 provided data. Thirty-two participants submitted their responses to qualitative questions and were included in analyses (see **Table 1** for participant demographics). In the whole sample ($n = 32$), 14 participants identified as having a current ED, 16 identified as in recovery, and two identified as recovered. Given the small sample of fully recovered participants, those in recovery and those recovered were grouped together for subgroup analyses.

Measures and Procedure

All participants provided informed consent before proceeding to the survey questions. They were then asked to provide demographic information, confirm their ED status (i.e., current/partial recovery/full recovery), and report relevant diagnoses and illness durations. Participants then completed the Eating Disorder Examination Questionnaire Version 6.0 [EDE-Q; (17)], a 28-item questionnaire assessing ED symptoms over the past 28 days. The EDE-Q contains four subscales (dietary restraint, eating concern, shape concern, weight concern) which combine into a global severity score (18). Participants also completed the Depression, Anxiety and Stress Scales–Version 21 [DASS-21; (19)], a 21-item questionnaire used to measure general psychopathology over the previous week. Each item is rated on a four-point scale from "did not apply to me," to "applied to me very much, or most of the time."

Finally, six open-ended questions asked individuals to describe their experience of the pandemic in their own words (**Figure 1**). Questions covered disordered eating behaviors

Finally, we would like you to tell us about your experiences during the coronavirus pandemic and associated lockdown in your own words. For the following questions, consider positive, negative, and neutral effects of the current situation.

How do you feel the coronavirus pandemic is affecting your eating disorder symptoms, behaviours, and thoughts, if at all? It may be helpful to consider your response in terms of eating difficulties, weight control/management behaviours, body image, exercise, and related thoughts and feelings.

How do you feel the coronavirus pandemic is affecting your ability to manage and cope with an eating disorder or recovery? For example, consider the impacts of new routines for school/college/university, work and home life, activity restrictions, meal planning, grocery shopping changes, etc.

How do you feel the physical (social) distancing and lockdown/isolation measures are affecting you during the coronavirus pandemic, if at all? If this is affecting you, can you explain or list in what ways? For example, consider the impact on your support network, social activities, social media and online socialising, and general contact with family, friends, and services, etc.

How do you feel the coronavirus pandemic is affecting your mood, anxiety, and stress levels, if at all? It may be helpful to consider your response in terms of whether they have improved, worsened, or stayed the same, and the possible reasons for this.

Are there any coping strategies that you are using during this coronavirus pandemic? If so, what are these coping strategies and how have they helped you?

Is there anything else about your experiences during this pandemic that you would like to mention?

FIGURE 1 | Open ended questions included in the survey.

and thoughts; their ability to cope with and manage ED symptoms/recovery; effects of lockdown measures; effects on mood, anxiety and stress levels; and coping strategies used during the pandemic. There was also space to report anything else that they would like to mention. All questions, except those checking eligibility criteria, were optional.

Data Analysis

Questionnaire responses were analyzed using thematic analysis, following the six phases described by Braun and Clark (20), taking an inductive approach. Analysis focused on understanding how aspects of the experience of the pandemic impacted upon people with past or present EDs to help inform support during and after the pandemic. Initial coding was conducted by one researcher (CM), with 30% of responses also coded by a second researcher (AA). Codes were developed through a process of line by line analysis, looking for concepts in the data related to the study aims and employing constant comparison across the dataset to see if these concepts recurred and/or formed patterns. A coding framework was developed on the basis of the first 15 responses and then applied to each and every response. Discussion of the coding framework and thematic development took place with three researchers reviewing the data (CM, AA, and BD), before discussion of the findings with the wider research team. Comparisons were made across recovery status (current or recovered/in recovery), but small diagnosis subgroups, other than for anorexia nervosa, prevented diagnosis subgroup comparisons.

TABLE 2 | Percentages of participants who referenced each theme.

Overarching themes		Sub themes	
Mechanisms contributing to ED exacerbation	88%	Isolation	66%
		Worry, rumination, and worsening anxiety and depression	81%
		Media impact	47%
		Structure and routine	69%
Positive aspects of life in lockdown	72%		

RESULTS

Two overarching themes were generated from the analysis—mechanisms contributing to ED exacerbation, and positive aspects of lockdown. Where there are clear differences in the experiences of current vs. in recovery/recovered participants, these are highlighted. Otherwise, the themes reflect experiences across diagnosis and recovery status. Following the title of each theme/subtheme and in **Table 2**, the percentage of participants (within the whole sample) who referenced that theme is given, as an indicator of the pertinence of the theme within this sample.

Mechanisms Contributing to ED Exacerbation (88%)

Distinct factors were identified by participants as directly contributing to deterioration in ED symptoms or relapse as a result of pandemic restrictions and associated changes in lifestyle. This theme consists of a number of subthemes, described below, that each contribute to the exacerbation of ED symptoms. Underlying this theme was the concept of balance and conflict: a constant struggle to balance coping with an ED or recovery while trying to effectively manage other aspects of life and mental health.

Isolation (66%)

The sense of physical and psychological isolation caused by lockdown measures affected ED symptoms in many ways. The lack of physical contact with and reassurance from others led to an increased sense of unease and difficulties in coping with ED cognitions–*"Video calls are not the same as a hug, or the reassurance of knowing my partner finds me attractive in my existing body, so it is easier to give in to the voices that say I need to drastically change"* (P12), *"I can't have a hug or hear and see them tell me I'm ok and safe when the eating disorder feels like it is winning"* (P1). Respondents reported that they had fewer distractions when staying at home (government-enforced lockdown) compared to in normal life, which led to an increase in rumination, ED thoughts and body-checking–*"More time alone to think about feelings/weight/food as unable to have usual social contact"* (P5), *"I definitely walk past the mirror more often and do some body checking"* (P2).

Many respondents reported that not seeing loved ones, or healthcare services in person made it easier to hide worsening ED symptoms and weight changes–*"It can be very easy to hide weight loss and how you are really feeling when not seen in person"* (P1). Participants also reported significant challenges and barriers associated with communicating solely through remote/virtual methods, such as finding it difficult to be honest through video or phone calls, feeling disengaged and more distant, and more prone to lie about their weight to their clinical team–*"My weight is now dropping and I have been told if it continues to drop I will have to go into hospital which I don't want so I am now basically giving a false weekly weight over the phone"* (P4). Although support was technically there, many responses suggested an awareness that isolation was increased by virtual communication–*"I find video calls can be quite draining and I find it hard to be honest about how I am feeling on them"* (P11).

There was a strong sense among participants that the ED voice (an internal critical voice that commentates on shape, weight, and eating) is in the background even in those long recovered, and that coping with an ED and/or maintaining recovery represent a continual effort to suppress this voice. Lack of distractions, competing voices, and in-person support were key contributing factors in making the ED voice more prominent and harder to resist: *"It's not like it ever really goes away but when I'm busy I'm able to distract from it more"* (P18), *"Not being able see family and friends is extremely difficult and makes it harder to tackle the 'voice' of anorexia when it appears"* (P13).

Balance between social activity and time for oneself was highlighted as a key issue, as most participants were living with others during the UK lockdown. For those who experienced changes in living situation due to the pandemic (e.g., previously living alone or with a different household), this was particularly challenging. Participants reported conflict around the need for space and privacy with the need for social support and contact. *"I'm feeling very bored and isolated - I'm normally very active but those things have shut down, and I dislike socializing online. I'm staying with family but finding myself becoming irritable and wanting space"* (P8).

The impact of isolation was referenced by many respondents as being difficult, and participants acknowledged that support from others, even across virtual platforms, has been essential in helping them cope. *"Reaching out to friends has helped a lot as I know others are struggling too and they can suggest things they are using to help"* (P14). Some also reported that trying to support others gave them a greater sense of purpose during lockdown–*"I also volunteer for a mental health charity so this has been good for my morale knowing I am helping in a small way"* (P22).

Worry, Rumination, and Worsening Anxiety and Depression (81%)

Participant responses shed light on how the interaction of depression and anxiety with ED symptoms had led to worsening overall psychological well-being during lockdown. Many reported that lack of enjoyable activities and social contact directly caused depressive symptoms–*"Without structure and focus (and meaning) of uni and friends and having a life that feels worth living, now it's just old habits and misery"* (P23). Several participants reported a subsequent increase in suicidal thoughts–*"Basically every day I wake up and I don't want to be here. I want to kill myself as most of the time I feel like there's no hope," (P4).*

For some, reduced stressors from normal life provided a relief from some anxiety, but the corresponding increase in mental space (i.e., time to think) worsened ED thoughts—*"The absence of usual stressors such as work has helped in a way but it's also caused eating disorder to increase in volume so it's a tricky one"* (P18). However, many people reported increases in generalized anxiety related to the global situation, including worries about work, family, friends, were reported to make tolerating anxiety around food harder, particularly in combination with having more time to ruminate than usual–*"The increase in general anxiety through the changes imposed on us has had the effect of raising the 'volume' of the voice inside me saying you can and can't have this or that to eat"* (P4). Generalized anxiety was one experience that seemed to differ between people in recovery/recovered and those with current EDs: higher levels of general anxieties were reported by the former group, particularly focused around work, family, and the general pandemic situation. Anxiety in the subgroup with a current ED was also high, but the content of reported worries tended to be more specifically associated with EDs.

A number of respondents also referenced anxiety around lockdown ending, with fear around a return to "normal" life and exposure to others' comments around their weight. For some, this was a source of internal conflict–"*I dread seeing people again and hearing them say that I've lost weight as a compliment and the horrible reinforcement of this battle in my mind, but I also fear that they won't say it*" (P19). Several participants referenced fear of their new-found balance being disrupted again as lockdown restrictions eased, with anxiety growing at the prospect of more changes–**"***When lockdown was more stringent my anxiety was better, but now it has relaxed a bit my anxiety has returned*" (P18).

Participants reflected that coping strategies that helped with depression and anxiety directly exacerbated ED symptoms. Several reported that exercise helped depression, but made ED symptoms worse–*"If I don't run I struggle to manage my mood, but if I do run it makes managing the eating symptoms harder"* (P8). Worsening depression lead to one participant being prescribed anti-depressants, which they were worried would lead to weight gain and were reluctant to take, highlighting the conflict associated with managing different aspects of mental health.

Media Impact (47%)

The negative impact of both social media and news coverage was referenced by many participants. Focus around lockdown weight gain/loss on social media was identified as something making it harder to ignore ED thoughts–*"There's a lot of diet talk and staying active in lockdown content all over social media. It's hard to ignore and not feel influenced"* (P28). UK Government advice on exercise made participants feel both pressured to exercise and guilty for not using their allowed exercise time, even when they knew this would be unhelpful for them–*"Started exercise as the Government advice kept talking about the importance of getting exercise even though I'm underweight. I was trying to be healthy and use it to help gain weight i.e., strength training... but now I feel I have to do it every day and am not taking rest days" (P29).* Media focus around exercise and compensating for food drove participants toward compulsive exercise–*"Without the constant daily exercise reminder I would never normally do any additional activity on days that I weight train"* (P28)–and strengthened ED-related thoughts—"*The news can make it seem dangerous to just eat, and I had only recently got to that point in recovery"* (P10).

Structure and Routine (69%)

Loss of control over day-to-day life caused by pandemic restrictions, contrasting with a need to maintain some sense of routine, impacted ED symptoms–*"I'm trying really hard not to set myself arbitrary rules around food to feel in control of SOMETHING during the pandemic"* (P19), "*I haven't had the external pressure to be flexible in my routine and therefore my restriction has become more rigid*" (P3). Increased free time presented another challenge in keeping ED behaviors at a healthy level for some, but for others this time allowed them to better focus on recovery-focused strategies *"I'm at home all the time so it's very easy to maintain a routine with meals"* (P8).

Disrupted routines meant finding a new balance, which proved challenging for many–*"It's made me realize that my structure and routine was keeping me safe and on track with recovery and now I've been forced to change my routine this has affected how I am managing recovery"* (P14).

Positive Aspects of Life in Lockdown (72%)

This theme reflects participants' resilience in finding good in difficult times, and highlights how some aspects of the pandemic have been helpful in managing a past or present ED.

While lockdown was experienced as negative by the majority of participants, many still found aspects of it that enhanced their well-being and/or tried to focus on positive impacts of life in lockdown, even those struggling with current EDs. Participants reported having more space and time for healing and self-care, with less time taken up by commuting and normal day-to-day activities—"*I'm furloughed so have had the mental space to acknowledge that I do actually have a problem. I have started recognizing my own ED thought patterns and behaviors and am working on challenging them"* (P28).

Having less pressure to engage in social activities and fewer worries around things such as shopping, events, meetings, and work, was experienced as positive by many, and lead to a sense of ease and comfort in time out to spend at home–*"I have framed this time as an opportunity to catch up on reading and movies I have missed. With this in mind, it is very easy not to be negatively affected*" (P22). Some reported that physical distance from friends, family, and colleagues had improved relationships, made them reach out more to others for support, and become more involved in their community–*"I can, and do, bring food to elderly friends and can generally be one of the people who are looking after others. So I guess in that sense the pandemic has some unexpectedly empowering aspects*" (P10). Several participants identified relief at the halting of normal life due to lockdown, particularly of social activities—*"I feel a reduction in guilt for being an introverted loner, it's ok to be antisocial now"* (P7).

For three (out of four) participants who reported an autism diagnosis, several aspects of lockdown were experienced as

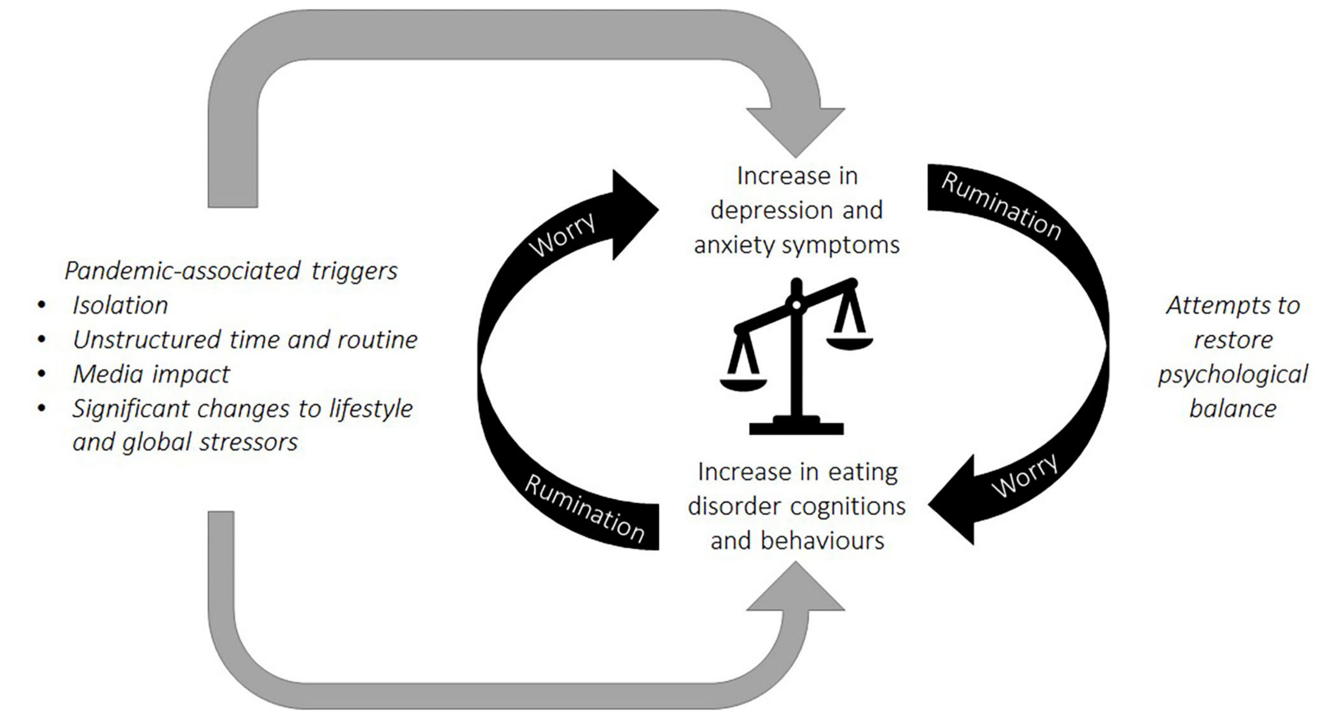

FIGURE 2 | A conceptual model based on the reported interplay of stressors and outcomes. Experiences during the pandemic, including isolation, disruption to routine, and media messages were associated with a worsening of ED cognitions and behaviors, alongside an increase in symptoms of depression and anxiety. Symptoms of general and ED-specific psychopathology interacted in a vicious cycle and worry and rumination served to maintain this. Coping strategies used in an attempt to manage depression and anxiety often conflicted with, and exacerbated, ED symptoms, and vice versa.

positive–*"Loving lockdown in many respects. Less people around and less cars and planes"* (P5), "*work from home finally is actually a big improvement to my everyday well-being and work stress*" (P19). The world seeming more peaceful and simple was also appreciated by many in the broader sample. Others referenced their life had not changed much through the pandemic, highlighting that not all experienced significant negative changes–*"I feel that one reason I'm not especially affected by lockdown is that the world has come to meet me in living a fairly minimalistic life. It's perhaps less of a change for me than for many others*" (P10).

DISCUSSION

Isolation, absence of valued elements of life, disruption to routine, and media triggers around the Covid-19 pandemic were seen as primary drivers of psychological distress in people with current and past EDs. Worries, rumination, and worsening anxiety and depression were identified as outcomes of Covid-19-related lifestyle changes, but also served as mechanisms contributing to ED deterioration in their own right. ED symptoms and depression and anxiety then appeared to interact in a vicious cycle, with worry and rumination seeming to play a key role in maintaining this. Attempts to manage depression and anxiety symptoms often conflicted with, and exacerbated, ED symptoms, and vice versa. Participants frequently reported that finding a balance between coping mechanisms was difficult to manage, which lead to increased feelings of guilt, shame, and depression. The observed interactions between factors impacting on distress, depression and anxiety, and ED symptoms are illustrated in **Figure 2**. Our findings add context to themes recently identified by individuals with EDs during the pandemic [e.g., (16, 21)], and highlight the universality of challenges experienced across ED diagnoses and stages of recovery during the pandemic. The findings also illustrate the additional burden of having pre-existing mental health conditions during a time of increased anxiety and depression among the general population (22, 23).

Difficulties around balancing conflicting priorities were experienced in a variety of ways by all participants, highlighting the psychological effort involved in managing an ED or maintaining recovery. Profound changes to daily life caused by the Covid-19 pandemic may have unbalanced psychological homeostasis in many people, resulting in attempts to restore equilibrium and reduce feelings of unrest (24). The findings support this idea, as participants seem to be striving toward psychological balance through the use of familiar adaptive and maladaptive (i.e., eating pathology, rumination) coping mechanisms, and through forming new routines to compensate for disruption of long-established routines. Challenges with this were experienced to a similar extent in both those recovered from or with a current ED. A prominent conflict described by respondents was of balancing the need for temporary relief from depression and anxiety, through behaviors such as binge eating and excessive exercise, with awareness of the negative impact of these on EDs. A harm reductionist approach, i.e., implementing practical strategies to reduce the damage to physical and mental health, as opposed to the traditional approach of promoting abstinence from ED behaviors, may be appropriate for some individuals during Covid-19 (25).

Isolation and unstructured time affected participants in many ways, and resulted in the ED voice becoming more prominent and harder to resist. Experience of the ED voice has been shown to influence ED pathology [e.g., (26)], such that a stronger ED voice has been associated with more severe ED psychopathology (27). This was reflected in the worsening of ED symptoms reported by the majority of participants, which is consistent with research showing that social support is an important factor in managing ED recovery (28, 29). Alongside physical isolation and increased volume of the ED "voice," difficulties around virtual communication (e.g., feeling distant, easier to be disengaged) lead to participants feeling that they lacked meaningful support. This made it easier for participants to hide worsening ED symptoms and weight changes from loved ones and clinical teams. Given the accelerated the drive toward virtual treatment and support, this may have important implications for online treatment (9).

Both people recovered from and with current EDs reported positive experiences, or "silver linings", associated with pandemic control measures, including more time for self-care and reduced social pressure. This active attempt to regulate emotion by cognitively reappraising an adverse experience (i.e., find "silver linings") is not typically associated with EDs (30). High rates reported here, therefore, speak to the active effort of participants to cope. However, given the challenges faced in this pandemic, these attempts do not appear to have had significant impacts on overall well-being. The current study suggests an even greater need for support and services for those with EDs, as they appear to still be experiencing a high level of symptomatology despite active attempts to combat this. The impact of the pandemic among those with EDs will extend beyond dates of lockdown restrictions, and the findings of this study highlight some areas for future investigation and support.

STRENGTHS AND LIMITATIONS

A key strength of this study is that it illustrates the difficulties experienced during the pandemic that appear applicable across ED type and recovery status. Asking detailed questions about experiences and enabling participants to respond in writing in their own time has provided rich and thoughtful responses, where participants have taken care to illustrate the many conflicting facets of their experiences. However, the sample is not representative of ethnic and gender diversity, and the recruitment strategy may have excluded people with limited access to internet, or who do not use social media. The small sample prevented subgroup analysis across diagnoses, which may have provided further insight into the commonalities and differences of experience across ED types. Additionally, findings cannot necessarily be generalized to other countries, as research by Termorshuizen et al. (16) has shown that experiences differ between countries, which may be an effect of differences in countries' responses to the pandemic. While the study only captures experiences at one point in time, thereby limiting understanding of how experiences may have changed over time, it provides a valuable basis for future investigations into the impact of the pandemic on people with past or present EDs.

CONCLUSIONS

In this self-selected sample, deterioration or recurrence of ED symptoms were the norm. By identifying the key challenges experienced by people with past or present EDs during the lockdown phases of the pandemic, we have been able to highlight which aspects of this have been most impactful, and how this has contributed to ED symptom exacerbation and relapse. This has implications for the provision of treatment and care for people with EDs currently and also in future waves of the pandemic. ED services need to prepare for a significant surge of new and re-referrals, and to support patients with balancing the many aspects of mental health that have been negatively affected by the Covid-19 pandemic.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by King's College London Psychiatry, Nursing and Midwifery Research Ethics Subcommittees. Written informed consent from the participants' legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

CM, AA, BD, VL, and US contributed to conception and design of the study. CM, AA, and BD performed the data analysis. CM and AA wrote the first draft of the manuscript. All authors contributed to the article and approved the submitted version.

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A Cross-Sectional Study of Psychological Status in Different Epidemic Areas in China After the COVID-19 Outbreak

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Background: The outbreak of coronavirus disease 2019 in Wuhan, Hubei Province, China has seriously affected people's mental health. We aimed to assess the psychological impact of the coronavirus disease 2019 on health care workers and non-health care workers in three different epidemic areas in China and to identify independent risk factors.

Methods: We surveyed 1,020 non-health care workers and 480 health care workers in Wuhan, other cities in Hubei except Wuhan and other provinces in China except Hubei.

Results: Health care workers in Hubei had higher levels of anxiety and depression than non-health care workers ($p < 0.05$), but there was no such difference in other provinces in China except Hubei ($p > 0.05$). Compared with other regions, health care workers in Wuhan was more anxious ($p < 0.05$), and this anxiety may be caused by concerns about occupational exposure and wearing protective clothing for a long time daily; health care workers in Hubei had more obvious depression ($p < 0.05$), which may be associated with long days participating in epidemic work and wearing protective clothing for a long time daily. Meanwhile, 62.5% of health care workers were proud of their work. The anxiety and depression of non-health care workers in Wuhan were also the most serious.

Conclusions: In Wuhan, where the epidemic is most severe, levels of anxiety and depression seem to be higher, especially among health care workers. This information may help to better prepare for future events.

Keywords: COVID-19, depression, anxiety, psychological stress, health care workers

INTRODUCTION

In December 2019, a new type of coronavirus disease 2019 (COVID-19) appeared in Wuhan and spread rapidly domestically and internationally, posing a global health emergency. As of March 7, 2020, more than 80,000 people in China have been diagnosed with COVID-19, and more than 100,000 people worldwide have been diagnosed. Confirmed cases have been reported in all provinces of China. The growing number of confirmed and suspected cases, as well as the geographical spread of the disease, has raised public concern about infection, triggering public panic and psychological stress (1, 2).

Studies have shown that the public exhibited significant mental disorders such as fear, stress, sleep disorders, anxiety, and depression during the COVID-19 epidemic (3). Based on experiences of severe acute respiratory syndrome (SARS), it was suggested that these psychological problems were closely related to the severity of the epidemic (4). The stress effects of infectious diseases may be qualitatively distinct from those of other disasters, especially for health care workers (HCWs) (5). HCWs, overworked at the front line, have a high risk of occupational exposure and infection (6). Infection rates among HCWs in various countries during SARS ranged from 3 to 51% (7). As of February 17, 2020, Chinese officials reported that more than 3,000 HCWs had been infected with COVID-19. Another important reason for the psychological burden on HCWs is the greater fear of their family members being at a higher risk of infection (8–11). Therefore, when new epidemics break out, HCWs often suffer from huge psychological health problem, such as anxiety and depression (12, 13).

The psychological disorder is not only a temporary process and it may persist for a few years after the epidemic ends (14). Therefore, in addition to identify pathogenic factors, pathophysiology, clinical manifestations, diagnosis and treatment, it is also important to study the impact of COVID-19 outbreak on people's mental health. Understanding the psychological impact during an outbreak, such as anxiety levels, can not only help predict key behavioral outcomes (e.g., wearing a face-mask) (4), but may also have important implications for future psychological and behavioral research and public health interventions related to respiratory communicable diseases. Although there has been some research in this area, we have also studied the psychological conditions of the general public and HCWs in three different epidemic areas in China during the outbreak period. Specifically, this study investigated the levels of anxiety and depression of HCWs and non-HCWs, determined the impact of the severity of the epidemic on people in corresponding regions (The epidemic is worst in Wuhan, followed by other cities in Hubei except Wuhan, and the situation in other provinces in China except Hubei are better than these two regions), and evaluated the work perceptions of HCWs.

METHODS

Participants

People aged 18 or above from all walks of life in Wuhan, other cities in Hubei except Wuhan, and other provinces in China except Hubei were welcome to join in the survey. Other cities in Hubei except Wuhan include 12 cities, autonomous prefecture in Hubei. Other provinces in China except Hubei include 30 provinces, autonomous regions and municipalities in the mainland of China. The classification was based on their geographic location, which was also closely related to the severity of the epidemic (e.g., Wuhan, other regions inside Hubei Province, and regions outside Hubei Province). The sample size was calculated to be 1,568. All participants are divided into HCWs (i.e., doctors and nurses) and non-HCWs (Others except doctors and nurses). Sociodemographic characteristics including name, gender, age, education level, occupation, annual family income, type of medical insurance, household registration location, current city.

Data Collection

The questionnaire was collected through social media WeChat (15) (Tencent, Shenzhen, China) using an online survey platform Sojump (Changsha ran Xing InfoTech Ltd.,) during February 6th to 13th, 2020, when the epidemic was in the outbreak period, the situation was chaotic (16–18) and the number of people infected with COVID-19 was escalating. The convenience sampling was adopted. After the researchers explained the purpose of the study, 1,568 volunteers completed the questionnaire-based surveys, of which 1,500 were valid. Among the three regions, there were 1,020 questionnaires for non-HCWs and 480 questionnaires for HCWs. Each person can only answer one questionnaire. Sojump APP can set the number of answers, which can be set as each WeChat account is only allowed to answer once, and each IP is only allowed to answer once. Informed consent is exempt. Ethical approval was received from the Institutional Review Board (IRB) of the University of Huazhong university of science and technology. The ethical number is TJ-IRB20200322.

Basic Information Survey

A self-designed questionnaire was used to determine the relevant factors. Basic information about COVID-19 including the degree of attention to the COVID-19, whether relatives or friends have the COVID-19, and the current status (healthy home quarantine, suspected isolation, mild illness isolation, fever outpatient service, hospitalization, square cabin hospital). For HCWs, we added some additional items that can reflect their occupational exposure risk, work intensity, worries and current thoughts about their occupation, including operating post (fever outpatient service, inpatient department, square cabin hospital, others), the number of days participating in epidemic work, rest days in the past month, the average working hours per week, daily wear protective clothing time (hours), whether you are worried about occupational exposure (none, occasionally, often), whether you are worried about your family's cross-infection because of you, and the main feelings about your career (pride, fear, pessimism, it doesn't matter).

Anxiety and Depression Status Assessment

The assessment scale was composed of the Hamilton Anxiety Rating Scale (HAMA; Hamilton, 1959) and Hamilton Depression Rating Scale (HAMD; Hamilton, 1960), both of which had high reliability reported in the literature (the reliability of HAMA ranged between 0.82 and 0.94; the reliability of HAMD ranged between 0.81 and 0.98) (19–21). In this study, HAMA and HAMD also showed good internal consistency, with Cronbach's α coefficients of the total scale being 0.94 and 0.90 respectively. HAMA includes 14 items, each with 0～4 points, corresponding to asymptomatic, mild, moderate, severe, and extremely severe. Total score $\geq$ 29 points, there may be severe anxiety; Total score 21～28 points, there must be significant anxiety; Total score 14～20 points, there must be anxiety; Total score 7～13 points, there may be anxiety; Total score $<$ 7 points, no anxiety symptoms. HAMD includes 24 items, a score of 0 in each item

TABLE 1 | Sociodemographic characteristics.

	HCWs	non-HCWs	*p*
Sex, *n* (%)			<0.05
Female	394(82.08)	628(61.57)	
Male	86(17.92)	392(38.43)	
Age	35.29 ± 8.85	31.87 ± 11.25	<0.05
Education, *n* (%)			<0.05
Bachelor degree or above	398(82.92)	446(43.73)	
Junior college or technical secondary school	82(17.08)	524(51.37)	
HAMA	4.30 ± 5.95	3.29 ± 5.92	<0.05
HAMD	8.19 ± 7.97	6.35 ± 7.93	<0.05

TABLE 2 | Comparison of anxiety among HCWs and non-HCWs.

	N	Composition of HAMA *n* (%)				
		<7	7∼13	>14	χ^2	*p*
All samples	1,500	1206(80.4)	199(13.27)	95(6.33)		
HCWs	480	364(75.83)	78(16.25)	38(7.92)		
non-HCWs	1,020	842(82.55)	121(11.86)	57(5.59)	9.36	<0.05
Wuhan						
HCWs	134	83(61.94)	32(23.88)	19(14.18)		
non-HCWs	208	157(75.48)	34(16.35)	17(8.17)	7.32	<0.05
Other cities in Hubei except Wuhan						
HCWs	207	161(77.78)	33(15.94)	13(6.28)		
non-HCWs	361	310(85.87)	34(9.42)	17(4.71)	6.40	<0.05
Other provinces in China except Hubei						
HCWs	139	120(86.33)	13(9.35)	6(4.32)		
non-HCWs	451	375(83.15)	53(11.75)	23(5.10)	0.81	>0.05

represents no symptoms. Total score > 35: major depression; Total score 21∼35: definitely having depression; Total score 8∼20: possible depression; Total score < 8, normal.

Statistical Analysis

All statistical analyses were conducted using SPSS 19. The measurement data are expressed as mean ± standard deviation, independent sample *t*-test was used for comparison between the two groups. The counting data were represented by the number of cases (%), and the comparison was tested using χ^2. Finally, the risk of anxiety and depression was further analyzed by multivariate logistic regression (using likelihood ratio estimation). Two-sided test with $p < 0.05$ was considered statistically significant.

RESULTS

Sociodemographic Characteristics

Table 1 shows the main demographic characteristics of the participants and their scores on measures of anxiety and depression. A total of 1,568 questionnaires were collected, of which 1,500 were valid and the effective rate was 95.66%. Among them, female accounted for 82.08% of HCWs and 61.57% of non-HCWs. The mean age of HCWs and non-HCWs were 35.29 ± 8.85 years and 31.87 ± 11.25 years, respectively. The education levels of HCWs were Bachelor degree or above (82.92%) and Junior college or technical secondary school (17.08%). The education level of non-HCWs were Bachelor degree or above (43.73%) and Junior college or technical secondary school (51.37%), the other 4.9% including primary, middle and high school. The average HAMA scores for HCWs and non-HCWs were 4.30 ± 5.95 and 3.29 ± 5.92, and the average HAMD scores for HCWs and non-HCWs were 8.19 ± 7.97 and 6.35 ± 7.93.

Anxiety

In general, HCWs were more anxious than non-HCWs ($\chi^2 = 9.36$, $p < 0.05$, **Table 2**). HAMA score less than 7 is considered to have no anxiety, accounting for 75.83% in HCWs and 82.55% in non-HCWs. Similarly, in Wuhan ($\chi^2 = 7.32$, $p < 0.05$) and other cities in Hubei except Wuhan ($\chi^2 = 6.40$, $p < 0.05$), HCWs was also more anxious than non-HCWs (**Table 2**). But in other provinces in China except Hubei, there was no significant difference in anxiety levels between HCWs and non-HCWs ($\chi^2 = 0.81$, $p > 0.05$, **Table 2**).

The anxiety levels of HCWs in other cities in Hubei except Wuhan ($\chi^2 = 10.95$, $p < 0.05$) and other provinces in China except Hubei ($\chi^2 = 21.44$, $p < 0.05$) were significantly lower than that in Wuhan, but there was no significant difference in HCWs anxiety levels between other cities in Hubei except Wuhan and other provinces in China except Hubei ($\chi^2 = 4.05$, $p > 0.05$, **Table 3**). Different from HCWs, although the anxiety level of non-HCWs in Wuhan was higher than that in other cities in Hubei except Wuhan ($\chi^2 = 9.69$, $p < 0.05$), it was not significantly higher than that in other provinces in China except Hubei ($\chi^2 = 5.53$, $p > 0.05$). Moreover, there was no significant difference between other cities in Hubei except Wuhan and other provinces in China except Hubei ($\chi^2 = 1.26$, $p > 0.05$, **Table 3**).

Next, we explored the reasons for the different anxiety levels of HCWs in different regions. We used the multivariable logistic regression analysis to test the variables of sex, age, whether you often worry about occupational exposure, whether you are worried about your family's cross-infection because of you, daily wearing protective clothing time (hours) and participation in epidemic work(days). It was found that whether you often worry about occupational exposure (OR 2.833; 95% CI 1.274–6.298) and daily wearing protective clothing time (hours) (OR 1.086; 95% CI 1.034–1.140) were the independent risk factors (<0.05) (**Table 4**).

Depression

Compared with non-HCWs, HCWs showed significant depression ($\chi^2 = 36.03$, $p < 0.05$, **Table 5**). Similar to the anxiety condition, the depression levels of HCWs were more serious than that of non-HCWs in Wuhan ($\chi^2 = 9.67$, $p < 0.05$) and other cities in Hubei except Wuhan ($\chi^2 = 30.52$, $p < 0.05$). There was no significant difference between other cities in Hubei

TABLE 3 | Comparison of anxiety in different areas.

	N	Composition of HAMA *n* (%)						
		<7	7~13	>14	χ^2	*P**	χ^2	*P#*
HCWs								
Wuhan	134	83(61.94)	32(23.88)	19(14.18)				
Other cities in Hubei except Wuhan	207	161(77.78)	33(15.94)	13(6.28)	10.95	<0.05*		
Other provinces in China except Hubei	139	120(86.33)	13(9.35)	6(4.32)	21.44	<0.05*	4.05	>0.05
non-HCWs								
Wuhan	208	157(75.48)	34(16.35)	17(8.17)				
Other cities in Hubei except Wuhan	361	310(85.87)	34(9.42)	17(4.71)	9.69	<0.05*		
Other provinces in China except Hubei	451	375(83.15)	53(11.75)	23(5.10)	5.53	>0.05	1.26	>0.05

P compared with Wuhan, P# comparison between other cities in Hubei except Wuhan and other provinces in China except Hubei.*

TABLE 4 | Risk of anxiety: logistic regression analysis.

Variable	OR (95% CI)	*p*
Male	1.254 (0.455–3.460)	0.662
Age	1.006 (0.964–1.050)	0.784
Whether you often worry about occupational exposure (yes)	2.833 (1.274–6.298)	0.011
Whether you are worried about your family's cross-infection because of you (no)	0.272 (0.035–2.116)	0.214
Daily wear protective clothing time (hours)	1.086 (1.034–1.140)	0.001
Participation in epidemic work(days)	1.012 (0.985–1.039)	0.397

OR, odds ratio; CI, confidence interval.

TABLE 5 | Comparison of depression among HCWs and non-HCWs.

		Composition of HAMD *n* (%)				χ^2	*p*
	N	<8	8~20	21~35	>35		
All samples	1500	1036(69.07)	343(22.87)	103(6.87)	18(1.20)		
HCWs	480	288(60.00)	142(29.58)	48(10.00)	2(0.42)		
non-HCWs	1020	748(73.33)	201(19.71)	55(5.39)	16(1.57)	36.03	<0.05
Wuhan							
HCWs	134	65(48.51)	45(33.58)	24(17.91)	0(0.00)		
non-HCWs	208	125(60.10)	56(26.92)	22(10.58)	5(2.40)	9.67	<0.05
Other cities in Hubei except Wuhan							
HCWs	207	119(57.49)	68(32.85)	19(9.18)	1(0.48)		
non-HCWs	361	282(78.12)	59(16.34)	15(4.16)	5(1.39)	30.52	<0.05
Other provinces in China except Hubei							
HCWs	139	104(74.82)	29(20.86)	5(3.60)	1(0.72)		
non-HCWs	451	341(75.61)	86(19.07)	18(3.99)	6(1.33)	0.56	>0.05

except Wuhan and other provinces in China except Hubei ($\chi^2 = 0.56$, $p > 0.05$, **Table 5**).

Further analysis showed that, among the three regions, HCWs in Wuhan ($\chi^2 = 25.82$, $p < 0.05$) and other cities in Hubei except Wuhan ($\chi^2 = 11.95$, $p < 0.05$) had significant differences in depression levels compared with those in other provinces in China except Hubei (**Table 6**). Unlike anxiety, non-HCWs in other cities in Hubei except Wuhan ($\chi^2 = 22.45$, $p < 0.05$) and other provinces in China except Hubei ($\chi^2 = 20.07$, $p < 0.05$) had lower depression levels than those in Wuhan. There was no difference between other cities in Hubei except Wuhan and other provinces in China except Hubei ($\chi^2 = 1.02$, $p > 0.05$, **Table 6**).

Finally, we explored the causes of different levels of depression in HCWs in different regions. It was found that daily wearing protective clothing time (hours) (OR 1.100; 95% CI 1.040–1.163) and participation in epidemic work(days) (OR 1.030; 95% CI 1.006–1.054) were the independent risk factors (**Table 7**).

DISCUSSION

At the end of 2019, the outbreak of COVID-19 swept China and affected the whole world. Due to the severe situation of the epidemic, it was listed as a public health emergency of international concern (PHEIC) by WHO on January 30, 2020 (22). In China, people's normal work and life were interrupted, all residents were quarantined at home, the situation was chaotic and China was pressed the pause button. There was a widespread feeling of perceived life threat, extreme vulnerability, uncertainty and helplessness at that time. This fear spread within the public and also the hospitals, causing panic. As with any disaster, the influence and trauma of COVID-19 outbreak will lead to anxiety and depression, the overall levels of anxiety and depression obtained in this study were similar to the results of other studies (23, 24). Furthermore, we found that HCWs in Wuhan and other cities in Hubei except Wuhan had higher levels of anxiety and depression than non-HCWs, but there was no such difference in other provinces in China except Hubei. Compared with the other two regions, the HCWs in Wuhan was more anxious, and this anxiety might be caused by concerns about occupational exposure and wearing protective clothing for a long time daily. Compared with other provinces in China except Hubei, HCWs in the remaining two regions had more obvious depression, which might be associated with long days participating in epidemic

TABLE 6 | Comparison of depression in different areas.

	N	Composition of HAMD n (%) <8	8∼20	21∼35	>35	χ^2	p*	χ^2	p#
HCWs									
Wuhan	134	65(48.51)	45(33.58)	24(17.91)	0(0.00)				
Other cities in Hubei except Wuhan	207	119(57.49)	68(32.85)	19(9.18)	1(0.48)	6.79	>0.05		
Other provinces in China except Hubei	139	104(74.82)	29(20.86)	5(3.60)	1(0.72)	25.82	<0.05*	11.95	<0.05#
non-HCWs									
Wuhan	208	125(60.10)	56(26.92)	22(10.58)	5(2.40)				
Other cities in Hubei except Wuhan	361	282(78.12)	59(16.34)	15(4.16)	5(1.39)	22.45	<0.05*		
Other provinces in China except Hubei	451	341(75.61)	86(19.07)	18(3.99)	6(1.33)	20.07	<0.05*	1.02	>0.05

P compared with Wuhan, P# comparison between other cities in Hubei except Wuhan and other provinces in China except Hubei.*

TABLE 7 | Risk of depression: logistic regression analysis.

Variable	OR (95% CI)	p
Male	1.433 (0.563–3.651)	0.450
Age	0.996 (0.957–1.036)	0.826
Whether you often worry about occupational exposure (yes)	1.587 (0.816–3.086)	0.173
Whether you are worried about your family's cross-infection because of you (no)	0.350 (0.079–1.543)	0.165
Daily wear protective clothing time (hours)	1.100 (1.040–1.163)	0.001
Participation in epidemic work(days)	1.030 (1.006–1.054)	0.012

OR, odds ratio; CI, confidence interval.

work and wearing protective clothing for a long time daily. Meanwhile, 62.5% of HCWs were proud of their work. The anxiety and depression of non-HCWs in Wuhan were also the most serious.

We assessed both anxiety and depression levels in HCWs and non-HCWs. The results suggest that HCWs are worse off than non-HCWs in both anxiety and depression. This is not hard to predict, as the burden on HCWs is greater, they faced high risk of infection, insufficient contamination protection, overwork, negative emotions from patient, exhaustion, discrimination, isolation, etc. (18, 25, 26). A literature review concluded that rescue workers have a higher incidence of post-traumatic stress disorder (PTSD) than the general population (27). In the early stages of the epidemic, the HCWs faced the uncertainty of encountering an undiagnosed COVID-19 patient every day, and there was no awareness of the need for systemic protection. When the epidemic broke out in full, the HCWs worked at the front line, and medical staff and resources were insufficient, their work intensity was high (28). As a result, both the occupational exposure and the risk of infection have greatly increased. Coupled with the fear of cross-infection among family members due to them, their psychological burden is heavier and pressure is greater. In addition, the differences in anxiety and depression levels between HCWs and non-HCWs in the three regions also implies that HCWs in Hubei are under more pressure and that the epidemic situation in Hubei is more serious which is consistent with the reality. The existing research has rarely investigated psychological status of HCWs and non-HCWs in Wuhan, other regions inside Hubei Province and regions outside Hubei Province during the COVID-19 outbreak (5, 12).

In order to clarify whether there is a difference in the psychological state of HCWs in different epidemic regions, we discussed the anxiety and depression of HCWs in Wuhan, other cities in Hubei except Wuhan and other provinces in China except Hubei. Our results suggest that during the outbreak of COVID-19 in mainland China, HCWs in high risk areas may have a higher prevalence of anxiety and depression. A study involving 34 hospitals showed that health care workers in Wuhan had more serious psychological problems (12). Other studies had also found that the proportion of frontline medical workers with anxiety and depression was significantly higher (29, 30). A recent comparative study showed that, at a time when confirmed COVID-19 cases rose sharply in Hong Kong and the epidemic in Hubei was under control, the prevalence of depression among health workers in Hong Kong (50.4%) were more severe than in Hubei province (15.1%) (25). It should be noted that the mental problems of both HCWs and general population in Hong Kong were reported to be exceptionally high (31). Since the performance of depressive symptoms is affected by comprehensive and complex internal and external factors, this discrepancy may due to the differences of regions, time points of the research, evaluation scales or sample sizes. Study on SARS have also shown that high-risk HCWs experience fatigue and poor sleep, worrying about health, accompanied by increased depression, anxiety, and post-traumatic stress scores (32). Moreover, we found that non-HCWs in Wuhan had a higher level of severe anxiety than other cities in Hubei except Wuhan, and a higher proportion of depression than the remaining two regions. In general, anxiety and depression levels among HCWs and non-HCWs in Wuhan, where the epidemic was most severe, were higher than elsewhere. Our conclusions were supported by a longitudinal study, which found that during SARS, anxiety levels were strongly correlated with the severity of the epidemic and closely mirrored the number of new cases per day (4, 25, 33, 34).

Then, we assessed the perception of job among HCWs during the COVID-19 epidemic and the risk factors that caused different levels of anxiety and depression for HCWs in different regions were discussed. It was found that whether you often worry about occupational exposure and daily wear protective clothing time (hours) exerted significant independent effects for anxiety, and participation in epidemic work (days) and daily wear protective clothing time (hours) exerted significant independent effects for depression. Sex, age, and whether worried about family's cross-infection had no effect on the joint analysis. Fear of occupational exposure is a direct cause of anxiety. This not only increases their own risk of infection, but also threatens the health of their families. Wearing protective clothing for a long time daily reflects the high work intensity of HCWs, as well as an increased risk of infection, which not only causes anxiety but also induces depression. It is suggested that HCWs should not work too many hours a day (18, 26). The results also indicate that depression is directly related to long-term participation in epidemic work. In our survey, 86.57% of HCWs in Wuhan, 89.37% of HCWs in other cities in Hubei except Wuhan, and 71.22% of HCWs in other provinces in China except Hubei were worried about their family's cross-infection because of them. Given the high infectivity of the virus and its transmission through respiratory droplets and close contact, fear of inadvertently endangering members of family and loved ones was a widespread concern among HCWs (8). The HCWs were torn between their own responsibilities and this concern. Although the work of HCWs is high-risk, fortunately, we find that 62.5% of HCWs are proud of their work.

The study's discussion of causation is limited by its cross-sectional nature. A further methodological limitation is the possible social expectation bias because of the use of self-report to assess psychiatric morbidity, some people may be inclined to underreport their psychopathology to avoid discrimination. We also cannot rule out the possibility that people with severe anxiety or depression was under-represented. Pre-COVID-19 anxiety and depression were not collected for HCWs and non-HCWs, so it was not possible to compare mental states before and after the outbreak. Finally, all residents in China are quarantined at home, so generalizations of our findings are limited, it may not apply to other countries. It would be meaningful to study the mental health status of HCWs and non-HCWs in different geographic regions at the beginning of the epidemic, the peak period, the remission period, and longer afterwards. Longitudinal studies with larger sample size are encouraged in future studies to conduct a more comprehensive assessment of this issue.

Despite these limitations, it is clear that HCWs, especially in Wuhan, have serious mental health problems. It is necessary to take relevant measures to treat or manage public anxiety and depression, for it may have a lasting effect after the epidemic ends (14). What's more, improving the psychological health of HCWs is of great significance for maintaining their physical health, keeping higher efficiency and working state, and controlling the epidemic (35, 36). The Chinese government has made some policies to address these psychological health problems and pay close attention to the psychological health of HCWs, such as caring for the elderly and children of HCWs to solve their worries, establishing a shift system so that front-line HCWs can take turns to rest, providing a professional psychological counseling platform, opening a public psychological hotline, and setting up psychological intervention teams to conduct psychological intervention and guidance to the masses through social platforms such as WeChat groups, etc.

In summary, when a new infectious disease breaks out, health care workers, especially where the epidemic is more severe, may bear heavier workloads and higher levels of anxiety and depression. Understanding the mental health response of COVID-19 may help prepare for future outbreaks of infectious diseases and improve the efficiency and quality of future crisis interventions.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Institutional Review Board (IRB) of Huazhong University of Science and Technology. Written informed consent from the participants was not required to participate in this study in accordance with the national legislation and the institutional requirements. The purpose and use of this research were explained at the beginning of the online questionnaire. All the participants provided online informed consent before entering the online questionnaire.

AUTHOR CONTRIBUTIONS

HC, GL, and FW designed the study. JL, LL, JZ, YH, CZ, and SH collected data. CZ and YH analyzed the data. FW and YJ administered the project. HC and CZ writing – original draft preparation. FW and GL writing – review & editing. YJ and FW funding acquisition. All authors read and approved the final manuscript.

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Mental Well-Being During Pandemic: The Role of Cognitive Biases and Emotion Regulation Strategies in Risk Perception and Affective Response to COVID-19

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Both cognitive appraisals of risks associated with the specific disease and affective response to crisis situations have been shown to shape an individual response to pandemics. COVID-19 pandemic and measures introduced to contain it present an unparalleled challenge to mental well-being worldwide. Here, we examine the relationship between self-reported cognitive biases (CB) and emotion regulation skills (ER), COVID-19 risk perception and affective response, and mental well-being (MWB). Five Hundred and Eleven individuals completed General Health Questionnaire, Emotion Regulation Questionnaire, Davos Assessment of Cognitive Biases Scale (DACOBS) as well as scales measuring COVID-19 risk perception and affective response during the initial days of the epidemic in Poland. We used path and bootstrapping analyses to examine the hypothesis that CB may shape MWB during COVID-19 pandemic both directly and indirectly by (i) decreasing ER capacity and (ii) by increasing COVID-19 risk perception and affective response. Negative effect of CB and positive effect of ER via cognitive reappraisal on MWB were observed in participants. Furthermore, in line with our hypothesis, we observed indirect effects of CB via increased COVID-19 risk perception and affective response and decreased use of reappraisal strategy, which all, in turn, were related to MWB. Finally, we found an indirect effect of CB on MWB through double mediation of suppression strategies and COVID-19 affective response. Results of the current study suggest that CB, which have been shown to be linked to a variety of mental health symptoms in non-clinical populations, may exacerbate the impact of the COVID-19 pandemic on mental health outcomes.

Keywords: COVID-19, pandemic, mental well-being, emotion regulation, cognitive biases, risk perception

INTRODUCTION

The novel coronavirus outbreak in late 2019 in Wuhan (Hubei, China) and its rapid worldwide spread have led to the pandemic on a scale not seen since the Spanish flu epidemic in the early 20th century. The COVID-19 pandemic enforced abrupt changes in the functioning of world and state organs, healthcare systems, economy and education, as well as the everyday lives and habits of individual people. Up to March 2020 the virus started to spread across all the continents and at the time the epicenter of the pandemic was localized in Europe. Therefore, many countries, including Poland, implemented the preventive measures aiming at slowing down the COVID-19 spread and "flattening the curve" of infection increase by minimizing the number of concurrently active cases. Since the state of epidemic threat has been declared by the Polish government on March 13th (soon after the first fatal COVID-19 cases occurred), the most important strategies introduced in Poland were travel and gathering restrictions, mandatory quarantine, lockdown of educational institutes and an obligation of wearing masks while in public. Importantly, unlike some of the European countries with the highest infection rates (e.g., Italy and Spain), Poland did not implement any general lock-down.

During the previous viral outbreaks, such as the SARS epidemic in 2003, several factors that may shape the impact of the pandemics on mental well-being were established. Apart from demographic factors such as age, gender, education, employment status (1), some psychological variables were shown to be particularly important to mental well-being of individuals during epidemic. Lau et al. (1) showed that a sense of community connectedness was a major mitigating factor for stress associated with SARS outbreak. However, the recent COVID-19 outbreak, declared as a state of pandemic by the World Health Organization [(2), March 11th], caused countries to implement unprecedented preventive measures. The highly contagious nature of the COVID-19 viral agent led to introducing social distancing restrictions and lockdown type measures across countries. Thus, the buffering effect of the social environment might have weakened.

In search of psychological factors contributing to the individual response to the H1N1 outbreak, known as the swine flu, Rudisill (3) conducted a study using data of 944 British participants from a survey taken right before the start of the government's vaccination campaign. Results showed that higher H1N1 risk perception was a strong predictor of the intent to vaccinate oneself against the virus and undertaking avoidance behaviors. However, optimism about personal risk of contagion did not predict any of these actions. Similar results were obtained by Brewer et al. (4) in a meta-analysis showing that risk perception indeed drives actions (e.g., vaccination) and people tend to accurately perceive risk as lower after implementing protective strategies (5).

However, evidence accumulates on how easily the risk perception of a virulent agent can be biased [see review by (6)]. For example, Finucane et al. (7) showed that the more emotional impact a given risk has, the greater the risk itself seems. This phenomenon is known as the "affect heuristic." Recent work found fear to be a crucial predictor of preventive behavior during the COVID-19 pandemic (8). While fear is known to increase the perception of risk, anger was found to diminish risk perception (9).

On the one hand risk perception may be influenced by exogenous factors e.g., media coverage, as shown by Chan et al. (10) on the case of Zika virus outbreak. On the other hand, the intrinsic human cognitive system is naturally biased, inter alia, in risk assessment (11). Previous research showed that both threatening context and a dispositional tendency to perceive infection risk as higher might be related to overperceiving disease cues (12). Thus, it is plausible that cognitive biases may affect risk assessment associated with COVID-19 pandemic. Yet, up to date, very few studies have addressed this issue [e.g., (13, 14)].

Cognitive biases are one of the core domains of social cognition. Biases (such as jumping to conclusions, attention to threat bias, belief inflexibility bias, external attribution bias) are studied extensively predominantly in neuropsychiatric populations, however they are also present in the general population to varying degrees [e.g., (15)]. Biased cognitions can influence affective states. In fact, cognitive biases and emotion regulation are intimately linked in various models of affective disorders [see review by (16)]. As cognitive biases may alter appraisal of an event they thus interfere with emotion regulation processes.

Effective emotion regulation is crucial for successful functioning in dynamic environments. The two most commonly used strategies of emotion regulation consist of re-evaluating a situation in order to diminish its emotional impact (cognitive reappraisal) and inhibiting outward expression of inner emotions (expressive suppression) (17). In a recent work of Restubog et al. (18) authors underline the important role that emotion regulation may play in maintaining psychological well-being during COVID-19 pandemic. In China, the drop in overall emotional well-being associated with the surge of COVID-19 reached 74% (19). A nationwide survey in which a total number of 14 000 respondents took part pointed out that the risk of contracting the virus, being in the high-risk group, relational issues and personal knowledge about the virus are some of the most important factors affecting mental well-being during pandemic.

Based on extensive literature research we identified several factors which may shape mental well-being during pandemic. It was shown before that cognitive biases are associated with psychopathology and may alter threat perception, while risk perception is greatly associated with emotional impact of the threat itself. At the same time, effective emotion regulation is associated with psychological well-being, also during pandemic. However, interactions of all aforementioned factors have not been investigated before. Thus, in the current study, we aimed at examining the relationship between self-reported cognitive biases and emotion regulation skills, COVID-19 risk perception and affective response, and its effect on mental well-being during pandemic. We hypothesized that cognitive biases, by interfering with emotion regulation processes, perception of risk and affective response to COVID-19, may decrease psychological well-being in time of pandemic.

TABLE 1 | Demographic characteristics of the study sample.

	Female	Male	Other	Decline to answer
Number of participants	378	90	4	2
Age in years [M(SD)]	23.01 (3.45)	23.75 (3.85)	24.0 (5.35)	24.5 (0.71)

METHODS

Participants

Subjects were recruited for the study via online adverts 48 h after declaring the state of epidemic threat in Poland. We invited adults aged between 18 and 35 to complete an open online survey via Qualtrics. The data was collected during the period of 36 h. We collected the data of 511 individuals, yet after excluding subjects with outlying outcomes in variables of interest the final study sample amounted for 474 individuals. The sample in the current study was a convenience sample. Detailed demographic information of the final study sample is depicted in **Table 1**.

The protocol of the study was accepted by the Ethics Committee at the Institute of Psychology, Polish Academy of Sciences. Prior to completing the online questionnaires participants were informed about the aim of the study and their right to withdraw at any moment. They were also insured about the anonymity of the data collected for the purpose of the study and that all analyses will be performed on the group level. Participants were not reimbursed for participation in the study.

Materials and Procedure

Participants were asked to complete online surveys concerning their current general health problems, emotion regulation capacity, social-cognitive biases and COVID-19 risk perception, and affective response.

The online survey was prepared in accordance with the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) (20). It consisted of 10 pages, each containing a number of items ranging from 7 to 40. Prior to launching the survey all online materials were previewed by five researchers from our team. In order to proceed to another page all questions had to be answered. Participants could not return to the previous page after they chose to go to the next one. Participation rate was 0.93, while the completion rate was 0.56. Only completed questionnaires were analyzed. We checked whether any IP Address appeared in the database more than once. Two IP Addresses duplicated but each of the entries contained a unique email address.

Mental well-being was assessed with the 30-item version of General Health Questionnaire [GHQ: (21)]. The Polish version of the GHQ-30 has excellent reliability (Cronbach's $\alpha = 0.97$) and was shown to have a three-dimensional structure. Higher GHQ overall score signifies more psychopathological symptoms and, overall, lower mental well-being.

The capacity of emotion regulation was measured with Emotion Regulation Questionnaire [ERQ: (22); Polish version by Smieja and Kobylińska (23)[1] ERQ is designed to assesses the two emotion regulation strategies: (1) cognitive reappraisal (CR)—reinterpretation of an emotional event in order to modify its meaning and change the emotional impact; (2) expressive suppression (ES)—attempt to hide and/or reduce experienced emotions (22). Smieja and Kobylińska (23) estimated Cronbach's alpha coefficients of each scale in Polish version between 0.74 and 0.85.

In self-assessment of social-cognitive biases we used 18-item version of Davos Assessment of Cognitive Biases Scale [DACOBS: (24), Polish 18-item version by Gawęda et al. (25)]. The 18-item version of DACOBS includes four subscales: (1) subjective cognitive problems, (2) safety behaviors, (3) attributional biases, (4) social cognition problems. Authors of the Polish version reported a satisfactory level of reliability for the whole scale—Cronbach's alpha for the total scale of 0.84.

Additionally, we aimed at measuring COVID-19 risk perception and affective response to pandemic in our participants. We implemented a scale prepared for the purpose of the current study in which participants were asked to rate the perceived probability of various events related to COVID-19 pandemic (e.g., contact with virus carrier, developing severe symptoms etc.) and the level of worry these events may arise on seven-point Likert scale (1–"Definitely not"; 7–"Definitely yes"). While in the previous research we have analyzed specific factor subscales (26), the current study utilized overall risk perception (seven items, Cronbach's alpha = 0.80) and affective response (10 items, Cronbach's alpha = 0.70) scores, as each of the scales has shown adequate internal consistency.

Statistical Analyses

The analyses were performed using SPSS version 26 and AMOS version 26.

We used path and bootstrapping analyses to examine the hypothesis that cognitive biases may shape mental well-being during COVID-19 pandemic both directly and indirectly by (i) decreasing emotion regulation capacity and (ii) by increasing COVID-19 risk perception and affective response. Sequential mediation was tested by entering cognitive biases, mental health symptoms, risk perception, affective response to COVID-19 pandemic to a path model in AMOS 26.

Model fit was assessed by using chi-square statistic to compare parameters of the model and the observed covariance matrix. Additionally, the goodness of fit was evaluated by using the comparative fit index (CFI) and root mean square error of approximation (RMSEA) (27). The significance of specific indirect pathways was examined by verifying whether 95% bootstrapped confidence intervals for any of the indirect effect contained the zero value.

RESULTS

Prior to examining the path model, we analyzed zero-order correlations between cognitive biases (DACOBS), mental health

[1] https://spl.stanford.edu/sites/default/files/polish.pdf

TABLE 2 | Zero-order correlations between cognitive biases, general health problems, risk perception and affective response to COVID-19.

	(1)	(2)	(3)	(4)	(5)	(6)
(1) DACOBS	1					
(2) GHQ	0.456**	1				
(3) ERQ cognitive reappraisal	−0.196**	−0.182**	1			
(4) ERQ expressive suppression	0.265**	0.116*	−0.005	1		
(5) COVID-19 risk perception	0.078	0.192**	0.074	−0.029	1	
(6) Affective response to pandemic	0.236**	0.300**	0.033	−0.102*	0.328**	1

***$p < 0.01$ (two-tailed).*
**$p < 0.05$ (two-tailed).*

symptoms (GHQ), risk perception, affective response to COVID-19 (see **Table 2**).

We have included total score from DACOBS as a main independent variable and total GHQ-30 score as a main dependent variable. Furthermore, two types of emotion regulation strategies (cognitive reappraisal and expressive suppression) as well as COVID-19 specific items were included as mediators in the model. We investigated both direct effects of DACOBS, emotion regulation strategies and COVID-19 specific items on GHQ and indirect effect via mediator variables.

The final model, depicted in the **Figure 1**, had good fit to the data (χ^2 (1) = 1.149, $p = 0.284$; RMSEA = 0.018, CFI = 0.999) and accounted for 27.2% of general health problems. We observed significant effects of cognitive biases ($\beta = 0.368$, $p < 0.001$), COVID-19 risk perception ($\beta = 0.114$, $p < 0.01$), affective response to pandemic ($\beta = 0.184$, $p < 0.001$) and emotion regulation via cognitive reappraisal ($\beta = -0.124$, $p < 0.01$) on general health problems.

More cognitive biases predicted higher COVID-19 risk perception ($\beta = 0.112$, $p < 0.05$), less emotion regulation via cognitive reappraisal ($\beta = -0.196$, $p < 0.001$) and more emotion regulation by suppression ($\beta = 0.265$, $p < 0.001$). We found a significant effect of emotion regulation via cognitive reappraisal ($\beta = 0.096$, $p < 0.05$) on COVID-19 risk perception. Additionally, significant effects of emotion regulation via suppression ($\beta = -0.164$, $p < 0.001$), COVID-19 risk perception ($\beta = 0.297$, $p < 0.001$), and cognitive biases ($\beta = 0.269$, $p < 0.001$) on COVID-19 affective response were observed.

Investigation of specific paths linking cognitive biases (independent variable) and general health problems (dependent variable) during pandemic revealed three significant indirect pathways. We found that the effect of cognitive biases on general well-being was positively mediated through use of emotion regulation strategy of cognitive reappraisal ($\beta = 0.024$, 95% CI = 0.008 to 0.05, $p = 0.001$), COVID-19 risk perception ($\beta = 0.013$, 95% CI = 0.002 to 0.033, $p = 0.015$) and affective response to pandemic ($\beta = 0.049$, 95% CI = 0.024 to 0.068, $p < 0.001$).

We also found that the effect of cognitive biases (independent variable) on affective response to COVID-19 (dependent variable) was mediated through emotion regulation via suppression ($\beta = -0.043$, 95% CI = −0.077 to −0.02, $p = 0.001$) and COVID-19 risk perception ($\beta = 0.033$, 95% CI = 0.004 to 0.068, $p = 0.023$).

Additionally, a double mediation explaining the effect of cognitive biases (independent variable) on affective response to COVID-19 (dependent variable) through emotion regulation by cognitive reappraisal and COVID-19 risk perception ($\beta = -0.006$, 95% CI = −0.015 to −0.001, $p = 0.029$) was found.

In total, the direct effect of cognitive biases on the outcome measure—general health problems—accounted for 81% of the total effect of DACOBS on GHQ variance ($\beta = 0.456$, $p < 0.001$), thus the impact of indirect effects on general health problems was very small ($\beta = 0.087$, $p = 0.001$).

DISCUSSION

In line with our initial hypothesis, we have found that cognitive biases may impact one's well-being in the wake of the COVID-19 crisis, both by directly affecting their perception and affective response to pandemics and by modulating effectiveness of one's emotion regulation strategies.

Firstly, we have observed that cognitive biases, as measured by self-assessment methods, may impact mental well-being via multiple possible pathways. The current study has observed a robust effect for the direct impact of cognitive biases on mental health problems in the general population during the COVID-19 crisis. While the relationship between cognitive biases and outcome measures was investigated so far mostly in clinical populations [e.g., patients with schizophrenia (28), patients with borderline personality disorder (29)], cognitive biases were also linked to the multiple detrimental outcomes, including psychopathological symptoms, e.g., psychotic-like experiences also in non-clinical populations (15). The current study provides additional support for the link between cognitive biases and overall mental health well-being, as indicated by a wide range of psychopathological outcomes measured by the GHQ. Moreover, the current study provides evidence that cognitive biases predict higher levels of disadaptive emotion regulation strategies (suppression) and lower levels of adaptive emotion regulation strategies (cognitive reappraisal) use in the general population. Furthermore, we observed an indirect effect linking cognitive biases with decreased mental-health well-being via reduced use of the cognitive reappraisal strategy. A similar effect

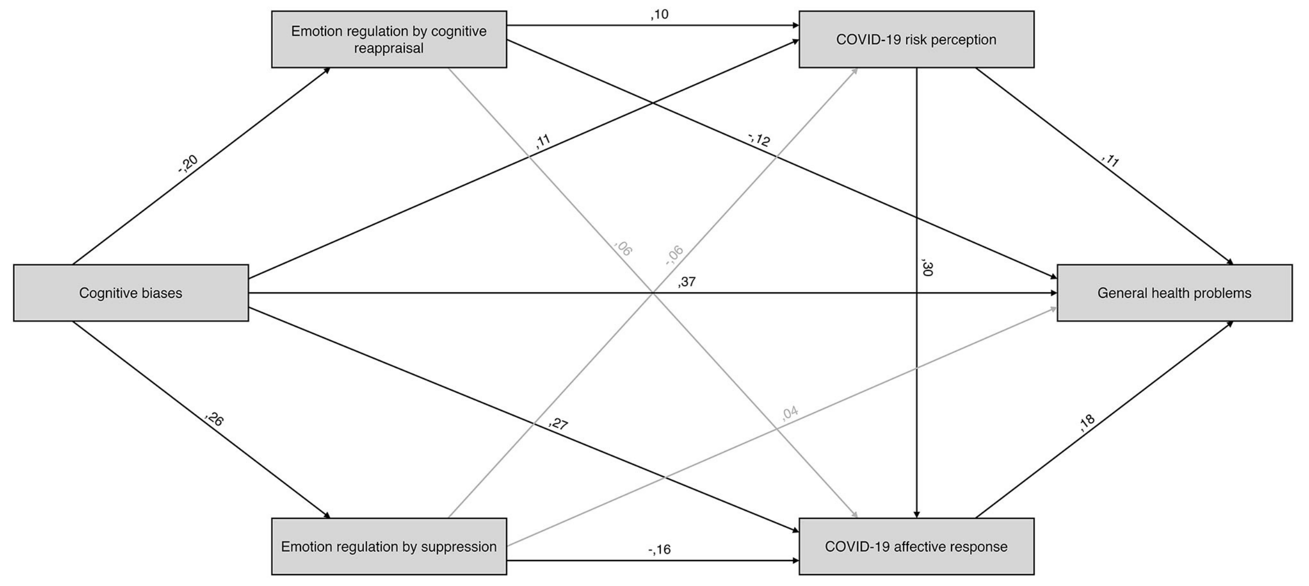

FIGURE 1 | Path model of the associations between cognitive biases, general health problems, risk perception and affective response to COVID-19. Statistically insignificant paths are displayed in gray.

was recently documented with regard to depressive symptoms—both disadaptive (brooding) and adaptive (positive reappraisal) strategies were observed to mediate the effects of cognitive biases on depressive symptoms in 119 healthy participants (30).

Secondly, higher levels of cognitive biases predicted higher COVID-19 risk perception in participants, which suggests that cognitive biases may be among factors shaping risk perception in response to pandemics crisis. Many recent studies have investigated the factors that underlie one's cognitive response toward COVID-19 pandemics, and identified both demographic [e.g., age: Gerhold (31)] and situational factors [e.g., being a health worker: Simione and Gnagnarella (32)], that predict COVID-19 risk perception. However, psychological factors including stress (32), dread (33) were also shown to be predictive on COVID-19 risk perception, thus emphasizing that subjective level of COVID-19 risk perception may be misshaped by numerous personal characteristics. The set of the specific cognitive biases assessed by the DACOBS is linked mostly to the social domain and include (i) increased interpersonal threat perception and avoidance, as well as (ii) subjective cognitive and social cognitive problems. Thus, the relationship between specific tendencies measured by the DACOBS and COVID-19 risk perception may be, at least partially explained, by the social nature of the COVID-19 transmission and focus on social distancing as a main preventive behavior during COVID-19 pandemics. Furthermore, the inconsistent nature of media coverage of the COVID-19 pandemics has been emphasized, e.g., during the first weeks of the pandemic, SARS-CoV-2 has been often compared, both by media and officials to the common flu which may have hindered the adequate risk assessment by individuals (Kumar, 03/27/2020), the effects of which may be particularly striking in individuals who report less-efficient cognitive capacities. Finally, it has been previously shown that the perceived threat from the A/H1N1is lower in the more self-efficacious individuals (34). As more self-efficacious individuals were shown to be more prone to produce subjective cognitive complaints both in clinical (35) and non-clinical (36) populations, further role of the cognitive biases and problem s as a mediator between self-efficacy and COVID-19 response should be investigated.

A robust effect of cognitive biases on COVID-19 affective response was also found in the current study. It has been previously shown, one's affective response to pandemic may be of more importance with regard to one's individual behavior compared to cognitive evaluations of risk associated with the virus (37). One of the most widely discussed cognitive biases in association with affective response is attention to threat bias. As Cisler and Koster (38) show in their review of models linking attention to threat bias and anxiety that this relation is likely to be moderated by emotion regulation strategies. In line with this claim we found that the effect of cognitive biases on affective response to COVID-19 pandemic was mediated by disadaptive emotion regulation strategy (expressive suppression), but for cognitive reappraisal strategy this mediation was not observed.

Only one of emotion regulation strategies assessed in the current study had a significant effect on COVID-19 risk perception. The effect of emotion regulation by cognitive reappraisal was positive—the tendency to use this strategy predicted higher COVID-19 risk perception.

Although it is commonly assumed that cognitive reappraisal is an adaptive emotion regulation strategy and expressive suppression is considered as one of the maladaptive ones, Gross (17) suggested that the emotion regulation strategy is only as adaptive as the context in which it is implemented is appropriate for its use. Bonanno et al. (39) found empirical evidence for the advantage of flexibility in emotion regulation strategies. In a longitudinal design study conducted after the 9/11 terrorist attacks on World Trade Center towers, authors found that flexibly implementing both emotion regulation strategies predicted lower levels of distress in college students after a year's time. In the case of COVID-19 pandemic Bonanno's et al. (39) findings seem especially relevant. The upsurging amount of contradictory information about the course of pandemic may require flexible implementation of various emotion regulation strategies to control psychological distress caused by COVID-19.

The observed direct effect of cognitive biases on general health problems explained the vast majority of GHQ variance in our study sample, while the effect of indirect effects linking those two variables was relatively small. As mentioned before, cognitive biases play an important role in numerous models of neuropsychiatric disorders (e.g., schizophrenia, social anxiety). Also, higher levels of cognitive biases are also found in at-risk populations [e.g., (40)]. Therefore, it may be hypothesized that the robust direct effect of cognitive biases on general health problems assessed in the current study in the general population may be linked to the general link between cognitive biases and psychopathology, rather than specific COVID-19 related circumstances.

Some limitations of the current study may be pointed out. Firstly, the cross-sectional design of the study does not provide insight into temporal relations between independent variables and GHP during pandemic. Secondly, cognitive biases are often considered as a mediator, rather than independent variable, e.g., it has been shown that cognitive biases mediate the relationship between childhood trauma and psychotic-like experiences (41), especially in research involving clinical or subclinical neuropsychiatric populations. Here, we did not assess any variables which may underlie prevalence for expressing more cognitive biases, thus the current observations may not fully account for potential independent variables e.g., childhood trauma [e.g., (41)], social adversities [e.g., (42)] etc. Lastly, a number of other factors such as history of mental illness, genetic vulnerability, social adversities, psychological individual differences or actual contact with the COVID-19 disease may also affect mental well-being during pandemic. Future research should address this limitation by including variables likely to impact cognitive biases as well as general health problems into the model.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics Committee at the Institute of Psychology, Polish Academy of Sciences. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

ŁO, AP, MW, and KŻ contributed to conception and design of the study. ŁO and AS performed the statistical analysis. AS and ŁO wrote the first draft of the manuscript. KŻ and AP wrote sections of the manuscript. MW prepared data visualizations. All authors contributed to manuscript revision, read, and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2020.589973/full#supplementary-material

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Psychosocial Correlates of Depression and Anxiety in the United Arab Emirates During the COVID-19 Pandemic

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The impact of the COVID-19 pandemic on mental health is likely to be significant. Identifying vulnerable groups during the pandemic is essential for targeting psychological support, and in preparation for any second wave or future pandemic. Vulnerable groups are likely to vary across different societies; therefore, research needs to be conducted at a national and international level. This online survey explored generalized anxiety and depression symptoms in a community sample of adults (N = 1,039) in the United Arab Emirates (UAE) between April 8th and April 22nd, 2020. Respondents completed symptom measures of depression (PHQ8) and generalized anxiety (GAD7), along with psychosocial and demographic variables that might potentially influence such symptoms. Bivariate and multivariate associations were calculated for the main study variables. Levels of anxiety and depression were notably higher than those reported in previous (pre-pandemic) national studies. Similar variables were statistically significantly associated with both depression and anxiety, most notably younger age, being female, having a history of mental health problems, self or loved ones testing positive for COVID-19, and having high levels of COVID-related anxiety and economic threat. Sections of the UAE population experienced relatively high levels of depression and anxiety symptoms during the early stages of the pandemic. Several COVID-related and psychosocial variables were associated with heightened symptomatology. Identifying such vulnerable groups can help inform the public mental health response to the current and future pandemics.

Keywords: COVID-19, depression, anxiety, Arab, UAE, pandemic

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INTRODUCTION

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) was first detected in Wuhan China in the latter part of 2019. The disease caused by this novel virus was officially named COVID-19 by the World Health Organization (WHO) on Feb 22nd, 2020 (1). After the virus spread internationally, the WHO officially declared COVID-19 a pandemic on March 11th, 2020 and many nations began acting to curb the spread. The United Arab Emirates (UAE), a federation of seven states on the east coast of the Arabian Peninsula, launched various infection prevention and control measures, which have included the promotion of social distancing, quarantine, the closing of educational and recreational facilities, the cessation of passenger air travel and curfews. **Table 1**, based on UAE governmental and media sources, provides a timeline of some of the primary infection prevention and control measures taken by the UAE Government.

The UAE reported its first case on Jan 29th, 2020 (a family of four who had traveled to the UAE from Wuhan, China) and despite the extensive infection control efforts, the UAE confirmed its first two deaths on March 20th, 2020. New infections and deaths have ensued daily, and at the time of writing (May 18th, 2020) the UAE has tested more than 1 million people, reporting 23,358 cases (0.2% of the population) with 8,512 recoveries and 210 deaths. There is little doubt that the pandemic, and the necessary response to it, is causing considerable concern about its impact on mental health (2). From the grief associated with COVID-19 fatalities to the anxiety of testing positive, the pandemic has clear implications for mental health. Beyond the actual illness and the fear of contracting the virus, necessary restrictions placed on the freedom-of-movement, such as social/physical distancing, social isolation, quarantine and curfews, can also have negative implications for psychological well-being (2). Furthermore, anxiety surrounding the indirect effects of the economic implications associated with anti-pandemic measures, such as economic insecurity, may become an issue for some individuals and families.

Early research exploring the mental health consequences of COVID-19 in other nations support this view. A general population survey undertaken in the UK found that symptom measures of depression (PHQ9) and anxiety (GAD7) were elevated above those typically obtained in population surveys undertaken before the COVID-19 pandemic (3). A Chinese study, undertaken in Yunnan province, explored the rates of depression and anxiety among individuals affected or unaffected by quarantine measures, finding that those quarantined reported significantly higher rates of both (4). Other studies have looked at a variety of psychosocial factors correlated with mental health during the pandemic. For example, a study undertaken in Beirut, Lebanon, reported perceived social support as a potential resilience factor, that is, it was associated with lower levels of depression and anxiety symptomatology (5). Another study, this time in the USA, looked at religious coping among a Jewish community in New York, finding positive religious coping to be associated with less depressive symptomatology during the early stages of the pandemic (6). In another study, undertaken across, all 34 provinces of China, testing positive or having a relative who tested positive for COVID-19 was strongly associated with elevated depression and anxiety (7), All of these studies invariably reported levels of anxiety and depressive symptomatology elevated above pre-pandemic norms.

A rise in the symptoms of depression and anxiety is to be expected during times of international crisis. However, there is apprehension that this elevated symptomatology could translate into an increase in the number of clinically significant cases (2). There is evidence from earlier pandemics that this may be the case. A study undertaken in Hong Kong, for example, found that the Severe Acute Respiratory Syndrome (SARS) epidemic of 2003 was associated with a 30% increase in completed suicides among females aged 65 years and over (8). One year after the outbreak, survivors of SARS still reported elevated levels of anxiety and psychological distress (9). Another study following SARS survivors over 30 months described SARS as "a mental health catastrophe," finding PTSD and depression to be the most prevalent long-term psychiatric morbidities (10). The work on SARS focused primarily on patients and healthcare workers. There is very little research exploring the broader mental health implications at the population level.

TABLE 1 | Timeline of the UAE's COVID-19 key infection prevention and control measures.

Date announced	Effective date	Emirate	No. of cases	No. of deaths	Control and prevention measures
Mar 3	Mar 8	UAE	6		All nurseries, schools and universities closed
Mar 12	Mar 14	Abu Dhabi	85		Remote working enacted for non-key workers
Mar 16	Mar 17	UAE	98		Places of worship closed
Mar 21	Mar 21	UAE	140	2	Closing of public recreational spaces (i.e., beach, parks)
Mar 22	Mar 22	Dubai			Social distancing in stores (1.5 m)
Mar 23	Mar 24	UAE	198		Closure of all shops and malls
	Mar 25	UAE			Grounding of flights
	Mar 26	UAE	333		3- days disinfection Program and Night curfew
	Mar 28	Abu Dhabi	468	4	First testing center opens
	Apr 5	Dubai	1,799	8	Movement permit requirements implemented
	Apr 7	Dubai	2,359	10	First drive through testing center open
	Apr 9	UAE	2,990	14	13 drive through testing centers open
	Apr 9	UAE			Mosques, churches, places of worship to stay closed as Ramadan approaches
	Apr 12	UAE		28	Home testing program for people of determination
Apr 15	Apr 16	Dubai	5,375		Field hospital with capacity to treat 3,000 COVID-19 patients opened
	Apr 28	Abu Dhabi	11,380		Mandatory COVD-19 test for mall employees before reopening Abu Dhabi malls

TABLE 2 | The study's main categorical variables with levels.

Variables	Levels	
Gender	Male	Female
UAE Citizen	Yes	No
College educated	Yes	No
Religious	Yes	No
Live alone	Yes	No
Children in household	Yes	No
History of mental health problems	Yes	No
Pre-existing health conditions	Yes	No
Perceived personal risk of COVID-19	High	Not High
COVID-19 infection status	Positive	Negative/Unknown
COVID-19 related anxiety	High	Not High
COVID-19 economic threat	High	Not High

Age groupings are also included with four levels, 18–24, 25–34, 35–44, 45+ years.

The possible rise in rates of depression and anxiety associated with the COVID-19 pandemic intersects with a point in time when several nations are already reporting a rising prevalence of depression and anxiety (11). Population-wide surveys of mental health in the UAE are relatively rare. However, based on data from the 2010 Global Burden of Disease study, the UAE has a rate of depression higher than the global average (12). Community surveys in the UAE (13–15) and neighboring Gulf states all confirm relatively high rates of depression and anxiety in the immediate region (16). How the current COVID-19 pandemic will impact mental health in the UAE and other nations remains an unanswered question. However, there is likely to be significant international variation, based on differing responses to the pandemic, variations in healthcare systems, as well as diverse demography and sociocultural norms. For example, citizens of the UAE frequently live in multi-generational extended family households (17). For many directly transmitted infectious diseases, household size plays a crucial role in transmission due to the greater strength of contacts between individuals sharing living arrangements (18). Household size may also impact levels of anxiety about possible infection. Similarly, relative to the global average, the UAE has a youthful population with estimates suggesting that one-half to one-third of the population are under the age of 25 years (19). Population age has been found to have a potential impact on epidemic patterns for infectious diseases, for example, in the absence of vaccination, population aging is shown to reduce per capita incidence of infection (20).

Here we report the initial findings from the first wave of a longitudinal, multi-wave survey of the psychological impacts of COVID-19 among a large community sample of residents and citizens of UAE, adapting survey methods used in a UK mental health survey (3). Administered during the early stages of the pandemic (April 8th to April 22nd, 2020), the study's primary aim is to identify psychologically vulnerable groups, by assessing the relationship between psychological well-being and variables likely to influence the symptoms of depression and anxiety. This includes variables related to living arrangements, COVID-19 infection status, and mental health history. The main variables explored in the study are detailed in **Table 2**.

In light of the rising COVID-19 mortality and morbidity at the time of our study, and given the extensive, and necessary, restrictions imposed on freedom-of-movement, we anticipate higher levels of anxiety and depression compared to similar regional studies undertaken before the COVID-19 pandemic. More importantly, however, we also predict that COVID-related variables (e.g., infection status of self or loved ones) will be strongly associated with current levels of depression and anxiety. This study potentially contributes to what we know about the psychological consequences of pandemics in the UAE. The lack of knowledge about the impact of pandemics on population-level mental ill-health in the UAE, and elsewhere, is a critical gap to address. There is evidence from modeling studies that the psychological reactions (emotional and behavioral) to a pandemic can influence its course (21). Furthermore, the economic burden associated with elevated rates of mental ill-health are likely to negatively impact post-pandemic national recovery (3).

MATERIALS AND METHODS

Participants

Participants ($N = 1{,}039$) were recruited via announcements in the UAE media and through the email networks of UAE's National Program for Happiness and Well-being. Participants were required to be residents of the UAE and aged 18 years or over. The sample was not representative of the whole UAE, but it did reflect many constituents. The sample comprised of people from 65 different nationalities, with citizens of the UAE (Emiratis) being the majority (73%). Reflecting the UAE's youthful population (19), the mean age was 28.33 ($SD = 11.38$) years. Females made up 85.6% of the sample, and the two most populous emirates/city-states represented, Abu Dhabi and Dubai, accounted for 59.2 and 31.7% of the sample, respectively.

Measures

All demographic and COVID-related measures were translated and back translated by two bilingual (Arabic/English) psychologists. Additional measures such as the GAD7 and PHQ8 were already available in Arabic and English. Participants were presented with English and Arabic links affording them a choice as to which language they completed the survey in.

Demographic/Personal History Items

Demographic survey items were adapted, with permission, from those used in a similar UK study by Shevlin et al. (3). Example items included: "What is your highest qualification?" and "How many adults (18 years or above) live in your household (including yourself)?" Personal history items included questions about pre-existing health conditions and mental health history. For the current analysis all demographic and personal responses were assigned to binary categories. For example, college educated (yes/no), religious affiliation (yes/no), lives alone (yes/no) were all dichotomized. Age was assigned to four groupings as detailed in **Table 3**. The dichotomization and categorization of continuous

TABLE 3 | The frequency count and (percentage) for the study's main demographic variables.

Variable	Frequency count and (%) per grouping category					
Age Groups	*18–24*	*25–34*	*35–44*	*45+*		
	587 (56.5)	178 (17.1)	160 (15.4)	113 (10.9)		
Religion	*Muslim*	*Other*	*None*			
	789 (75.9)	168 (16.2)	80 (7.8)			
Education	*None*	*High Sch.*	*Bachelors*	*Masters*	*PhD*	
	6 (0.6)	420 (40.4)	385 (37.0)	161 (15.5)	68 (6.5)	
Employment	*Fulltime*	*Part-time*	*Self Emp.*	*Student*	*Unemp.*	*Other*
	308 (29.6)	32 (3.1)	32 (3.1)	496 (47.7)	89 (8.6)	82 (7.9)
Residence	*City*	*Rural*				
	939 (90.4)	100 (9.6)				
Occupancy	*Live alone*	*Two*	*Three*	*Four*	*Five*	*>5*
	83 (8.0)	162 (15.6)	127 (12.2)	127 (12.2)	133 (12.8)	423 (40.2)
Children	*None*	*One*	*Two*	*Three*	*Four*	*>4*
	227 (26.7)	167 (16.1)	209 (20.10)	127 (12.2)	97 (9.3)	154 (15.5)

Children = number of children (under 18) living in the household, Occupancy = number of adults (18 years and older) living in the household.

variables is commonly used in health related research to stratify patients according to risk, and guide the allocation of resources based on easily communicated models of greatest need/highest risk (22).

COVID-Related Items

The COVID-related items were also adapted from Shevlin et al. (3) These specifically probed infection status: "Have you been infected by the coronavirus COVID-19?" and "Has someone close to you (a family member or friend) been infected by the coronavirus COVID-19?" Response options were "yes," "no," and "unsure." These two items were collapsed into a single binary item called COVID-19 Positive, where anyone who had tested positive or had a family member test positive was assigned a one/yes. Meanwhile, those who have tested negative or were unsure about COVID-19 status were assigned a zero/no. Additional items asked people to rate their level of worry about COVID-19 ("How anxious are you about the coronavirus COVID-19 pandemic? 0 = not at all anxious and 100 = extremely anxious") and to indicate, from 1 to 10, their level of concern about finances: "On balance, how much are you worried about the way that your household finances have been affected by the coronavirus COVID-19 pandemic SO FAR?" These last two scales were represented by slider controls, where sliding the control past the 50% mark indicated an orientation toward the unpleasant side of the scale. These normally distributed items were also dichotomized for the current analysis, with respondents scoring over 50 categorized as high in COVID-related anxiety while those scoring 50 or below were categorized as low to moderate. The same dichotomization was applied to financial worry, with scores above five categorized as high in COVID-19 related economic threat, while those scoring 5 or less were classed as experiencing low to moderate economic threat/insecurity.

Participants were also asked to provide an estimation of their perceived personal risk of contracting COVID-19 in the coming month, this was a single item as used in an earlier UK-based study[4]. Response options were low, moderate and high. The low and moderate were collapsed into a single category, creating two categories of self-perceived risk, high and not high (low to moderate).

The Patient Health Questionnaire-8 (PHQ8)

The PHQ8 (23) is a widely used, standardized assessment of the prevalence and severity of depressive symptoms in the general population. It consists of eight questions probing the frequency of depressive symptoms over the past 2 weeks. Responses can range from 0 to 3 (0 = not at all, 1 = several days, 2 = more than half the days, 3 = nearly every day). Total scores, obtained by summing the responses to each item, range from 0 to 24. Total scores below 5 are viewed as indicating an absence of significant depressive symptoms. A cut-off score of ≥10 was used in the present study to indicate the presence of clinically significant depressive symptoms (moderate depression), this cut-off has previously been associated with excellent sensitivity and specificity for the detection of depressive disorders (23). The PHQ8 also uses scores of 15 and 20 and above to indicate severer levels of depression. The psychometric properties of the PHQ-8 scores have been widely supported, and the reliability of the scale among the current sample was excellent ($\alpha = 0.915$).

The Generalized Anxiety Disorder-7 (GAD7)

The GAD7 (24) is a widely used measure of anxiety in the general population. Participants are asked to indicate how often, in the past 2 weeks, they have experienced each of seven main symptoms associated with generalized anxiety disorder. Total scores can range from 0 to 21 and are calculated by assigning scores of 0 (not at all), 1 (several days), 2 (more than half the days), and 3 (nearly every day), to item response. Scores of 5, 10, and 15 are considered cut-off points for mild, moderate and severe anxiety, respectively. The psychometric properties

TABLE 4 | Means and bivariate correlations for all continuous variables.

	M	*SD*	PHQ8	GAD7	Economic threat	COVID-19 anxiety	Household occupancy
Age	28.32	11.39	−0.337**	−0.251**	0.118**	0.056	−0.472**
PHQ8	12.10	7.60	–	0.757*	0.124**	0.181**	0.212**
GAD7	11.37	7.43		–	0.180**	0.314**	0.139**
Economic threat	6.42	3.37			–	0.455**	−0.065*
COVID-19 anxiety	33.58	33.15				–	0.014
Household occupancy	7.43	4.54					–

Two-tailed bivariate Pearson's correlation, N = 1,039 to 1,024 due to occasional missing age data.
**p < 0.05, **p < 0.001.*

of the instrument have been widely supported (25), and the reliability of the scale among the current sample was excellent ($\alpha = 0.921$).

Procedure

The study received ethical clearance from the university's research ethics committee (R201213) and from the Ministry of Health and Prevention's research ethics committee (MOHAP/DXB-REC/ MMM/No. 49/2020). Data collection took place online (www.symplexsoftware.com/covid19/), where participants first selected their preferred language (63.2% selected English) and then read the participant information page, prior to consent giving. Consenting participants answered demographic and personal history questions first, followed by the PHQ8, the GAD7 and then the section specific to COVID-19 concerns. The median completion time for the survey was 18 min and 3 s.

RESULTS

Descriptive Analysis

With the exception of age, all continuous variables were normally distributed. Age was left skewed due to a large number of relatively young people in the sample. Scores above the PHQ8 cut-off were notably high (58.4%). Similarly, scores above the GAD7 cut-off were also notably high (55.7%). The mean, standard deviation and bivariate correlation coefficient for all continuous variables are detailed in **Table 4**.

Regression Analysis

Bivariate and multiple logistic regressions were done with R (26), using generalized linear models in the base package. Two binary logistic regression models were used to predict caseness on Anxiety (GAD7) and Depression (PHQ8), computing bivariate odds ratios (OR) and multivariate adjusted odds ratios (AOR) for all predictor variables. The predictor variables were age, gender, education, employment status, citizenship, lone adult, number of children in household, pre-existing health condition, mental health history, COVID-19 infection status (self and other), and personal perceptions about risk of infection over the following month. The details of these analysis are detailed in **Tables 5** and **6** with adjusted odds ratios clearly illustrated in **Figures 1** and **2**.

Similar variables were statistically significantly associated with both depression and anxiety, most notably younger age, being female, having a history of mental health problems, self or loved ones testing positive for COVID-19, and having high levels of COVID-related anxiety and economic threat.

DISCUSSION

To the best of our knowledge, there is no previous research exploring the psychosocial correlates of infectious illness pandemics on the population of the UAE, or the broader Arab world. Even globally, the literature on the potential mental health implications of previous pandemics is relatively scarce. There are a few studies, primarily from the Far East, which focused on the SARS (8–10) and the H1N1 (27) pandemics of the first decade of the present century. With the notable exception of work undertaken in Canada (28), these earlier studies generally reported elevated levels of psychopathology (anxiety, depression) during the respective outbreaks, with their primary focus being healthcare workers and those who survived the illnesses The present study, however, explored depression, anxiety and the psychosocial correlates among a general community sample during the early stages of the COVID-19 pandemic. This was during the month of April, shortly after the national response (curfews, social distancing, working from home and the closure of retail and recreational venues) had been enacted. The primary aim of the study was to identify psychosocial and specific COVID-related variables that were associated with elevated levels of depression and anxiety. Identifying such variables can potentially help target support to vulnerable groups. A secondary aim was to assess levels of depression and anxiety, with the expectation that, relative to earlier regional surveys, symptomatology would be elevated.

There were several statistically significant variables associated with elevated depressive symptoms (scores 10 and above on the PHQ8). After age group, the foremost correlate was having tested positive for COVID-19 or having a similarly infected close friend or relative (COVID-19 positive). This finding is similar to data reported from a general survey in the UK (3). Also, in line with the UK survey, was the observation that rates of depression and anxiety were highest among the youngest age group (18–24 years). This finding is particularly significant for the UAE, which has a relatively youthful population (19). Much of the economic burden associated with depression arises from the relatively early age of onset and it's typically chronic course, having younger

TABLE 5 | Bivariate (OR) and multivariate (AOR) logistic regression predicting PHQ8 depressive symptom scores above cut-off.

	N	Above cut-off PHQ8 *N* (%)	Odds ratio	Adjusted odds ratio
Age (years)				
18–24	587	407 (69%)	–	–
25–34	178	101 (56%)	0.472 (0.333–0.668)***	0.573 (0.365–0.899)*
35–44	160	63 (39.4%)	0.286 (0.195–0.418)***	0.301 (0.176–0.51)***
45+	113	36 (31.9%)	0.217 (0.136–0.342)***	0.227 (0.119–0.43)***
Gender				
Male	145	55 (37.97%)	–	–
Female	889	547 (61.5%)	2.63 (1.83–3.83)***	1.72 (1.12–2.65)*
Nationality				
Other	281	117 (41.6%)	–	–
Emirati	758	490 (64.6%)	2.55 (1.92–3.39)***	1.11 (0.727–1.67)
Religious				
No	80	35 (43.8%)	–	–
Yes	959	572 (59.6%)	2.004 (1.262–3.205)**	1.175 (0.680–2.044)
Completed college				
Yes	613	315 (51.4%)	–	–
No	426	292 (68.5%)	2.119 (1.623–2.270)***	1.111 (0.796–1.6)
Unemployed				
No	950	553 (58.2%)	–	–
Yes	89	54 (60.7%)	1.087 (0.699–1.709)	1.025 (0.625–1.695)
Lone adult				
Yes	64	27 (42.2%)	–	–
No	975	580 (59.5%)	1.996 (1.995 – 3.367)**	1.406 (0.880 – 2.703)
Children at home				
No	278	135 (48.6%)	–	–
Yes	761	472 (62.0%)	1.805 (1.362–2.398)***	1.215 (0.840–1.754)
History of mental health				
No	828	460 (55.6%)	–	–
Yes	211	147 (69.7%)	1.832 (1.319–2.564)***	2.410 (1.669–3.509)***
Pre-existing health conditions				
No	926	539 (58%)	–	–
Yes	110	68 (61.8%)	1.136 (0.746–1.754)	1.247 (0.769–2.037)
Tested positive for COVID-19 (Self or Loved One)				
No	764	607 (58.4%)	–	–
Yes	275	216 (78.5%)	4.00 (2.857–5.682)***	4.049 (2.817–5.917)***
See self as high risk for COVID-19 in coming months				
No	855	476 (55.7%)	–	–
Yes	184	131 (71.2%)	1.905 (1.348–2.725)***	1.311(0.893–1.946)
COVID-19 economic threat				
No	423	225 (53.2%)	–	–
Yes	602	374 (62.1%)	1.477 (1.142–1.908)**	1.445 (1.065–1.965)*
COVID-19 related anxiety				
No	718	389 (54.2%)	–	–
Yes	315	212 (67.3%)	1.838 (1.383–2.457)***	1.916 (1.370–2.703)***

AOR model included all variables listed above.
**** < 0.001, ** < 0.01, * < 0.05.*

TABLE 6 | Bivariate (OR) and multivariate (AOR) logistic regression predicting GAD7 anxiety symptom scores above cut-off.

	N	Above cut-off GAD7 *N* (%)	Odds ratio	Adjusted odds ratio
Age (years)				
18–24	587	373 (63.5%)		
25–34	178	93 (52.2%)	0.513 (0.364–0.724)***	0.532 (0.339–0.83)**
35–44	160	74 (46.3%)	0.459 (0.316–0.664)***	0.378 (0.221–0.639)***
45+	113	39 (34.5%)	0.311 (0.197–0.483)***	0.247 (0.13–0.464)***
Gender				
Male	145	52 (35.9%)		
Female	889	522 (58.7%)	2.5 (1.74–3.63)***	1.98 (1.3–3.05)**
Nationality				
Other	281	117 (41.6%)		
Emirati	758	490 (64.6%)	1.56 (1.18–2.07)**	1.42 (0.936–2.18)
Religious				
No	80	35 (43.8%)		
Yes	959	572 (59.6%)	1.988 (1.252–3.205)**	1.531 (0.885–2.688)
Completed college				
Yes	613	315 (51.4%)		
No	426	292 (68.5%)	1.664 (1.285–2.160)***	1.091 (0.763–1.555)
Unemployed				
No	950	524 (55.2%)		
Yes	89	55(61.8%)	1.290 (0.826–2.033)	1.276 (0.781–2.105)
Lone adult				
No	64	27 (42.2%)		
Yes	975	580 (59.5%)	1.656 (0.990–2.786)*	1.203 (0.625–2.304)
Children at home				
No	278	135 (48.6%)		
Yes	761	472 (62.0%)	1.529 (1.156–2.024)**	1.104 (0.769–1.585)
History of mental health				
No	825	460 (55.6%)		
Yes	211	147 (69.7%)	1.838 (1.333–1.585)***	2.151 (1.502–3.106)***
Pre-existing health conditions				
No	929	539 (58%)		
Yes	110	68 (61.8%)	1.212 (0.8–1.859)	1.125(0.699–1.818)
Tested positive for COVID-19 (Self or Loved One)				
No	764	607 (58.4%)		
Yes	275	216 (78.5%)	2.342 (1.733–3.195)***	2.398 (1.721–3.367)***
See self as high risk for COVID-19 in coming months				
No	855	476 (55.7%)		
Yes	184	131 (71.2%)	2.037 (1.447–2.899)***	1.479 (1.012–2.179)*
COVID-19 economic threat				
No	423	194 (45.9%)		
Yes	602	375 (62.3%)	1.927 (1.493–2.494)***	1.585 (1.178–2.137)**
COVID-19 related anxiety				
No	718	342 (47.6%)		
Yes	315	231 (73.3%)	3.165 (2.358–4.292)***	3.175 (2.268–4.505)***

AOR model included all variables listed above.
**** < 0.001, ** < 0.01, * < 0.05.*

individuals experience depression is particularly problematic from the health economics perspective. The observation of poorer mental health among youth in the UAE, and elsewhere, may reflect a matrix of despair about the future. From the climate crisis to the employment-related threat of artificial intelligence, these are concerns that may be experienced more acutely by

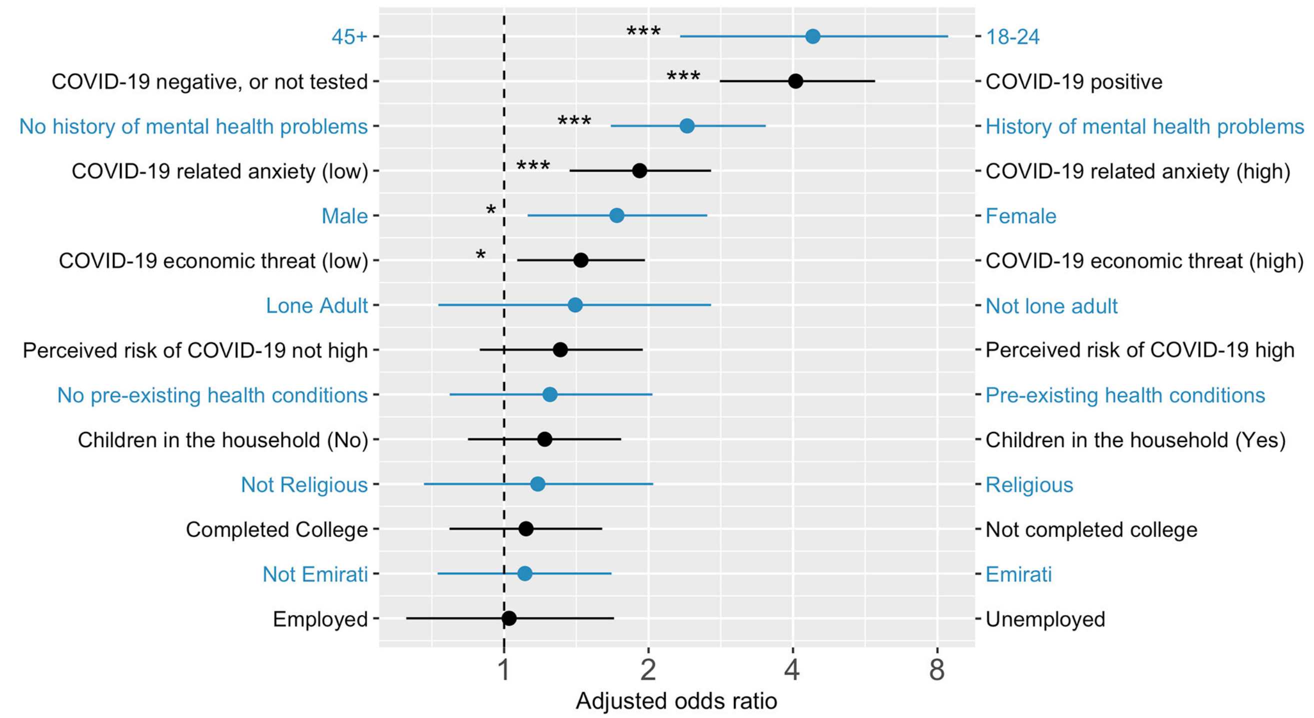

FIGURE 1 | Adjusted odd ratios from a logistic regression predicting PHQ8 depressive symptom scores. Note: 18–24 years age group had significantly higher odds of depression and anxiety when compared to all other ag groups. Figure built using https://github.com/SourCherries/odds-forest. *$p < 0.05$, ***$p < 0.001$.

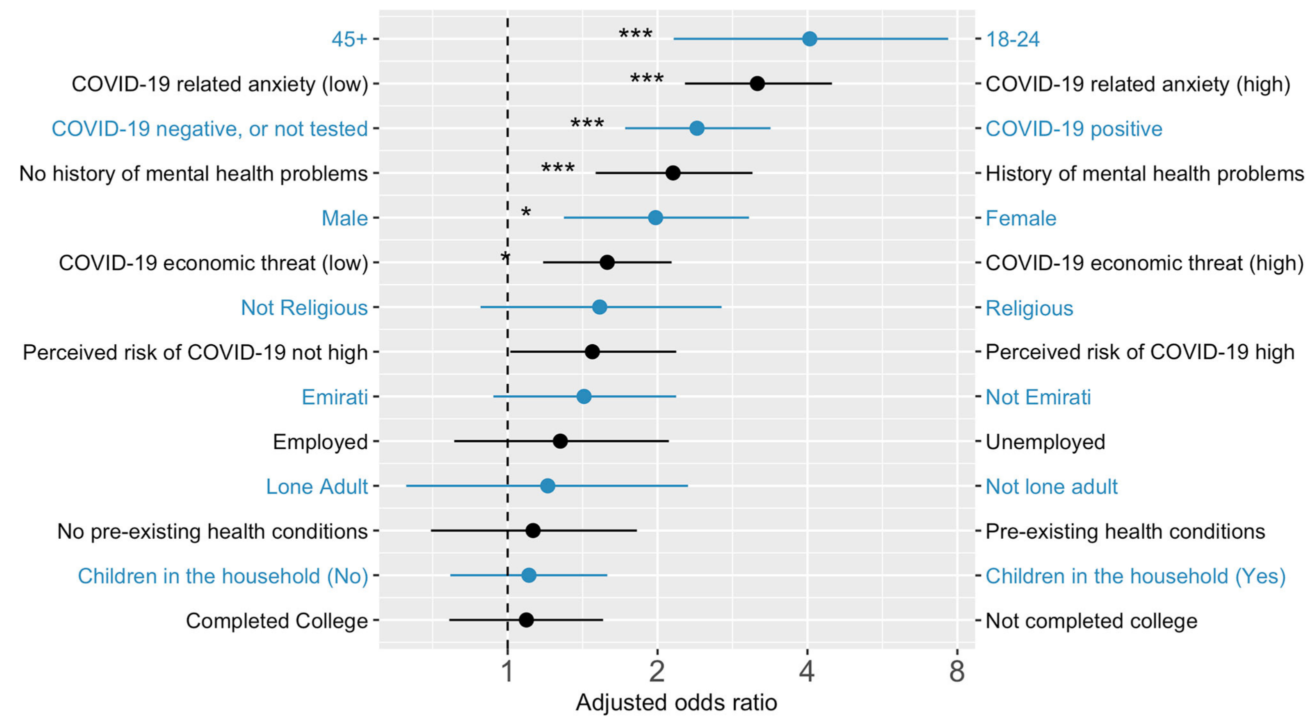

FIGURE 2 | Adjusted odd ratios from a logistic regression predicting GAD7 anxiety symptom scores. Note: 18–24 years age group had significantly higher odds of depression and anxiety when compared to all other ag groups. Figure built using https://github.com/SourCherries/odds-forest. *$p < 0.05$, ***$p < 0.001$.

people who expect to witness them within their own lifetimes. A further correlate of depression in the present study was a pre-existing history of mental health problems, as assessed by simple self-report item on the survey. It might be that the pandemic, and the necessary response to it, exacerbate pre-existing morbidities and perhaps contribute to relapse in the vulnerable. Common mental health conditions, such as depression, have a chronic course and relapse is common with a mean of four major lifetime episodes (29). Furthermore, stressful life events, particularly those that disrupt social rhythms (which is likely if people are confined to home), are often implicated in the onset and reoccurrence of mood disorders (30, 31). As has frequently been observed, female gender was associated with a higher risk of having elevated anxiety and depressive symptoms. Such gender differences are typically explained in terms of gender-role socialization processes that lead to females being more likely to adopt passive ruminative responses to negative moods (32, 33). These ruminative response styles appear to represent a cognitive vulnerability in the context of depression (34, 35). A previous, large-scale, community survey undertaken in the UAE also reported females as being at greater risk for depression compared to their male compatriots (14). Cultural norms relating to gender-role socialization in the UAE may also play a role in the elevated rates of depression and anxiety observed in the current study. The final two variables associated with depression were specific to the current pandemic: COVID-19 related anxiety and COVID-19 economic threat (financial worries). This finding accords with the extensive literature on the links between economic/financial insecurity and depression (36).

The factors associated with elevated generalized anxiety symptoms were similar to those correlated with depression, with the addition of perceived risk of contracting COVID-19 in the next month. Elevated perceived risk of contagion would fit with ideas that trait anxiety leads to heightened risk perceptions and estimates (37).

There are perhaps also insights to be gained from noting the variables that, at least in the UAE context, were not associated with elevated depression or anxiety; notably religion, and having children in the household. Religion has previously been found to be a protective factor against depression (38–40) but in the present study it was not. However, we only assessed religion as an identity (affiliation) rather than an individual's levels of religious commitment. Having children at home during the pandemic was associated with depression in a similar COVID-19 survey undertaken in the UK (3). Having children at home while working from home may prove stressful for some families. However, in the UAE, among citizens, it is not uncommon to find three generations of the same family living in one household along with extended family members (17). In the present study, the mean number of people (children and adults) per house, for Emirati citizens, was 8.84 (SD = 4.29), for non-citizens the mean was 3.64 (SD = 2.62). Larger households might reduce the stress of having children at home, through increased support with home-learning and social support in general. Surprisingly, however, household size was not associated with levels of COVID-19-related anxiety. Given that there is a higher risk of infectious disease transmission in larger households (18), this may reflect an area of focus for future health messaging in the context of infectious illness outbreaks in the UAE.

A secondary aim of the study was exploring changes in symptom levels (depression and anxiety) relative to previous, pre-pandemic, regional survey work. The majority of recently published studies, exploring depression and anxiety in the UAE, tend to focus on clinical populations. Alsaadi et al. (41), for example, explored depressive symptoms among multiple sclerosis patients from the UAE, reporting a prevalence of 17.6% for depression and 20% for anxiety. Similarly, Alsaadi et al. (42) report a prevalence of 26.9% for depression and 25% for anxiety among UAE patients diagnosed with epilepsy. Despite chronic health conditions being associated with elevated levels of depression (43), both of these reasonably contemporaneous studies reported lower rates of depression and anxiety than the current study; 58.4 and 55.7% for depression and anxiety, respectively. Similarly, in a non-clinical sample of 302 medical residents in the UAE, depression rates ranged from 6 to 33% depending on residents' medical specialty (44). However, it should be noted that web-based surveys can be prone to self-selection bias (the most anxious and depressed are keenest to take the survey). Furthermore, it should be noted that differences in methods of data collection and mental health assessment make formal, between-studies, comparisons difficult. However, the high rates in the present study are likely, at least in part, to be related to the COVID-19 pandemic and the subsequent infection prevention and control measures.

This study has several important limitations. Firstly, the sample was not representative of the entire UAE population. Notably absent were male workers in fields such as construction and other manual endeavors. Reaching this group was beyond the scope of the present study based on time constraints and the necessary restrictions placed on movement during April 2020. Another important limitation is the correlational nature of the study, rendering all causal and temporal inferences tentative at best. However, obtaining a preliminary understanding of the psychosocial factors associated with elevated levels of depression and anxiety among segments of the UAE population during the pandemic may help inform public mental health plans for current and future outbreaks of infectious illness. Furthermore, post-pandemic economic recovery is likely to be significantly impacted by societal levels of mental ill-health. Exploring potential risk and resilience factors associated with psychological well-being may also help inform broader strategies aimed at national economic recovery.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because the ethical approval for the study requires that only anonymized data may be shared on request with verified researchers. Requests to access the datasets should be directed to Prof. Justin Thomas, Justin.Thomas@zu.ac.ae.

ETHICS STATEMENT

The study received ethical clearance from the research ethics committees of Zayed University (R201213) and the UAE Ministry of Health and Prevention (MOHAP/DXB-REC/MMM/No. 49/2020). All participants provided informed consent prior to undertaking the survey.

AUTHOR CONTRIBUTIONS

JT: study design, write up, and project management. MB and RB: study design and write up. MV and JG: write up. CG: analysis and data visualization. MM: translation and write up. AM: translation, survey development, and data acquisition. MF and TA: review and data acquisition. All authors provided approval for publication of the manuscript content and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Physical Inactivity Is Associated With Increased Levels of Anxiety, Depression, and Stress in Brazilians During the COVID-19 Pandemic: A Cross-Sectional Study

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Objective: To evaluate the levels of anxiety, depression, and stress associated with the practice of physical exercise (PE) during pandemic by COVID-19.

Methods: This study has a cross-sectional characteristic and was carried out between May 12 and 14, 2020. An online questionnaire was applied with questions to assess sociodemographic characteristics and physical exercise during the CoVID-19 pandemic, in addition to depression, anxiety, and stress analysis. The study was approved by the local ethics committee (CAAE: 31521720.8.0000.5082).

Results: One thousand one hundred and fifty four answered the questionnaire (69.84% female). During the isolation period, the number of participants who declared not to exercise was 54.16%. Women generaly presented higher levels of anxiety, depression, and stress when compared to men ($p < 0.0001$ for all domains). The risk of having increased anxiety were 118% higher (OR = 2.183; 95% CI = 1.717–2.775), the risk of depression was 152% higher (OR = 2.525; 95% CI = 1.991–3.205), and the risk of stress symptoms increased 75.1% (OR = 1.751; 95% CI = 1.386–2.213) in the participants who did not perform PE when compared to those who maintain regular PE.

Conclusion: People who was not involved with PE during the COVID-19 pandemic had higher anxiety, depression, and stress scores. Based on this, it seems important to advise people to continue PE, following all the recommendations of preventive measures of the pertinent health organizations.

Keywords: anxiety, depression, stress, COVID-19, physical exercise, mental health, pandemic, physical inactivity

INTRODUCTION

In December 2019, the World Health Organization (WHO) officially reported cases of pneumonia with no apparent cause, in the province of Hubei in China, the new disease caused by a type of coronavirus was designated with COVID-19 (1). COVID-19 quickly crossed borders, infecting people around the world, and was considered a pandemic in early March (2). Currently there are officially 5,438,837 confirmed cases and 340,585 deaths by the new virus. At the moment, Brazil stills in an upward curve of contamination, in May 24, 2020 there were 347,398 cases of infected with 22,013 numbers of deaths (https://covid.saude.gov.br).

Widespread outbreaks of infectious diseases, such as COVID-19, are associated with emotional and psychological distress and symptoms of mental disorders, with a higher prevalence of anxiety, depression, and stress (3–7). The number of people affected by these symptoms tends to be higher than the number of people affected by the infection (8, 9). Limited knowledge about COVID-19, lack of update on COVID-19, duration of home confinement, poor physical health and physical symptoms, lack of access to healthcare, lack of activity, uncertainty regarding the economic scenario and health systems can increase anxiety and depression (3, 6, 10, 11). In addition, social isolation—working and studying at home, having dependent children, decreased physical contact with other people—can be a significant psychological stressor (12, 13) and cause negative lifestyle changes such as poor diet and physical inactivity (14).

Physical exercise (PE) has been associated with improved psychological outcomes (15); and its neurobiological effects seem to influence several neural mechanisms related to depressive and anxiety disorders (16, 17). The absence or reduction of PE has been associated with an increased risk of mental disorders such as anxiety and depression (18–20). Although there is not yet an ideal dose of exercise for this type of diseases, there is evidence demonstrating that any exercise is better than none on mental disorders (15, 20, 21). Studies show that the regular practice of PE can be compared to pharmacological measures for the treatment of mental disorders such as depression (22, 23).

However, in the midst of the global public health crisis scenario, little is known about the relationship between PE and the attenuation of symptoms of mental disorderscaused by the current pandemic. Morover, it would be important to know if physcial activity habits would be related to markers of stress, anxiety, and depression. In view of the above, the objective of this study was to evaluate the levels of anxiety, depression, and stress associated with the practice of PE during COVID-19 outbreak.

METHODS

Study Design and Participants

This study has a cross-sectional characteristic and was conducted between May 12 and 14, 2020, the invitation to participate in the study was made through social media to reach the largest number of respondents. All participants were informed of the evaluation model to be applied and consented to participate. The study was approved by the local ethics committee (CAAE: 31521720.8.0000.5082).

Procedures

A questionnaire was applied via online platform to all those who showed interest to participate in the survey, using the Google® forms system. The questionnaire was divided into two parts, the first involved demographic characteristics (age, gender, marital status, and educational level), weight and height for BMI calculation, history of diseases, PE practice before and during COVID-19 outbreak, fear of contamination and prevention measures adopted.

In the second part of the questionnaire, mental health status was assessed using the Depression Anxiety Stress Scale (DASS-21) (24), based on previous studies (25, 26). The scale consists of 21 self-reports items that assess the leve of anxiety (items 2, 4, 7, 9, 15, 19 e 20), depression (items: 3, 5, 10, 13, 16, 17 e 21) and stress (items 1, 6, 8, 11, 12, 14 e 18), the answers are according to the Likert scale, four points and pass through points 0 (Did not apply to me at all), 1 (Applied to me to some degree, or some of the time), 2 (Applied to me to a considerable degree or a good part of time), and 3 (Applied to me very much or most of the time).

The DASS-21 scale scores are classified by summing the relevant items, and the cutoff points for the anxiety subscale are: normal (<7), mild (8–9), moderate (10–14), severe (15–19), and extremely severe (>20). For depression subscale: normal (<9), mild (10–13), moderate (14–20), severe (21–27), and extremely severe (>28). The cutoff points for the stress subscale are: normal (<14), mild (15–18), moderate (19–25), severe (26–33), and extremely severe (>34).

Statiscal Analysis

The continuous variables of the study are presented in mean ± standard deviation and categorical variables were presented in frequency (percentage). The Shapiro-Wilk was used to assess the normality of the continuous variables. The independent sample *t*-test was used to compare anxiety, depression, and stress scores between men and women. The Chi-square test was used to verify the differences between categorical variables. The binary logistic regression was used to assess the association between regular physical exercise and levels of anxiety, depression, and stress. The significance level adopted was $p < 0.05$ and the statistical software used was the Statistical Package for the Social Sciences (SPSS, IBM Corp., Armonk, NY, USA) version 21.0.

RESULTS

Participants and Demographics Characteristics

A total of 1,154 responded the questionnaire, among them 69.84% were women. Mean age of the participants was 31.15 ± 9.68 and mean BMI was 25.32 ± 5.05. The majority of the participants were single (women: 55.08% and men: 71.83%, with a statistical difference $p = 0.042$). Only 193 interviewees reported pre-existing diseases, including: cancer (0.49%), diabetes mellitus (1.73%), respiratory diseases (9.61%), and arterial hypertension (5.02).

TABLE 1 | Characteristics of the participants.

	Total (n = 1154)	Female (n = 806)	Male (n = 348)	
	N (%)	N (%)	N (%)	p-value
Age, year				0.116
18–29	604 (52.33)	389 (48.26)	215 (61.78)	
30–45	450 (39.00)	334 (41.44)	116 (33.33)	
>45	100 (8.64)	83 (10.30)	17 (4.89)	
BMI, kg/m²				0.397
<24.9	631 (54.67)	460 (57.07)	171 (49.14)	
25.0–29.9	367 (31.80)	235 (29.15)	132 (37.93)	
>30.0	156 (13.53)	111 (13.78)	45 (12.93)	
Marital status				
Single	694 (60.13)	444 (55.08)	250 (71.83)	0.042*
Married/common-law marriage	402 (34.83)	314 (38.96)	88 (25.28)	
Divorced/widowed	58 (5.04)	48 (5.96)	10 (2.89)	
Educational Level				0.261
Elementary education	73 (6.32)	48 (5.95)	25 (7.18)	
College degree	417 (36.13)	270 (33.50)	147 (42.24)	
Graduate degree	464 (40.20)	358 (44.43)	106 (30.45)	
Not answer	200 (17.35)	130 (16.12)	70 (20.11)	
Reported dieases				
Arterial hypertension	58 (5.02)	40 (4.96)	18 (5.17)	
Cancer	4 (0.49)	4 (0.49)	–	
Diabetes	20 (1.73)	15 (1.86)	5 (1.43)	
None	976 (84.57)	674 (83.62)	302 (86.78)	
Respiratory diseases	111 (9.61)	86 (10.66)	25 (7.18)	
Physical exercise before pandemic				0.057
Yes	804 (69.67)	528 (65.62)	276 (79.31)	
No	350 (30.33)	278 (34.48)	72 (20.79)	
Physical exercise during pandemic				0.127
Yes	569 (49.30)	372 (46.24)	197 (56.79)	
No	585 (50.70)	434 (53.86)	151 (43.31)	

*X^2—test; *Statistically significant $p < 0.05$.*

When asked about PE practice before and during the COVID-19 outbreak, 278 women and 72 men reported not practicing any type of PE before social isolation (30.32% of the participants). During the isolation period the number of participants who stated no PE practicewere 434 women and 191 men representing 54.16% of the total. The other data are presented in **Table 1**.

Risk of Contamination and Preventive Measures

A considerable percentage of the participants (96.78% of the women and 85.62% of the men) reported having some fear of contamination by COVID-19. **Table 2** presents the measures taken by the participants, all reported taking at least two of the measures mentioned.

TABLE 2 | Percepction of contamination risk and preventive measures taken by respondents.

	Female (n = 806)	Male (n = 348)
	N (%)	N (%)
Are you afraid of being infected with the new coronavirus (Covid-19)?		
Very	470 (58.31)	158 (45.40)
Little	294 (38.47)	140 (40.22)
None	42 (5.22)	50 (14.38)
What is your chance of being infected by the new coronavirus (Covid-19)?		
Big	64 (7.94)	35 (10.05)
Medium	275 (34.11)	131 (37.64)
Small	288 (35.73)	111 (31.89)
None	28 (3.47)	24 (6.89)
Don't know to answer	151 (18.75)	47 (13.53)
Preventive measures		
Cleaning hands with alcohol gel	691 (85.73)	323 (92.81)
Washin hands with soap	736 (91.31)	296 (85.05)
Using disinfectants at home	546 (67.74)	162 (46.55)
Avoiding leaving home	709 (87.96)	279 (80.17)
Avoiding physical contact	652 (80.89)	278 (79.88)
Avoiding crowded places	756 (93.73)	313 (89.94)
Avoiding touching eyes and nose	581 (72.08)	241 (69.25)

Anxiety, Depression, and Stress Levels

Women presented higher levels of anxiety, depressoin, and stress when compared to men (p < 0.0001 for all domains). It was observed that 374 women (46.41%) and 100 men (28.74%) had mild to extremely severe anxiety levels. In the depression domain, 487 women (60.43%), and 142 men (40.81%) showed mild to extremely severe levels. Regarding stress, 417 women (51.74%), and 110 men (31.61%) presented levels from mild to extremely severe. The frequency per domain is shown in **Table 3**.

Associations and Influence of Physical Exercise During Quarantine on Anxiety, Depression, and Stress

Table 4 shows the comparison of the general scores of anxiety, depression, and stress among the interviewees according to PE practice during the period of social isolation. Individuals who performed PE had lower levels of anxiety, stress, and depression (p < 0.0001 in all domains for women p = 0.0103, <0.0001 and 0.0001, respectively, in men) when compared to individuals who were not performing PE during the COVID-19 outbreak.

Table 5 shows the association between psychological symptoms and PE practice, adjusted for age, in the total population, between women and men. The risk of having increased anxiety were 118% higher (OR = 2.183; 95% CI = 1.717–2.775), the risk of depression was 152% higher (OR = 2.525; 95% CI = 1.991–3.205) and the risk of stress symptoms increased 75.1% (OR = 1.751; 95% CI = 1.386–2.213) in the participants who did not perform PE when compared to those who maintain regular PE. Among women, the chance of showing symptoms of anxiety and depression was more than two times greater (OR = 2.341; 95% CI = 1.760–3.112 and OR = 2.363; 95% CI = 1.771–3.154, respectively) for those did no perform PE. Absence of PE was related to 60% higher risk of having elevated stress levels (OR = 1.602; 95% CI = 1.212–2.117). In men, there was a greater risk of having higher levels of anxiety, depression, and stress (OR = 2.929; 95% CI = 1.911–4.449; 4.045; 95% CI = 2.657–6.155 and 3.247; 95% CI = 2.147–4.993, all presented $p <$ 0.0001) in those who did not perform PE.

TABLE 3 | Number of participants showing psychological symptoms during quarantine by COVID-19, stratified by sex, using DASS-21.

	Sex		*p*-value
	Female (*n* = 806) N (%)	**Male (*n* = 348) N (%)**	
Anxiety			<0.0001*
Normal	432 (53.59)	248 (71.26)	
Mild	61 (7.56)	16 (4.59)	
Moderate	146 (18.11)	49 (14.08)	
Severe	61 (7.56)	13 (3.73)	
Extremaly severe	106 (13.18)	22 (6.34)	
Depression			<0.0001*
Normal	319 (39.57)	206 (59.19)	
Mild	124 (15.38)	39 (11.20)	
Moderate	195 (24.19)	54 (15.51)	
Severe	68 (8.43)	27 (7.76)	
Extremaly severe	100 (12.43)	22 (6.34)	
Stress			<0.0001*
Normal	389 (48.26)	238 (68.39)	
Mild	112 (13.89)	42 (12.06)	
Moderate	126 (15.63)	34 (9.77)	
Severe	123 (15.26)	26 (7.47)	
Extremaly severe	56 (6.94)	8 (2.31)	

**Statistically significant p < 0.05.*

DISCUSSION

A recent scientometric analysis found that the most common research topics include emergency care and surgical, viral pathogenesis, and global responses in the COVID-19 pandemic but there is a lack of research on PE (27). Our results showed an increase of 67.14% in the number of people who did not perform PE during the COVID-19 pandemic. Women had higher scores of anxiety, depression, and stress when compared to men. Our analysis showed that thosewho did not practice PE showed higher values in all subscales evaluated (anxiety, depression, and stress). After binary logistic regression, the lack of PE practice was associated with higher values of anxiety, depression, and stress in both men and women.

Our results showed that individuals who performed PE during coronavirus outbreak presented lower levels of anxiety, stress and depression. When considering both sexes, those who did not perform PE had a 118% higher risk of presenting symptoms of anxiety, 152% more chance of having values of depression above normal and 75.1% higher risk of having symptoms of

TABLE 4 | Comparison of anxiety, depression, and stress levels in respondents who do or do not physical exercises during quarantine by COVID-19.

	Female			Male		
	PA (*n* = 372) N (%)	**PI (*n* = 434) N (%)**	***p*-value**	**PA (*n* = 197) N (%)**	**PI (*n* = 151) N (%)**	***p*-value**
Anxiety			<0.0001			0.0103
Normal	241 (64.80)	191 (44.00)		148 (75.13)	100 (66.22)	
Mild	29 (7.79)	32 (7.37)		10 (5.08)	6 (3.97)	
Moderate	51 (13.70)	95 (61.88)		24 (12.18)	25 (16.55)	
Severe	20 (5.38)	41 (9.44)		3 (1.52)	10 (6.63)	
Extremaly severe	31 (8.33)	75 (17.31)		12 (6.09)	10 (6.63)	
Depression			<0.0001			<0.0001
Normal	188 (50.55)	131 (30.18)		136 (69.04)	70 (46.35)	
Mild	61 (16.41)	63 (14.51)		20 (10.15)	19 (12.58)	
Moderate	70 (18.81)	127 (29.26)		25 (12.69)	29 (19.20)	
Severe	27 (7.25)	39 (9.00)		8 (4.06)	19 (12.60)	
Extremaly severe	26 (6.98)	74 (17.05)		8 (4.06)	14 (9.27)	
Stress			<0.0001			0.0001
Normal	203 (54.59)	186 (42.85)		146 (74.12)	92 (60.92)	
Mild	60 (16.12)	52 (11.98)		30 (15.23)	12 (7.94)	
Moderate	58 (15.59)	68 (15.69)		11 (5.58)	23 (15.26	
Severe	40 (10.75)	83 (19.12)		6 (3.04)	20 (13.24)	
Extremaly severe	11 (2.95)	45 (10.36)		4 (2.03)	4 (2.64)	

PA, physically active during pandemic for Covid-19; PI, physically inactive during pandemic for Covid-19.

TABLE 5 | Association between physical exercise and mental health status measured by DASS-21, adjusted for age and stratified for sex.

		Anxiety			Depression			Stress		
		OR	**95% CI**	***p*-value**	**OR**	**95% CI**	***p*-value**	**OR**	**95% CI**	***p*-value**
All	Physically active during quarantine	1.00			1.00			1.00		
	Physically inactive during quarantine	2.183	1.717; 2.775	<0.0001	2.526	1.991; 3.205	<0.0001	1.751	1.751; 2.213	<0.0001
Female	Physically active during quarantine	1.00			1.00			1.00		
	Physically inactive during quarantine	2.341	1.760; 3.112	<0.0001	2.363	1.771; 3.154	<0.0001	1.602	1.212; 2.117	0.001
Male	Physically active during quarantine	1.00			1.00			1.00		
	Physically inactive during quarantine	2.929	1.911; 4.490	<0.0001	4.045	2.657; 6.155	<0.0001	3.247	2.147; 4.993	<0.0001

OR, odds ratio; 95% CI, 95% confidence interval.

stress. Women who did not perform PE were 134% more likely to have high anxiety scores, 136% more likely to have depressive symptoms and 66% more likely to show high levels of stress. As for men, those who were not involved with PE were 192, 304, and 224% more likely to have high levels of anxiety, depression, and stress, respectively, as shown in **Table 5**.

Our results are in agreement with previous studies. Fluetsch et al. (28) evaluated the "The 2015 Behavioral Risk Factor Surveillance System" and found an inverse relationship between PE and mental health for those who reported being insufficiently active. Teychenne et al. (29) reported that sedentary behavior was associated with increased risk of anxiety. A meta-analysis documented that PE interventions significantly improved depressive symptoms among healthy adults (30). Moreover, it has been shown that PE have the potential to decrease the self-reported days of mental health problems due to anxiety, depression, and stress (28). Schuch et al. (31), when performing a meta-analysis with prospective studies (at least 1 year of follow-up), showed that higher levels of self-reported PE are associated with a lower risk of anxiety symptoms and anxiety disorders when compared to lower levels of PE.

The relationship between PE and mental health problems seems to be bidirectional. Exercise reduce the risk of anxiety and/or depression symptoms, but these symptoms may also lead the individual perform PE. Da Silva et al. (32), reported that regular PE was associated with a lower probability of depressive symptoms; but in the inverse analysis, participants with symptoms of anxiety and depression were more likely to not reach the recommended levels of PE. However, there are possible mechanisms that might explain the influence of PE on mood. These mechanisms though might involve the release of endorphins (33), thermogensis (34), the activation of the mTOR axis in specific brain regions (35) and neurotransmitters such as dopamine and serotonin (36, 37).

In the current scenario, measures aiming to control covid-19 dissemination require social isolation and restrictions that might agravate mood symptoms. However, the present results suggest that PE may decrease the risk of depression, anxiety, and stress. Therefore, it might be advisable to recommend the performance of PE, obviously respecting safety recommendations as part of the behavior therapy (38) and health education (39) during the COVID-19 pandemic.

The WHO recommends 150 min of PE for asymptomatic people, which can be distributed throughout the week, and for those people with comorbidities who do not present symptoms the recommendation is to continue with active habits (40) From a practical standpoint, PE can be performed with numerous possibilities. It is possible to adapt materials, use body weight exercises, elastic bands, exercise with no external loads, calisthenics and others (41–49).

The study has some important limitations. We opted to perform a simple analysis of PE habits (yes or no question). Whist this facilited response, it does not precisely define different levels, so we cannot stablish a dose response relation. Another important limitation is that the mode of delivery (electronic) leaded mostly younger adults that have access to internet to respond; therefore, it might not reflect the situation of groups with different socioechonomical and age status. It might not reflect the situation of groups with different socioechonomical and age status. This study did not explore the use of face mask as preventive measures which was found to be associated with lower prevalence of depression (7) but cannot be used during PE.

CONCLUSION

Based on the present results, it is possible to note a reduction in regular PE during social isolation. Moreover, people who was not involved with PE during the COVID-19 pandemic had higher anxiety, depression, and stress scores. Based on this, it seems important to advise people to continue PE, following all the recommendations of preventive measures of the pertinent health organizations.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

This study involved human participants and was reviewed and approved by the Research Ethics Committee linked to the Center for Excellence in Teaching, Research and Projects Leide das Neves Ferreira of the National Health Council. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

LRBS: concept and study design, collected and analyzed data, wrote, reviewed, and edited the manuscript. CS and CO: collected data, wrote, reviewed, and edited the manuscript. PS, JO, LFMS, and CP: collected data and edited the manuscript. PG and AR: contributed with data analysis, reviewed, and edited the manuscript. All authors contributed to the article and approved the submitted version.

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Psychological Effects of Social Isolation Due to Quarantine in Chile: An Exploratory Study

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As we all know, COVID-19 has impacted the entire world. Quarantine disrupts people's lives, with high levels of stress and negative psychological impacts. Studies carried out mostly in the Far East, Europe, or the United States have started to provide evidence on survivors, frontline healthcare workers, and parents. The present study is the first survey to be carried out in Latin America (in Santiago, the capital of Chile). It aims to (a) explore the perceived psychological impact and future concerns; (b) evaluate vulnerability factors; (c) describe the perceived psychological impacts on participants whose psychological help and actual online psychotherapy was interrupted; and (d) explore the future need for psychological help. *Procedure:* An online survey was carried out (the first 2 weeks of lockdown in Santiago), which included sociodemographic data, perceived psychological impact, future concerns, and questions about psychological support. *Participants:* A total of 3,919 subjects answered, mostly women (80%). *Results:* The main perceived psychological impacts were concern (67%) and anxiety (60%). *Future concerns were*: general health (55.3%), employment (53.1%), and finances (49.8%). Younger participants had a greater perceived psychological impact (p's < 0.01) and concerns about employment, finances, mental health, stigma, and general health (p's < 0.001). Women reported more perceived psychological impact than men (p's < 0.05). Men reported mainly boredom ($\chi^2 = 11.82$, gl $= 1$, $p < 0.001$). Dependent employees experienced more boredom, anxiety, distress, sleep problems, an inability to relax, and a lack of concentration than the self-employed (p's < 0.05). While the latter reported future concerns about employment and finances (p's < 0.001), dependent employees reported them on their general and mental health (p's < 0.001). Regarding psychological support, 22% of participants were receiving it before lockdown. They showed more perceived psychological impact than those who were not (p's < 0.01), and 7% of them had online psychotherapy, reporting excellent (32.1%) or odd but working (65.2%) results. Finally, of the total sample, almost half of the participants (43.8%) felt they would need emotional support after this pandemic, and these are the ones that also showed higher perceived psychological impact (p's < 0.001). This study confirms the presence of perceived negative emotional impact and concerns about the future. Also, there are vulnerable groups, such as women, younger people, the self-employed, and people with psychological processes that were interrupted.

Keywords: psychological impact, COVID-19, psychological support, tele-psychotherapy, vulnerability factors

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INTRODUCTION

There have been several pandemics in human history (e.g., Spanish Flu, 1918–1919; Asian Flu, 1957–1958; A1NH1 2009–2010). The current pandemic, COVID-19, has impacted the entire world, starting in China in December 2019. At the time of writing the manuscript, COVID-19 was affecting 213 countries and territories around the world, with almost 16,575,090 cases and 654,623 deaths (1). In Chile, the first case of COVID was a 33-year-old man who had to be hospitalized on 3 March. The first death took place on 21 March.

This study was carried out in Chile between 23 March and 15 April 2020. At the end of the survey, 95 people had died out of 8,273 confirmed cases (2). Artificial respirators and ICUs were at ≤20% occupancy (3).

In the history of pandemics, one of the viruses with a worldwide impact was H1N1, which had an infection rate of ∼1.6 infected by one subject with the virus, and its symptomatology was quickly evident (4, 5). COVID-19 has a higher level of contagion, estimated at 4.08 (5), and it also presents characteristics that are mutating, such as the symptoms and presence of the virus, even in asymptomatic conditions (4–6). These cause high levels of anxiety and fear about the future (7, 8). Countries around the world have established more or less strict quarantine measures. It is believed that confinement, such as social isolation, helps to prevent the spread of the virus (9).

Quarantine or social isolation disrupts people's jobs and lives immensely, and hence it may have important implications for their health and well-being (7, 8). These necessary measures lead the general population to a high level of stress and psychological problems, producing uncertainty, fear of contagion, and illness in themselves and their loved ones, and a fear of financial loss (7, 10, 11). Separation from loved ones, loss of freedom, losing direct social contact, employment, recreation, privileges, boredom (12), and uncertainty over the disease's status, on occasion, create dramatic effects that are among the significant stressors that will undoubtedly contribute to widespread emotional distress (13).

Indeed, the well-being implications of quarantine were evident in previous outbreaks such as SARS or MERS. After quarantine, hospital staff showed more acute stress disorders (13) and post-traumatic symptoms, even 3 years later (14). Among the general population, anger and anxiety were predominant, mainly because of economic concerns several months later (13), with an increase in the number of suicides (15, 16).

The studies that have been done so far on the COVID-19 pandemic, and especially on the effects of quarantine, have shown a high negative psychological impact. These studies were conducted mostly in the Far East, Europe, or the United States, and they have started to provide showing adverse emotional effects such as increased stress, depression, anxiety, sleeping difficulties, post-traumatic stress, anger, boredom, stigma, substance use, and loneliness (17–28). Moreover, some studies have compared negative emotions before lockdown and during the COVID-19 outbreak. The results have shown that there has been an increase in negative emotions during lockdowns, such as anxiety and depression (7, 29), and a decrease in life satisfaction (30). After 1 month of confinement, Zhang et al. (22) found that those who stopped working reported worse mental health and more distress. Because of these long-lasting effects, it is extremely relevant to enquire about the actual psychological impact and future concerns during this particular pandemic quarantine in other regions, such as South America.

From all of the studies, it is evident that pandemics such as this one, and its concomitant lockdowns, have a massive impact on people, especially on their mental health, which includes different feelings about it and future concerns. Identifying these is very important in terms of taking measures to prevent or treat the psychological impact. Few studies have evaluated these issues among the general population (25, 31), mainly targeting specific people such as health professionals [e.g., (4, 32–34)], COVID-19 survivors (33), or specific age groups (35).

From COVID-19 studies, particular vulnerability factors have been identified. As such, they increase the presence of a negative emotional impact due to quarantine. Some of these are gender, educational level, and age [e.g., (28, 36)]. Findings on gender suggest that women are more vulnerable to stress than their male counterparts (4, 37), increasing the possibility of developing post-traumatic disorders afterwards (19, 31). On the other hand, people with a higher level of education tend to have more distress, probably because of a high level of self-awareness about their health (19, 37). Concerning age, individuals between 18 and 30 years of age, or above 60, presented the highest levels of emotional distress (19). Younger people, such as college students, showed that they were experiencing anxiety during COVID-19 (4, 35). Other studies found that one of the vulnerability factors for screening anxiety or depression was a younger age (31, 36). Some studies in Italy have related the impact of quarantine to personality traits such as negative affect and attachment, finding that detachment and negative affect were related to depression, anxiety, and stress (25).

Besides vulnerability factors, concerns about the present and future are among the main issues that lead to high stress during lockdown. As is expected for infectious disease, the main concern is about becoming sick or that a family member will (7). However, there have also been high economic consequences related to other pandemic conditions (38). In the SARS outbreak in Canada and the United States, concern about financial loss meant that people did not comply with quarantine or evacuation (37, 39–41). Also, months after SARS struck in China, the fear of income reduction was among the highest vulnerability factors for psychological disorders (39). Specifically, with the COVID-19 pandemic, college students have been worried about the economic influences of the epidemic, which are related to the high levels of anxiety (24, 35). Therefore, not only are the concerns about health issues relevant, but economic or financial matters will also be highly prevalent.

However, there is another part of the population that has gone unnoticed, namely, those who were having psychological help before lockdown. Few studies have focused on this type of person, concentrating instead on psychiatric patients or inpatients [e.g., (42)], showing that quarantine exacerbates existing mental health disorders (43–45), or asking about psychological support or psychotherapy as one of the areas but not relating it to psychological distress or symptoms (25). Diagnosed before the pandemic, mental health symptoms are associated with anxious and irritable symptoms 4–6 months after quarantine (46, 47). However, in the area of mental health, not only must people with severe mental disorders be taken into account, there are also people who were having psychological outpatient help before lockdown (48). These people have faced not only the impact of social isolation and quarantine, but also without this support. For this reason, they need to be evaluated, as they are likely to have a different or more intense perceived psychological impact.

We know that there has been an increase in the development of online psychotherapy (i.e., providing mental healthcare remotely, using telecommunications such as telephone or video conferencing tools), which has been introduced suddenly and expanded significantly to serve patients at treatment or in actual need of treatment (49). Many discussions of clinicians on organizations and some qualitative studies (50) have emerged with the intention of evaluating the impact of this new approach on therapists and their settings, and yet, no review has asked patients how they have experienced this change. This is an essential issue, since other pandemics had shown that mental health support and follow-up should be provided even 6 months after release from isolation for those individuals with or without a prior vulnerable mental health status (51). How patients evaluate the effectiveness of this new approach will be relevant to installing it as a modality to be performed in the future, in both online psychotherapy and online psychiatry.

The COVID-19 epidemic has caused a parallel epidemic of fear, anxiety, and depression worldwide, along with concerns about the future. This study is the first to evaluate the perceived psychological impact on a South American country such as Chile. The objectives are to (a) survey the general public to understand better their levels of psychological effect and future concerns; (b) identify relationships between vulnerability factors (age, gender, and occupation), perceived psychological impact, and future interests; (c) describe the perceived psychological effects on survey participants who had processes interrupted because of this pandemic, and evaluate online psychotherapy; and (d) explore the future need for psychological help. It is hypothesized that there will be perceived psychological impacts, such as anxiety and depression. Also, future concerns will appear mainly related to overall health and economic issues. Furthermore, vulnerability factors such as being a woman, younger, and self-employed may reveal differences. Finally, it is expected that those who had their processes interrupted will be more emotionally affected and that virtuality may help them. Finally, it is expected that there will be a significant percentage of people who think they will need psychological help in the future.

MATERIALS AND METHODS

Participants

The sample comprised 3,919 participants, living in Santiago (the capital of Chile) (80% women). Participants' age ranges were created based on a quantile cutoff criterion, using the 20, 40, 60, and 80 quantiles. Accordingly, 20.0% of participants ranged from 18 to 29 years of age, 20.3% were between 30 and 38 years of age, 21.5% were between 39 and 46 years of age, 18.8% were between 47 and 55 years of age, and, finally, 19.37% participants were between 55 and 89 years of age. For the sample, only participants over 18 years of age were considered. Forty-six percent of the participants reported being employed workers, while 26% reported being self-employed.

Procedure

In order to fulfill the objectives, an online survey was carried out (disseminated through personal and social networks) from 23 March to 15 April 2020 (23 days). This coincided with the first case of COVID-19 in Chile and the government's subsequent decision to keep the pandemic under control through a lockdown of Santiago.

This study was reviewed and approved by the Institutional Review Board of the Universidad Diego Portales (N°006-2020), which conformed to the principles embodied in the Declaration of Helsinki. All respondents provided informed consent.

Measures

Survey Development

As a result of the need to screen several psychological symptoms that could appear during the COVID-19 pandemic, the survey items were developed with a focus on previous surveys on the psychological effects of SARS, Ebola and influenza outbreaks, and actual studies on COVID-19 (see *Introduction*). Specifically, we focused on Brooks et al.'s (52) revision, since it provided very thorough evidence on the psychological impact of quarantine. Brooks et al. (52) reviewed 903 studies on the prevalence of psychological symptoms, and they found that the most prevalent were insomnia, irritability, fear, stress, depression, concern, anxiety, and fear. Other input was Taylor's book (17), with the most reported psychological impact in almost all pandemics being anxiety, concern, fear, stress, uncertainty, irritability, and depression.

New dimensions appeared in Zhang et al. (22), which considered working conditions to be a vulnerability factor for psychological distress. Other authors [e.g., (52, 53)] mentioned the effect on financial loss of quarantine and therefore economic concerns as a stressor. With this input, the authors decided to separate the psychological impact from concern, mainly because quarantine was just starting in Chile and the future was therefore a big issue.

On the other hand, as three of the four authors are clinical psychologists, the question was quickly raised about how patients who were having help were managing to cope without it, and virtuality was also increasingly being used in Chile at the time, so there was a need to understand the subjective experience of patients of this new helping tool.

Therefore, the survey consisted of 16 questions, which evaluated several areas: (a) sociodemographic data (gender, age, education, and occupation); (b) the perceived psychological impact of quarantine; (c) future concerns; and (d) psychological support (pre-quarantine support, actual support, and future support needs).

Regarding the actual perceived psychological impact, respondents had to select one or more of the following perceived impacts: boredom, distress, anxiety, lack of concentration, frustration, inability to relax, restlessness, irritability, fear, loss of control, loss of freedom, concern, sleep problems, feeling trapped, and loneliness. On future concerns, respondents also had to select one or more of the following concerns: policy, school, economic issues, work, mental health, overall health, and stigma.

On psychological support, respondents were asked if they were receiving psychological help before quarantine [0 = no; 1 = yes], and those who answered affirmatively to this question had to answer the next questions as a sub-sample. First, if they had psychological support, 16 questions had to be answered: how long they had been receiving help when quarantine started (a few sessions, more than 6, or more than 12). They were asked about why they had started psychotherapy, and they could choose more than one alternative from depression, anxiety, psychosis, cognitive and learning problems, personality problems, eating disorders, physical problems, addictions, trauma abuse, grief, self-esteem, interpersonal relations, life and well-being, work, or study. They were also asked if they had psychological help online [0 = no; 1 = yes], and how they rated this new tool (excellent, odd but it works, it generates disgust, or no good).

Another aspect related to psychological support was to ask about the future need for psychological help after lockdown [0 = no; 1 = yes]. For this question, all survey respondents had to answer.

Data Analysis

Given the exploratory nature of the study, the data analysis had two pivotal moments. The first moment consisted of the estimation of descriptive statistics for each of the variables of interest. Most of the study variables were measured as categorical variables, so their frequencies and total percentages were studied. In a second moment, bivariate relations between the variables of interest were calculated. When two categorical variables were associated, a chi-squared statistic was used to determine a statistically significant relationship, and when a categorical variable was related to a quantitative one, the Student t statistic was used to determine statistically significant differences. All statistical analyses were carried out using R v4.0.0 software (54).

RESULTS

Perceived Psychological Impact and Future Concern

Table 1 shows the percentage of data of the different perceived psychological impacts reported by the study participants. It can be seen that the most frequently reported feeling was concern, with 67% of people reporting it. Next, the second most frequently reported perceived impact was anxiety, with 60% of the sample reporting feeling it during quarantine. On the other hand, feelings of loneliness were the second least reported, namely, 16% of the sample, and a feeling of loss of control was the least reported perceived impact, with only 9.5% of participants reporting feeling it.

Regarding future concerns of the participants, **Table 1** shows that the most frequent concern was overall health, with 55.3% of the sample reporting it. Next, with a similar percentage, 53.1% of participants reported feeling concerned about work issues. Similarly, 49.8% of participants reported being concerned about economic issues. In contrast, only 1.5% of participants reported being concerned about stigma.

TABLE 1 | Number and percentage of reports of the current perceived impact and future concern.

	Does not report		Reports	
	f	%	*f*	%
Current impact				
Fear	2,648	67.6	1,271	32.4
Concern	1,288	32.9	2,631	67.1
Frustration	2,898	73.9	1,021	26.1
Boredom	2,556	65.2	1,363	34.8
Anxiety	1,556	39.7	2,363	60.3
Distress	2,324	59.3	1,595	40.7
Feeling trapped	2,991	76.3	928	23.7
Loss of control	3,546	90.5	373	9.5
Loneliness	3,283	83.8	636	16.2
Sleep problems	2,329	59.4	1,590	40.6
Inability to relax	2,962	75.6	957	24.4
Loss of freedom	2,716	69.3	1,203	30.7
Lack of concentration	2,476	63.2	1,443	36.8
Irritability	2,370	60.5	1,549	39.5
Restlessness	2,281	58.2	1,638	41.8
Future concern				
Employment	1,837	46.9	2,082	53.1
School	3,365	85.9	554	14.1
Financial issues	1,966	50.2	1,953	49.8
Policy	2,437	62.2	1,482	37.8
Mental health	2,654	67.7	1,265	32.3
Stigma	3,860	98.5	59	1.5
Overall health	1,751	44.7	2,168	55.3

Vulnerability Factors Related to Perceived Psychological Impact and Future Concern

Age, Perceived Psychological Impact, and Future Concern

When looking at the perceived psychological impact in relation to age, it can be seen in **Table 2** that, for all feelings, the average age for people who reported feeling them was significantly lower (p's < 0.01). The widest difference was observed in the feeling of frustration, where those who reported this feeling were on average 35.36 years old, and those who did not report it were on average 43.34 years old ($t = 21.28$, $p < 0.001$). The perceived psychological impact where the least age difference could be observed was worry, where those who reported feeling this way were, on average, 42.24 years old, while those who did not report being worried were 43.77 years old ($t = 3.10$, $p = 0.002$).

Comparisons between participants' ages who reported, and did not report, different types of concern during quarantine are shown in **Table 3**. As a general trend, younger participants reported employment, finances, mental health, stigma, and general health concerns (p's < 0.001). However, no significant differences could be observed in the age of participants that reported school and political concerns.

TABLE 2 | The average age of perceived impact reports on current feelings.

	Does not report		Report		*t*
	M	**DE**	***M***	**DE**	
Fear	43.98	14.38	40.17	13.18	8.24***
Concern	43.77	17.77	42.24	13.75	3.10**
Frustration	43.34	13.72	35.36	12.50	21.28***
Boredom	40.06	13.14	36.51	13.76	21.03***
Anxiety	48.03	13.86	39.26	13.16	19.80***
Distress	45.59	14.01	38.59	13.19	15.90***
Feeling trapped	44.57	13.73	36.85	13.71	14.96***
Loss of control	43.30	14.26	37.45	11.24	9.30***
Loneliness	43.88	13.58	36.88	15.26	10.76***
Sleep problems	44.92	14.17	39.55	13.40	12.05***
Inability to relax	44.68	14.05	36.76	12.52	16.49***
Loss of freedom	44.21	13.96	39.43	13.89	9.93***
Lack of concentration	45.76	13.83	37.57	13.04	18.52***
Irritability	45.82	14.42	38.02	12.20	18.18***
Restlessness	44.19	13.77	40.72	14.32	7.60***

****p* < 0.001, ***p* < 0.01, **p* < 0.05.

Gender, Perceived Psychological Impact, and Future Concern

Table 4 shows the percentage of men and women who reported different perceived psychological impacts. In general, some statistically significant gender differences can be highlighted. The perception of fear, worry, frustration, anxiety, distress, feeling trapped, loss of control, sleep problems, inability to relax, irritability, and restlessness were reported mostly by women (p's < 0.05). However, 40.1% of the men in the sample reported feeling bored, while only 33.5% of the women reported boredom ($\chi^2 = 11.82$, gl $= 1$, $p < 0.001$). In terms of feelings of loneliness, loss of freedom, and lack of concentration, no gender differences were observed.

On gender differences in each of the future concerns studied (see **Table 5**), more men reported having more future concerns on employment and politics than women (p's < 0.05). However, for mental health and general health concerns, more women reported having them (p's < 0.01). And for school, financial, and stigma concerns, no statistically significant differences were observed.

Occupation, Perceived Psychological Impact, and Future Concern

For reporting current perceived psychological impacts and the type of occupation that the participants had, those working as employees were compared with those who were self-employed. The results of this comparison can be seen in **Table 6**. In general, there was a higher percentage of employed workers who reported feeling bored, anxious, distressed, experiencing sleep problems, an inability to relax, and a lack of concentration (p's < 0.05). For the rest of the perceived psychological impacts, no significant differences were observed.

Table 7 shows the results for the type of concern reported by both types of occupation. A majority of self-employed workers reported feeling employment and financial concerns (p's < 0.001). In contrast, a higher percentage of people with dependent employment reported having mental health and general health concerns (p's < 0.001). For school, policy, and stigma concerns, no statistically significant differences were observed between the work mode of the study participants.

Previous Psychological Support

Table 8 shows the percentage of data on the number of participants who had received pre-quarantine psychological therapy and some particularities of the treatment they received. From all of the sample, 22.3% of participants reported that they had received some type of psychological therapy before quarantine.

Of the participants that reported being in treatment, 54.7% reported that they had more than 6 sessions and 19.2% reported that they had more than 12 sessions. In general, the most recurrent frequency was weekly sessions, with 51.1% of the study participants reporting having followed this format. However, 19.2% reported receiving sessions once a month, and 17.3% had no fixed frequency of their sessions.

The most recurrent reason for consultation was anxiety, with 47.14% of participants receiving therapy, followed by depression, with 39.36%. Among the least frequent reasons for consultation in the sample were cognitive and learning problems (1.95%), psychosis (2.17%), and addictions (2.63%). Finally, only 7.6% of participants who had previously been receiving emotional support reported that they were currently attending psychological therapy. When asked about this experience, most of them referred to having a positive experience, or at least feeling that it was helping them (97.3%).

Perceived Impact, Previous Psychological Support, and Future Needs

Table 9 shows the associations between the percentage of people who reported having received psychotherapy before quarantine

TABLE 3 | Average age of future concern reports.

	Does not report		Report		*t*
	M	***DE***	***M***	***DE***	
Employment	43.73	14.96	41.88	13.25	4.06***
School	42.70	14.76	43.05	9.20	−0.76
Financial issues	43.56	14.86	41.94	13.26	3.57***
Policy	43.04	13.46	42.26	15.11	1.63
Mental health	45.30	13.88	37.38	13.03	17.31***
Stigma	42.84	14.10	36.49	13.30	3.67***
Overall health	43.61	13.71	42.04	13.39	3.48***

****$p < 0.001$, **$p < 0.01$, *$p < 0.05$.*

TABLE 4 | Percentage of reporting of perceived impact on current feelings by gender.

	Male		Female		$\chi^2_{(1)}$
	F	**%**	***F***	**%**	
Fear	161	20.5	1,110	35.4	63.37***
Concern	480	61.1	2,151	68.7	16.05***
Frustration	169	21.5	852	27.2	10.27**
Boredom	315	40.1	1,048	33.5	11.82***
Anxiety	405	51.5	1,958	62.5	31.13***
Distress	213	27.1	1,382	44.1	74.64***
Feeling trapped	163	20.7	765	24.4	4.50*
Loss of control	52	6.6	321	10.2	9.20**
Loneliness	115	14.6	521	16.6	1.70
Sleep problems	239	30.4	1,351	43.1	41.60***
Inability to relax	169	21.5	788	25.2	4.39*
Loss of freedom	221	28.1	982	31.3	2.93
Lack of concentration	266	33.8	1,177	37.6	3.6
Irritability	2.36	30.0	1,313	41.9	36.6***
Restlessness	300	38.2	1,338	42.7	5.13*

****$p < 0.001$, **$p < 0.01$, *$p < 0.05$.*
Only the percentages of people who reported having the sensation are included in the table, for ease of reading.

TABLE 5 | Percentage of reporting of future concern by gender.

	Male		Female		$\chi^2_{(1)}$
	f	**%**	***f***	**%**	
Employment	448	57.0	1,634	52.2	5.72*
School	101	12.8	453	14.5	1.21
Financial issues	387	49.2	1,566	50.0	0.11
Policy	337	42.9	1,988	36.5	10.43**
Mental health	218	27.7	1,047	33.4	9.02**
Stigma	11	1.4	48	1.4	0.01
Overall health	371	47.2	1,797	57.4	25.81***

****$p < 0.001$, **$p < 0.01$, *$p < 0.05$.*
Only the percentages of people who reported having the concern are included in the table, for ease of reading.

and the feelings they were currently experiencing. In general, people who had received some kind of previous psychotherapy reported feeling most of the perceived psychological impacts studied in higher percentages than those who did not have psychological help (p's < 0.01). However, the association between previous psychological treatment and feeling worried was not statistically significant ($\chi^2 = 1.26$, gl $= 1$, $p = 0.28$).

TABLE 6 | Percentage of reporting of impact on current feelings by occupation.

	Employed worker		Self-employed worker		$\chi^2_{(1)}$
	f	%	*f*	%	
Fear	608	33.6	305	30.1	3.52
Concern	1,227	67.9	682	67.3	0.07
Frustration	410	22.7	228	22.5	0.01
Boredom	565	31.3	280	27.6	3.89*
Anxiety	1,135	62.8	544	53.7	21.98***
Distress	736	40.7	341	33.7	13.44***
Feeling trapped	401	22.2	197	19.4	2.76
Loss of control	179	9.9	88	8.7	0.98
Loneliness	242	13.4	118	11.6	1.62
Sleep problems	740	41.0	354	34.9	9.61**
Inability to relax	460	25.5	177	17.5	23.20***
Loss of freedom	509	28.2	298	29.5	0.43
Lack of concentration	685	37.9	308	30.4	15.69***
Irritability	708	39.2	368	36.3	2.12
Restlessness	715	39.6	416	41.1	0.54

****p < 0.001, **p < 0.01, *p < 0.05.*
Only the percentages of people who reported having the sensation are included in the table, for ease of reading.

TABLE 7 | Percentage of reporting of future concern by occupation.

	Employed worker		Self-employed worker		$\chi^2_{(1)}$
	f	%	*F*	%	
Work	907	50.2	632	62.4	38.45***
School	293	16.2	149	14.7	1.00
Economic issues	819	45.3	630	62.2	73.26***
Policy	664	36.7	373	36.8	0.01
Mental health	609	33.7	215	21.2	48.26***
Stigma	24	1.3	14	1.4	0.01
Overall health	1,039	57.5	487	48.1	22.83***

****p < 0.001, **p < 0.01, *p < 0.05.*
Only the percentages of people who reported having the concern are included in the table, for ease of reading.

Perceived Impact and the Need for Further Psychological Support

Finishing with the studied perceived psychological impacts, we see in **Table 10** the association between the current feelings and reporting the need for psychological support after quarantine. Of the total number of respondents, 43.8% (1,717) reported that they thought they would need some psychological help post-quarantine. These participants reported a statistically significant higher frequency of all the perceived psychological impacts studied than those who reported they would not need help (p's < 0.001).

DISCUSSION

The goal of the present study was to examine through a survey the perceived psychological impact and future concerns regarding the COVID-19 lockdown in Santiago, Chile. The study also aimed to identify those participants receiving psychological support before quarantine, the psychological effects on them of interruption of the process due to quarantine, and the usefulness of online psychotherapy. It was intended to explore the likely need for psychological support after lockdown.

As we know, worldwide, COVID-19 has caused a parallel epidemic of fear, anxiety, depression, and concern about the future. In this study, being in quarantine for the first 2 weeks of this pandemic had adverse effects on the participants. Mainly, the results show a high presence of general concern and anxiety, consistent with COVID-19 research [e.g., (12, 20, 55)] and past research on the psychological consequences of quarantine during a pandemic (14). Unlike other studies, we did not find a high presence of sleep problems (26), and the results even showed a lower presence of loneliness than was evident in other studies (28).

Regarding future concerns, this study shows how a higher number of participants reported being concerned about their overall health, work, and economic issues. General health has

TABLE 8 | Frequencies and percentages for previous, current, and future psychological support.

	f	%
Previous psychological support		
No	3,045	77.7
Yes	874	22.3
Therapeutic process progress		
Few sessions	228	26.1
More than 6	478	54.7
More than 12	168	19.2
Frequency of psychotherapy sessions		
More than once a week	29	3.3
Weekly	447	51.1
Less than once a week	79	9.0
Once a month	168	19.2
No fixed frequency	151	17.3
Reason for consultation		
Depression	344	39.36
Anxiety	412	47.14
Psychosis	19	2.17
Cognitive and learning problems	17	1.95
Personality problems	52	5.95
Eating disorders	57	6.52
Physical problems	34	3.89
Addictions	23	2.63
Trauma abuse	107	12.24
Grief	122	13.96
Self-esteem	210	24.03
Interpersonal relations	263	30.09
Life and well-being	250	28.60
Work or study	164	18.76
Current psychological support		
No	3,620	92.4
Yes	299	7.6
Experience with current virtual psychological support		
Excellent	96	32.1
Odd, but it works	195	65.2
It generates disgust	1	0.3
No good	7	2.3

been one of the main concerns during quarantine [e.g., (52)], as the number of deaths has been increasing worldwide, and second outbreaks have even appeared in countries where the pandemic was supposedly under control.

Furthermore, some studies have shown how economic concern is a dimension (38, 39, 56, 57). However, what this study found to be different from the rest is how concerns about work and economic issues had the same relevance as overall health. There are many possible interpretations of this, and some authors [e.g., (53)] have concluded that the perceived psychological impact of COVID-19 has an impact on health concerns, but also quarantine shows other stress-related factors, such as economic or social concerns. On the other hand, South America has been the last continent to be struck by COVID-19, and therefore, the information from the mass media has been intense in terms of health issues, with an increasing number of deaths worldwide. This could explain how health concerns were very prevalent, even though there were fewer deaths than in other countries. The high presence of economic and financial concerns may be understandable because Chile has a particular condition: in October 2019, there was a social outbreak that lasted until the beginning of the pandemic. During this outbreak, 600,000 employees were fired, so the economy was a big concern before COVID-19, and the country was not prepared for this huge possible effect.

When considering vulnerability factors, this study showed that one of the factors is younger people, who reported the most significant perceived psychological impact, with their main issue being frustration. These results are consistent with the findings of Qiu et al. (19) and others (17, 58) of higher emotional distress among individuals aged between 18 and 30. Young people tend to obtain a large amount of information from social media, which can easily trigger stress (45, 59). However, in addition, actual studies on COVID-19 have shown how people aged 60 or above have also reported high levels of psychological distress. This study did not find this result. In fact, older people reported a low presence of perceived psychological impact compared with other ages. This is an unusual result, since every study on COVID-19 and prior pandemics (19) has shown the huge perceived impact on this group. A possible hypothesis is that, as this survey was carried out in the first 2 weeks of quarantine, older people had already been prepared and isolating as a precaution, and therefore, it did not have the same perceived impact as a sudden quarantine, as in other groups, especially the young.

As expected, as in other studies, gender is a vulnerability factor, mainly for women, who reported having more perceived psychological impacts, while men mainly felt bored. We can understand that women had perceived more negative impacts than men, since some of the authors report that women are, in fact, more vulnerable to stress than their counterparts, and they are therefore more susceptible to negative feelings and even post-traumatic stress disorders (12, 19, 31). The fact that the main negative feeling among men was being bored is challenging to understand, but it may have to do with the time of the survey, namely, the first 2 weeks of quarantine, meaning there were still no other perceived impacts on men since it was in the early stages. Women may be more susceptible to connecting to the probable psychological and health impact. These gender differences have been detected in many other studies, for example, Wang et al. (21).

On future concerns, gender differences were also found. Men reported having more concerns about work and politics than women. Meanwhile, women were concerned about their mental and overall health. These differences can probably be explained by traditional male and female gender roles, which are prevalent in South American countries such as Chile. Even though Chile is a developing country, women tend to develop many roles, such as employees, housewives, and childcare providers, while

TABLE 9 | Percentage of reporting of perceived impact on actual feelings by previous psychological support.

	No		Ye		$\chi^2_{(1)}$
	f	%	*F*	%	
Fear	926	30.4	345	39.5	25.04***
Concern	2,030	66.7	601	68.8	1.26
Frustration	722	23.7	299	34.2	38.16***
Boredom	1,012	33.2	351	40.2	14.05***
Anxiety	1,736	57.0	627	71.7	60.91***
Distress	1,144	37.6	451	51.6	54.82***
Feeling trapped	657	21.6	271	31.0	32.89***
Loss of control	262	8.6	111	12.7	12.76***
Loneliness	429	14.1	207	23.7	45.29***
Sleep problems	1,199	39.4	391	44.7	7.87**
Inability to relax	678	22.3	279	31.9	33.76***
Loss of freedom	893	29.3	310	35.5	11.75***
Lack of concentration	1,053	34.6	390	44.6	29.00***
Irritability	1,152	37.8	397	45.2	16.05***
Restlessness	1,237	40.6	401	45.9	7.5**

****p < 0.001, **p < 0.01, *p < 0.05.*
Only the percentages of people who reported having the sensation are included in the table, for ease of reading.

TABLE 10 | Percentage of reporting of perceived psychological impact on current feelings by the need for further support.

	No		Ye		$\chi^2_{(1)}$
	f	%	*f*	%	
Fear	492	22.3	779	45.4	232.42***
Concern	1,351	61.4	1,280	74.5	75.36***
Frustration	403	18.3	618	36.0	155.82***
Boredom	668	30.3	695	40.5	43.28***
Anxiety	1,037	47.1	1,326	77.2	364.68***
Distress	611	27.7	984	57.3	348.10***
Feeling trapped	389	17.7	539	31.4	99.81***
Loss of control	122	5.5	251	14.6	91.27***
Loneliness	217	9.9	419	24.4	149.13***
Sleep problems	642	29.2	948	55.2	270.60***
Inability to relax	329	14.9	628	36.6	243.49***
Loss of freedom	560	25.4	643	37.4	65.93***
Lack of concentration	600	27.2	843	49.1	197.04***
Irritability	681	30.9	868	50.6	154.66***
Restlessness	754	34.2	884	51.5	117.21***

****p < 0.001, **p < 0.01, *p < 0.05.*
Only the percentages of people who reported having the sensation are included in the table, for ease of reading.

men are usually focused on work and concerned about financially supporting the family (60).

The other group evaluated had not been considered in any other studies, or in studies on COVID-19 or other pandemics. Of those people who were receiving psychological support before quarantine, 22% of the participants had this support before lockdown. Almost half of them had more than six sessions on a weekly basis. Their initial consultations were mainly on anxiety and depression, which coincides with the global prevalence of both disorders worldwide and in Chile (61, 62).

When assessing the perceived psychological impacts that these participants reported, it was found that they had more, and a broader, perceived psychological impact than participants who were not receiving this support before lockdown. These results confirm that the psychological impact of quarantine could more substantially influence people with mental health issues, and, therefore, it may worsen their symptoms because of their high susceptibility to stress compared with the general population (48, 63, 64).

Quarantine disrupts people's lives, especially since there is no possibility of getting around or carrying out daily activities outside the home (11, 12). Therefore, one of the most interrupted activities was the possibility of attending psychological support sessions. For this reason, services are developing expertise in conducting psychiatric assessments and delivering interventions remotely (e.g., by telephone or digitally). There has been worldwide discussion about the change of setting this entails and how therapists are coping with it, but the viewpoint of patients has gone unnoticed. In this study, most of the participants who had virtual support evaluated it as excellent or rare but useful. This is very important because it confirms that these new working practices should be implemented more widely. The results showed that almost half of respondents (43.8%) reported that they believed they needed future psychological support, which confirms and emphasizes the importance of having devices that allow psychological support on a broader scale, benefiting a more significant part of the population. This is highly relevant because the expectation is that, even as contagion decreases worldwide, many people will still be on voluntary quarantine.

This study emphasizes the high presence of psychological effects due to initial quarantine on COVID-19, showing mainly anxiety and concern. As Forte et al. (65) state, this pandemic could even be considered a traumatic event. Vulnerability groups were identified through this study, including women, younger people, and the self-employed, who had a higher presence of perceived psychological effects. Because of its magnitude, this study confirms the need for a national strategic and coordination plan for psychological support, aimed at vulnerable groups, which goes beyond healthcare workers, survivors, or parents in charge of small children.

However, the general population is suffering from negative psychological impacts, such as women, younger people, the self-employed, and those with interrupted psychological help. The delivery of this support must be virtual because of its high potentiality (66, 67), and mainly because this study showed that it is perceived to be effective for patients. Some authors (33, 46) have been developing a specialized psychological intervention for COVID-19 that must be dynamic and flexible enough to adapt quickly to the different phases of the pandemic and the specific groups. Finally, Van Daele et al. (50) have made some specific recommendations for policy-makers on e-mental health and tele-psychotherapy, which must be considered.

Limitations and Further Research

Because this was an exploratory study, carried out during the first 2 weeks of quarantine in Santiago, it has several limitations. The first relates to the sample, since it is not a probabilistic sample of the Chilean population. Furthermore, the sample is biased because it was obtained through personal contacts and social networks on which we did not explore the participation rate. The sample implied a few sample biases, for example, gender (more women) and level of studies (mostly university or postgraduate). Therefore, the results cannot be generalized to all of the population, but hopefully, they will motivate further studies that cover the Chilean population more generally.

Regarding the survey's validity, our instrument was not a standardized scale designed to measure psychological disorders. So, the results on psychological symptoms during the pandemic are proxies that give us hints about the psychological well-being of the Chilean population. This is especially important because, without a standard survey, some issues with comparability rise. Furthermore, given the metric and heterogeneous nature of our items, reliability measures such as Cronbach's alpha could not be estimated. However, the present research was aimed at screening as many symptoms as possible to offer a descriptive basis for future studies, so we decided to use single items for each symptom based on previous research [e.g., (8, 20, 52, 68)]. Furthermore, our results are in line with reports from the current literature. Nevertheless, it is recommended that future studies use standardized instruments to confirm our findings. Another issue is the limitations self-report assessment has, compared with face-to-face interviews, since the latter may give more and reliable information.

As the pandemic has developed, new research has appeared, showing new variables that must be taken into account for future studies that were not considered for this research. Relevant to this topic is specific symptomatology, since new studies have found a high prevalence of stress, post-traumatic disorder, depression, general anxiety, and a deterioration of sleep quality (25, 26, 53, 65). On the other hand, past adverse experiences must be taken into account since they highly relate to symptomatology. This information is relevant because it may increase psychological vulnerability to COVID (69). Other dimensions must be considered, such as having contact with a family member or friend with COVID-19. Favieri et al. (53) found a low level of psychological well-being among those with such contact.

Moreover, there are groups of people with other vulnerabilities that were not taken into account, such as those suffering from chronic medical conditions, who are more vulnerable to severe disease outcomes (25, 26); health workers on the frontline of COVID-19, who have a higher possibility of being infected; people talking care of children (20); family; and specially survivors (25, 67). In fact, patients who recovered from COVID-19 suffer afterwards from multiple sequelae on several organs and psychiatric symptoms that require a multidisciplinary approach (70).

Finally, many researchers have pointed out [e.g., (52)] that it is essential to understand the potential psychological changes caused by COVID-19 over time. As the pandemic continues, it is expected that the negative impact will have more severe consequences with long-lasting effects (26). One of the study's limitations is that the survey was carried out at one time point. However, Qiu et al. (19) found a decrease in distress levels as time passes. However, a recent study undertaken in the USA, using a longitudinal data set, showed stable levels of stress, anxiety, and depression between two surveys and, therefore, no clinically significant reduction in the perceived psychological impact on the general population (71).

Qiu et al. (19) attributed the decrease of distress to the effective prevention and control measures taken by the Chinese government, which has shown itself to be effective and exerting more control through rapidly closing its borders, increasing traceability, and adequate data information. Chile, on the other hand, started the pandemic with contradictory information and with restrictive measures suddenly adopted. All of this could have provoked an intense perceived psychological impact at the beginning, because of the uncertainty, and as time passes, it may become even more intense with the increase in deaths and the possibility of a second wave.

Either way, a follow-up must be undertaken to identify these patterns and participants' characteristics to develop a target intervention if necessary, for each of the phases of the pandemics.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available upon request to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Institutional Review Board of the Universidad Diego Portales (N°006-2020). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

PD and VA: conceptualization, methodology, formal analysis, and writing—original draft. KE and SC: writing—reviewing draft and editing. All authors: contributed to the article and approved the submitted version.

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SYSTEMATIC REVIEW
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A Systematic Review of the Impact of Viral Respiratory Epidemics on Mental Health: An Implication on the Coronavirus Disease 2019 Pandemic

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Background: The twenty-first century viral respiratory epidemics have taught us valuable lessons. Our systematic review examined the impact of these epidemics, including coronavirus disease 2019 (COVID-19), on mental health among different population groups, drawing on their insights for recommendations for the current COVID-19 pandemic.

Methods: Searches were performed on PubMed, Embase, PsycINFO, Web of Science, Scopus, CINAHL, and Cochrane on April 4, 2020. Studies that had undefined mental health outcomes or did not use a validated scale for measure were excluded. Quality assessment was carried out *via* the Newcastle–Ottawa Scale.

Results: We included 95 studies, most of which were conducted in Hong Kong (31.6%) and China (21.4%). A total of 30 (30.9%) studies are on the general public, 41 (42.2%) on healthcare workers, and 26 (26.6%) on patients and quarantined individuals. Furthermore, 36 (37.1%) of the studies are of high quality, 48 (49.5%) are of moderate quality, and 13 (13.4%) are of low quality. The most significant mental health outcomes reported include anxiety, depression, and post-traumatic stress disorder symptoms. The subgroups identified to have a higher risk of psychiatric symptoms among the general public include females, the elderly, individuals with chronic illness, migrant workers, and students. Long-term mental health impact was reported in some healthcare workers and epidemic patients, even up to 3 years in the former. Interestingly, when compared to non-quarantined groups, quarantine was not significantly associated with worse mental health outcomes.

Conclusion: Important implications for the COVID-19 pandemic were highlighted. Respiratory epidemics pose a significant psychological morbidity onto many population groups. Psychological support for vulnerable groups, including healthcare workers and patients, should be implemented to prevent them from spiraling into clinical psychiatric conditions.

Keywords: epidemics, coronavirus, COVID-19, SARS, MERS, influenza, mental health

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INTRODUCTION

Respiratory epidemics erupted around the world at an unprecedented level in recent years. In 2002, severe acute respiratory syndrome coronavirus (SARS-CoV) resulted in an epidemic involving 26 countries and more than 8,000 people (1). This was soon followed by the influenza A/H1N1 pandemic, the Middle East Respiratory Syndrome (MERS) epidemic, and the influenza A/H7N9 epidemic. As the world becomes increasingly globalized, the spread of highly contagious viruses has never been wider. From December 31, 2019 until May 20, 2020, coronavirus disease 2019 (COVID-19) has infected 4,761,559 people and caused 317,529 deaths (2).

COVID-19 has produced a substantial impact among many groups of people. Amidst the high unemployment rates in this epidemic, a mental health crisis has been brewing, which confers significant psychological morbidity onto vulnerable individuals (3–5). Healthcare workers face an overwhelming patient load and a high risk of infection (6). In the SARS epidemic, quarantined patients faced social isolation and activity restriction (7). Patients who were impacted with the novel respiratory illness had to face the risk of mortality and long-term functional impairment (8).

While many articles addressing the various treatment options and clinical outcomes of patients during these outbreaks emerged, we must not overlook the mental health status of different population groups. Individuals who suffer from psychiatric disorders during and after epidemics confer a less-established medical burden on society that is worth exploring. A well-presented systematic review and meta-analysis, studying the prevalence of psychiatric conditions among healthcare workers during the current COVID-19 pandemic, was conducted (9). A high proportion of healthcare workers experienced symptoms of depression, anxiety, and insomnia. In preventing further deterioration of mental health, timely, and focused interventions should be instituted. Building onto their knowledge, we find value in exploring past epidemics and including a wider scope of coverage to include other population groups.

In this systematic review, we explore the relationship between viral respiratory epidemics in the 21st century and their impact on mental health in populations around the world—particularly the general public, healthcare workers and students, patients of the epidemics, and quarantined individuals. These epidemics, selected due to their common mode of transmission *via* respiratory droplets, include H1N1, H7N9, SARS, MERS, and COVID-19. In conducting this study, we hope to draw on the insights from the included studies and provide recommendations for the current COVID-19 pandemic.

METHODOLOGY

Search Strategies

This study is in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (10). A search was conducted on April 4, 2020 on PubMed (2,333), Embase (3,011), PsycINFO (440), Web of Science (4,938), Scopus (3,317), CINAHL (722), and Cochrane (506). A total of 15,267 articles from January 2000 to April 2020 were identified. We used a combination of controlled vocabulary, where appropriate, and free-text terms relating to SARS, MERS-CoV, COVID-19, influenza outbreak, and psychiatric conditions (see **Appendix A**).

Inclusion and Exclusion Criteria

Two researchers (YL and CRC) independently screened the titles and the abstracts and assessed the full-text articles to select those that met the criteria. In the case of unresolved disputes between the two researchers, a third researcher (ZX) was involved. We included peer-reviewed observational/experimental studies examining the impact of SARS, MERS-CoV, influenza A/H1N1 and influenza A/H7N9, and COVID-19 on mental health outcomes. The population groups that we included are the general public, healthcare workers, healthcare students, patients of the viral respiratory epidemics, and quarantined individuals. We excluded outbreaks which occurred before year 2000, narrative reviews, systematic reviews, meeting or conference abstracts, commentaries, case reports, protocols, articles which reported unclear outcomes, outcomes not determined by validated scales, and full-text articles not in English.

Data Extraction

Data were extracted independently into a pre-specified data extraction form and cross-checked by two researchers (YL and CRC). As the data were unsuitable for statistical pooling or meta-analysis, a narrative synthesis was carried out. In our review, long-term mental health outcomes were identified based on a cutoff of 6 months after the epidemics. Data were analyzed separately into subgroups.

Quality Assessment

Two researchers (YL and CRC) conducted the scoring independently, and discrepancies were resolved by a third researcher (ZX). Quality assessment was carried out using the Newcastle–Ottawa Scale (NOS) for case–control and cohort studies (11). Stars (*) are awarded based on the three categories assessed: selection, comparability, and exposure. The maximum number of stars is nine. An adapted NOS by Herzog was used for cross-sectional studies (12). The maximum number of stars is 10. The higher the number of stars that each paper received, the better the research quality. In terms of quality, seven stars or higher is considered high quality, five to six stars as moderate quality, and four stars and below as low quality.

RESULTS

Search Results and Study Characteristics

We identified 270 potential articles and excluded 175 papers after examination of full text (see **Figure 1**). A total of 95 papers were included. These papers were divided into three population subgroups, namely, the general public (n = 30, 30.9%), healthcare workers (n = 41, 42.2%), and patients and quarantined individuals of respiratory epidemics (n = 26, 26.6%). The included studies were carried out in 13 regions. These regions included Hong Kong (n = 31), China (n = 21), Taiwan (n = 10), Singapore (n = 9), South Korea (n = 9), Canada (n = 8),

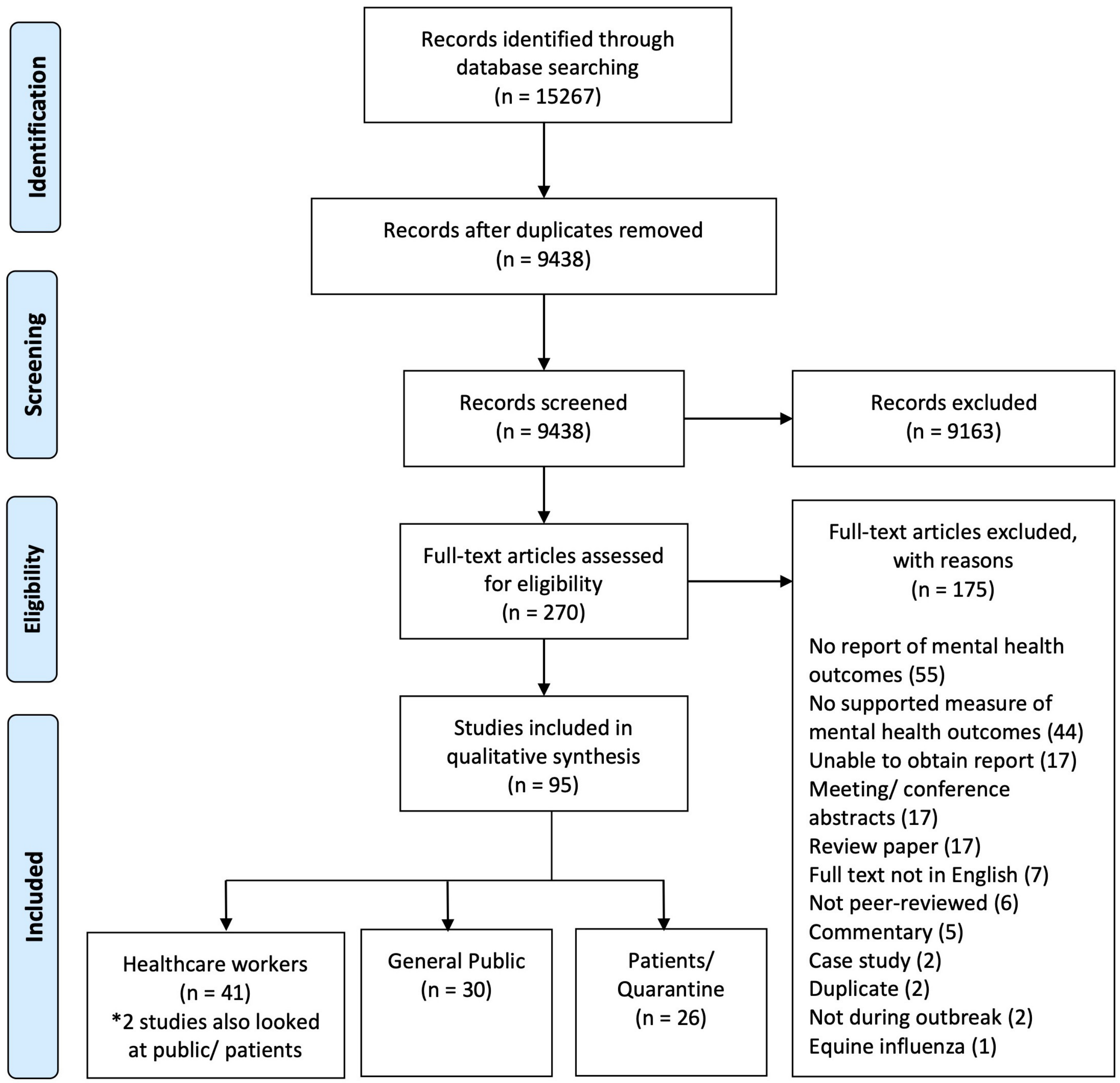

FIGURE 1 | Preferred reporting items for systematic reviews and meta-analyses flow diagram.

Saudi Arabia ($n = 2$), United States ($n = 2$), and others ($n = 5$). The epidemics included are SARS ($n = 59$), influenza ($n = 14$), MERS-CoV ($n = 12$), and COVID-19 ($n = 10$). Of all the mental health outcomes explored, post-traumatic stress disorder (PTSD; $n = 43$), anxiety ($n = 42$), and depression ($n = 34$) were the most prevalent. In terms of timing of study, 52 studies were done during the epidemic, 40 done after, and 5 done before and after. Details of the study characteristics are provided in **Table 1**.

Results specific to each population group will be analyzed in the respective sections. A summary of identified studies can be found in **Appendix B**. For COVID-19-specific articles, a separate summary can be found in **Table 2**.

Quality Assessment

A total of 36 (37.1%) of the studies are of high quality, 48 (49.5%) are of moderate quality, and 13 (13.4%) are of low quality. The quality assessment results for cohort studies, case–control studies, and cross-sectional studies can be found in **Tables 3–5**, respectively.

Two studies each looked at two different populations with different sampling methods or study designs and hence were assessed twice under each population category (13, 37). All studies extracted outcomes *via* self-reporting, except for two studies which extracted outcomes *via* records (46, 47).

TABLE 1 | Overall study characteristics.

Characteristics	*N* (%)
Population (*n* = 97)	
Healthcare workers	41 (42.2)
General public	30 (30.9)
Patients/quarantined individuals	26 (26.6)
Outbreaks (*n* = 95)	
SARS	59 (62.1)
Influenza	14 (14.7)
MERS-CoV	12 (12.6)
COVID-19	10 (10.5)
Mental health outcomes (*n* = 156)	
Post-traumatic stress disorder	43 (27.6)
Anxiety	42 (26.9)
Depression	34 (21.8)
Others	37 (23.7)
Countries/regions (*n* = 98)	
Hong Kong	31 (31.6)
China	21 (21.4)
Taiwan	10 (10.2)
Singapore	10 (10.2)
South Korea	9 (9.2)
Canada	8 (8.2)
Saudi Arabia	2 (2.0)
United States	2 (2.0)
Others (Greece, India, Japan, Mexico, United Kingdom)	5 (5.1)
Study period (n = 97)	
During outbreak	52 (53.6)
After outbreak	40 (41.2)
Both during and after outbreak	5 (5.2)
Study design (n = 97)	
Cross-sectional	75 (77.3)
Cohort study	18 (18.6)
Case–control	4

All of the included studies have a validated tool for assessing mental health outcomes as this was part of our initial exclusion criteria. To assess anxiety, the scales commonly used were Self-Rating Anxiety Scale (SAS) ($n = 7$), State-Trait Anxiety Inventory (STAI) ($n = 6$), Hospital Anxiety and Depression Scale (HADS) ($n = 6$), Generalized Anxiety Disorder-7 ($n = 4$), and Depression Anxiety Stress Scale (DASS) ($n = 4$). To assess psychological distress in general, the scales commonly used were General Health Questionnaire ($n = 14$), 36-Item Short Form Health Survey ($n = 9$), Perceived Stress Scale (PSS) ($n = 6$), and Chinese Health Questionnaire ($n = 4$). To assess PTSD, the commonly used scale was Impact of Event Scale (IES) ($n = 16$). To assess depression, the scales commonly used were Beck Depression Inventory (BDI) ($n = 6$), Center for Epidemiologic Studies Depression Scale (CES-D) ($n = 6$), HADS ($n = 6$), Self-Rating Depression Scale ($n = 4$), and Patient Health Questionnaire-9 ($n = 4$). To assess insomnia, the commonly used scale was Pittsburgh Sleep Quality Index ($n = 5$).

General Public

A total of 30 papers were identified for the general public.

Anxiety Symptoms

In general, public anxiety levels varied with epidemics and countries but were generally low. A high-quality cross-country study reported a significantly lower anxiety level of the public in Singapore compared to Hong Kong (STAI = 1.77 vs. 2.06, $p < 0.001$) during the SARS epidemic (54). In two high-quality studies on H1N1, the reported average general public STAI score in Hong Kong was measured to be 1.8 (48), while only 2.1% of the population in the United Kingdom reported high anxiety (six-item STAI of 18 and more) (57).

Two studies reported decreases in public anxiety associated with more effective dissemination of government information on ongoing epidemics, with a high-quality study demonstrating a significantly lower anxiety in the STAI score of individuals who read government material regarding the epidemic (mean STAI difference = −0.5, 95% CI = −0.9 to −0.05, $p = 0.03$) (16, 57). Three high-quality articles reported that high anxiety was associated with an increased adoption of personal protective measures in three countries: United Kingdom (mean difference 1.7, CI = 1.3 to 2.1, $p < 0.001$), Hong Kong (OR 2.24, CI = 1.27–3.97, $p < 0.01$), and Singapore (OR = 1.140, 95% CI = 1.031–1.283, $p < 0.05$) (54, 56, 57). On the contrary, one high-quality article reported high anxiety being associated with a decreased adoption of such measures instead, suggesting that lower compliance to measures leads to high anxiety (48). However, it is worth mentioning that, in this study, the group with the highest anxiety is more likely to clean and disinfect the house (OR = 1.41, 95% CI = 1.13–1.76).

The risk factors of higher anxiety identified from high/moderate-quality studies include female gender (48), low social capital (22), contact with suspected cases (63), and staying in close proximity to hospitals (50, 62). Interestingly, one moderate-quality case–control study particularly looked at pregnant women before and during SARS, identifying elevated anxiety levels in mothers during the SARS outbreak (mean STAI = 37.2 vs. 35.5, $p = 0.02$) (41). Moreover, 92% of the women surveyed refrained from leaving the house, and 70% worried about the possible teratogenicity of treatment should it be required.

PTSD Symptoms

Several risk factors for PTSD were identified from high/moderate-quality studies: children with parents having PTSD (59), low education level (52), female gender (14, 63), older age (53), and proximity to outbreak-prevalent regions (53, 63). One moderate-quality study on COVID-19 reported better sleep quality in those with lower PTSD Checklist for DSM-5 (PCL-5) scores ($p < 0.05$) (14). Interestingly, one moderate-quality COVID-19 study identified higher Vicarious Trauma Scale scores in the general public when compared to front-line nurses [75.5 (95% CI = 62–88.3) vs. 64 (95% CI = 52–75), $p < 0.001$] (13).

Depression Symptoms

In terms of depression, one moderate-quality cohort study reported an increase in CES-D score during SARS as compared to the participants' baseline before SARS (mean CES-D = 12.94 vs. 10.74, $p < 0.05$) (24), while one moderate-quality case–control study of pregnant women showed no significant difference in BDI score between the pre-SARS and post-SARS cohort (7.8 vs. 8.7, $p = 0.16$) (41). A study in Taiwan demonstrated that the Taiwanese Depression Questionnaire score was significantly higher if the family or friends were affected (quarantined or contracted) by SARS ($t = 7.95$, $p < 0.001$) (51). The risk factors of depression from the moderate-quality studies include age ≥60 years (53), personal perception of risk of infection (14), financial loss (14, 52), and directly impacted by SARS (52).

Population Subgroups

All studies covering the subgroup population are of moderate/low quality. One subgroup identified to have the highest risk by a moderate-quality study is migrant workers (mean = 31.89, $F = 1{,}602.501$, $p < 0.001$) due to the financial impact and perceived risk of infection from long-distance travels (15). Another subgroup identified by a low-quality study is university students, where they scored significantly higher for IES ($B = 0.20$, 95% CI = 0.05–0.35), DASS stress subscale ($B = 0.11$, 95% CI = 0.02–0.19), and DASS anxiety subscale ($B = 0.16$, 95% CI = 0.02–0.30) when compared to the employed population (16). Among five studies for undergraduate students, two moderate-quality studies are specific to healthcare students (45, 62). One study compared medical students to non-medical faculties in the same school and non-medical faculties in another school. It was found that the medical students have significantly higher mean SAS scores (34.05 vs. 33.43 vs. 31.71, $p < 0.01$) (62).

The last subgroup at risk is the chronically ill patients. Although one moderate-quality study showed high levels of anxiety and depression in thoracic surgery patients on waitlist during SARS, it was unable to demonstrate statistical significance ($p = 0.582$ for anxiety, $p = 0.841$ for depression) (60). When psychological support is provided, one moderate-quality study reported lower depression rates of 5.5% compared to a meta-analysis data of 20%, while another moderate-quality study reported a significantly lower Brief Symptom Inventory score in depression subsection only [$F_{(1, 28)} = 5.215$, $p < 0.05$] (37, 42). However, these two studies had a small sample size.

Risk of Older Individuals

Older individuals have a higher risk of developing a psychological disease (15, 46, 47, 49, 52, 53). In healthy individuals, increasing perceived stress levels is associated with increasing age (Spearman's rho 0.33, $p < 0.005$, Bonferroni-corrected) (64). One high-quality study identified older age as an association for high levels of depression (0.05 CI = 0.04–0.07, $p < 0.001$) and death anxiety (0.32 CI = 0.23–0.41, $p < 0.001$) during H1N1 when their family members were in the intensive care unit (49). The possibility of losing a younger family member may explain the high rates. On the extreme end of the mental health spectrum, two high-quality papers by the same author identified the significantly higher suicide rates among Hong Kong's elderly, ≥65 years of age, during the period coinciding with the SARS outbreak in April 2003 (April 2001 IRR = 0.362, $p = 0.002$; April 2002 IRR = 0.548, $p = 0.032$) (46, 47). The higher level of suicide was found to persist for a year after SARS (2004 IRR = 0.835, $p = 0.045$).

Healthcare Workers

A total of 41 papers were identified for healthcare workers.

Anxiety Symptoms

During epidemics, the development of anxiety symptoms is chiefly propelled by the healthcare workers' consistently high exposure to infected patients. One paper reported healthcare workers to have higher STAI scores compared to administrative staff (mean = 51.1 vs. 47.1, $p < 0.001$) and higher STAI scores among healthcare workers exposed to patients with SARS than those not exposed (mean = 52.6 vs. 49.8, $p < 0.001$). The same paper reported that a greater proportion of exposed compared to non-exposed healthcare workers had discomfort from wearing a protective gear (4.1 vs. 2.9%, $p < 0.001$), worry of being infected (2.0 vs. 1.8%, $p < 0.001$), worry of infecting others (2.0 vs. 1.7%, $p < 0.001$), and perceived prejudice from others (1.2 vs. 0.9%, $p < 0.001$) (95). All these factors could explain why healthcare workers with a high exposure to infected patients are at a higher risk of anxiety symptoms.

Fear of transmitting the virus to family members was consistently reported as a leading cause of anxiety (45, 80, 92, 105). Two of the studies identified the rate of fear to be around 60% of the respondents (80, 92). Another cited study reported that females are more likely to be worried about family transmission compared to males, with higher reported anxiety scores (mean = 3.67 vs. 2.16, $p < 0.05$) (105). Among non-physicians, this fear was compounded by the perceived threat of mortality imposed by the respiratory virus itself according to a Canadian study of 333 nurses as measured *via* the emotional exhaustion subscale of the Maslach Burnout Inventory (79).

Anxiety among healthcare workers was propelled by traits of neuroticism. In one high-quality and one low-quality study, if workers lacked maternal care or were overprotected by their mothers, they would have poorer mental health outcomes after the epidemic (38, 88). A high-quality Taiwanese study demonstrated significant neuroticism among a sample group of 24 physicians as measured on the Eysenck Personality Questionnaire (mean = 2.75), who also scored high on the Chinese Health Questionnaire (mean = 1.63) across three domains of anxiety, somatic symptoms, and depression (88). This is supported by another study of moderate quality where neuroticism is associated with worse mental health outcome on the same scale ($\beta = 0.44$, SE = 0.06, $p < 0.001$) (38).

PTSD Symptoms

Fear of transmission of respiratory viruses to family members, especially their children, is a significant factor for the development of PTSD, though both studies reported that this was of low quality (81, 106). A Hong Kong study showed that, using the SARS Fear Scale (SFS) score, the fear item of worry about family being infected had the highest mean score

TABLE 2 | Summary of the study characteristics for COVID-19 articles.

References	Country	Subgroup	Reported outcome	Timeframe	Study design	Data collection	Sample size	Scale used	Results
Li et al. (13)	China	General public, HCW	Vicarious traumatization	During	Cross-sectional	Self-reported questionnaire	214	Vicarious trauma scale	The general public and medical staff suffer from vicarious traumatization. However, the vicarious traumatization of non-front-line medical staff is more serious than that of front-line medical staff.
Liu et al. (14)	China	General public	PTSD	During	Cross-sectional	Self-reported questionnaire	285	PTSD checklist for DSM-5 (PCL-5), Pittsburgh Sleep Quality Index (PSQI)	2019-Cov pandemics have a high prevalence of post-traumatic stress symptoms (PTSS) in the hardest-hit areas in China of 7%. Most importantly, PTSS sub-symptoms, including re-experiencing, negative alterations in cognition or mood, and hyper-arousal are more common in females than males. Better sleep quality and unfragmented sleep patterns are associated with lower PTSS prevalence.
Qiu et al. (15)	China, Hong Kong, Taiwan	General public	Psychological distress	During	Cross-sectional	Online questionnaire	52,730	COVID-19 Peritraumatic Distress Index (CPDI)	Multinomial logistic regression analyses showed that one's CPDI score was associated with female gender, higher education, migrant workers and staying in the middle region of China (most affected by epidemic). Lower psychological distress levels are associated with male gender, availability of local medical resources, efficiency of the regional public health system, and prevention and control measures taken against the epidemic situation, age under 18 years.
Wang et al. (16)	China	General public	Depression, anxiety, PTSD	During	Cross-sectional	Online questionnaire	1,210	Impact of Event Scale-Revised (IES-R), Depression Anxiety Stress Scale (DASS)	Higher IES-R and DASS scores are associated with female gender, student status, specific physical symptoms, and no confidence in their own doctor's ability to diagnose or recognize COVID-19. Higher IES-R scores are associated with high levels of concern about other family members getting COVID-19 and dissatisfaction with the amount of health information available about COVID-19. Higher DASS depression subscale scores are associated with male gender, uneducated status and breathing difficulty. Higher DASS anxiety subscale scores are associated with male gender, clinic consultations and hospitalizations, contact with an individual with suspected COVID-19 or infected materials, breathing difficulty and high levels of concern about other family members getting COVID-19. Higher DASS stress subscale scores are associated with male gender, a low perceived likelihood of surviving COVID-19 if infected, high levels of concern about other family members getting COVID-19 and dissatisfaction with the amount of health information available about COVID-19. Lower IES-R and DASS scores are associated with specific up-to-date and accurate health information and particular precautionary measures. Lower IES-R scores are associated with male gender. Lower DASS depression subscale scores are associated with additional information on availability and effectiveness of medicines/vaccines. Lower DASS anxiety subscale scores are associated with low perceived likelihood of contracting COVID-19, regular updates for the latest information and additional information on the availability and effectiveness of medicines/vaccines. Lower DASS stress subscale scores are associated with low perceived likelihood of contracting COVID-19 and the information on the increase in the number of recovered individuals.

(Continued)

TABLE 2 | Continued

References	Country	Subgroup	Reported outcome	Timeframe	Study design	Data collection	Sample size	Scale used	Results
Wang et al. (17)	China	General public	Depression, anxiety	During	Cross-sectional	Online questionnaire	600	Self-Rating Anxiety Scale (SAS), Self-Rating Depression Scale (SDS)	SAS and SDS standard scores showed a significant positive correlation. High risk in female gender, 40 and below age group, those with a master's degree or above (compared to those with a bachelor's degree), professionals (compared to industrial service workers and other staff).
Lai et al. (18)	China	Healthcare workers	PTSD, anxiety	During	Cross-sectional	Self-reported questionnaire	1,257	Patient Health Questionnaire-9 (PHQ-9) Insomnia Severity Index (ISI-7) General Anxiety Disorder-7 criteria (GAD-7)	More severe symptoms in all areas in these populations: nurses, women, and frontline workers. Significantly higher symptoms of depression (OR = 1.52, 95% CI = 1.11–2.09, $p = 0.01$), anxiety (OR = 1.57, 95% CI = 1.22-2.02, $p < 0.001$), insomnia (OR = 2.97, 95% CI, 1.92–4.60, $p < 0.001$), and psychological distress (OR = 1.60, 95% CI = 1.25–2.04, $p < 0.001$) in front-line workers, compared to the second-line workers.
Liang (19)	China	Healthcare workers	Depression and anxiety	During	Cross-sectional	Self-reported questionnaire	59	Zung's Self-Rating Anxiety Scale (SAS) Zung's self-rating depression scale (SDS)	Zung's self-rating depression scale showed higher rates of depression in COVID healthcare workers above 30 years old. Zung's self-rating anxiety scale showed no higher rates of anxiety than in other departments.
Xiao et al. (20)	China	Healthcare workers	Anxiety	During	Cross-sectional	Self-reported questionnaire	180	Self-Rating Anxiety Scale (SAS) Pittsburgh Sleep Quality Index (PSQI)	Higher levels of anxiety led to poorer outcomes. Higher levels of social support led to better sleep quality. Lower anxiety led to better outcomes in mental health.
Kang et al. (21)	China	Healthcare workers	Anxiety	During	Cross-sectional	Self-reported questionnaire	994	Patient Health Questionnaire-9 (PHQ-9) General Anxiety Disorder-7 criteria (GAD-7) Insomnia Severity Index (ISI-7)	36.3% had received psychological materials, 50.4% had obtained psychological resources available through media, and 17.5% had participated in group psychological counseling. Those with severe disturbances had accessed fewer psychological materials and psychological resources available through the media. Medical and nursing staff with subthreshold disturbances most wanted to obtain skills to help alleviate others' psychological distress, whereas other medical and nursing staff most wanted to obtain self-help skills. Medical and nursing staff with higher levels of mental health problems were more interested in skills for self-rescue and showed more urgent desires to seek help from psychotherapists and psychiatrists.
Xiao et al. (22)	China	Self-isolated public	Anxiety, sleep	During	Cross-sectional	Self-reported questionnaire	170	Self-Rating Anxiety Scale (SAS), Pittsburgh Sleep Quality Index (PSQI)	Low level of social capital is associated with higher levels of anxiety. Anxiety is associated with stress and lower sleep quality. High level of social capital associated with higher level of sleep quality. With the effect of stress and anxiety, this reduces the effect of social capital on sleep quality.

TABLE 3 | Newcastle–Ottawa Scale quality assessment for cohort studies ($n = 18$).

References	Selection				Comparability	Outcome			Total score	Quality
	Representativeness of the exposed cohort	Selection of the non-exposed cohort	Ascertainment of exposure	Demonstration that outcome of interest was not present at start of study	Comparability of cohorts on the basis of the design or analysis controlled for confounders	Assessment of outcome	Was follow-up long enough for outcomes to occur	Adequacy of follow-up of cohorts		(Low: ≤4; Moderate: 5-6; High: ≥7)
General population/Students										
Cheng (23)			*		**		*	*	5	Moderate
Yu et al. (24)			*	*	**		*		5	Moderate
Patients/Quarantined										
Bonanno et al. (25)	*		*	*			*	*	5	Moderate
Chen et al. (26)	*		*	*			*	*	5	Moderate
Cho et al. (27)	*		*	*			*	*	5	Moderate
Hong (28)	*		*	*			*	*	5	Moderate
Hui (29)	*		*	*			*	*	5	Moderate
Lam et al. (30)	*		*	*		*	*	*	6	Moderate
Lee et al. (31)	*	*	*	*	**		*		7	High
Lee (32)	*		*	*			*	*	5	Moderate
Mak et al. (33)	*		*	*		*	*		5	Moderate
Mak et al. (34)	*		*	*		*	*		5	Moderate
Tansey et al. (35)	*		*	*			*	*	5	Moderate
HCW										
Chen et al. (36)	*		*	*			*	*	5	Moderate
Lee et al. (37)	*		*	*			*		4	Low
Lung et al. (38)	*		*	*			*	*	5	Moderate
McAlonan et al. (39)	*		*	*			*	*	5	Moderate
Su et al. (40)	*		*	*		*	*	*	6	Moderate

** = 1 star awarded; ** = 2 stars awarded.*

TABLE 4 | Newcastle–Ottawa Scale quality assessment for case–control studies ($n = 4$).

References	Selection				Comparability	Exposure			Total score	Quality
	Is the case definition adequate?	Representativeness of the cases	Selection of controls	Definition of controls	Comparability of cases and controls on the basis of the design or analysis	Ascertainment of exposure	Same method of ascertainment for both groups	Non-response rate		(Low: ≤4; Moderate: 5-6; High: ≥7)
General population/Students										
Lee et al. (41)	*	*		*		*	*	*	5	Moderate
Ng et al. (42)	*	*		*		*	*	*	5	Moderate
Patients/Quarantined										
Lee et al. (43)	*	*	*	*	**	*	*		7	High
Han et al. (44)	*	*	*	*		*	*		6	Moderate
HCW										
No papers										

** = 1 star awarded; ** = 2 stars awarded.*

(2.24 ± 0.56, $p = 0.483$ on a four-point Likert scale) in a sampled group of 82 healthcare workers (81). The correlation analysis showed that the three subscales of SFS scores were positively correlated with the three subscales of the Chinese version of IES-R ($p < 0.01$), and the total scores of scales had $r = 0.64$ and $p < 0.01$.

Consistent contact with patients was another major risk factor in two high-quality, one moderate-quality, and one low-quality study (65, 80, 93, 102). Elevated rates of PTSD were reported in all healthcare professions, as supported by one high-quality and one low-quality study (37, 107), especially those who work in high-risk areas (77, 89, 98) such as the Emergency Department (86) and respiratory medicine department (39) or those who were quarantined (72). One high-quality study attributed it to the workers' exhaustion, lethargy, and high workload (89). The nurses in this aforementioned Japanese study, who felt more exhaustion ($B = 0.34$, SE = 0.12, $\beta = 0.14$, $p = 0.004$) and workload ($B = 0.34$, SE = 0.07, $\beta = 0.21$, $p < 0.001$) than doctors, also had higher total IES scores than that of doctors (nurses: $B = 0.90$, SE = 0.32, $\beta = 0.14$, $p = 0.005$) (89). High-risk workers with PTSD symptoms retrospectively reported fatigue (70.3%, compared with 22.1% of low-risk workers; $\chi^2 = 37.9$, $p < 0.05$), poor sleep (30.2%, compared with 7.4% of low-risk workers; $\chi^2 = 12.7$, $p < 0.05$), health anxiety (57.3%, compared with 41.2%; $\chi^2 = 4.1$ of low-risk workers, $p < 0.05$), and fear of social contact (41.7%, compared with 23.5% of low-risk workers; $\chi^2 = 5.8$, $p < 0.05$) in a moderate-quality study (39).

In one high-quality and one low-quality study, non-modifiable risk factors of young age and inexperience were highlighted as contributors to PTSD (77, 100). One study reported higher PTSD Checklist-Civilian Version scores in healthcare workers aged 20–30 years compared to those aged above 40 years (mean = 1.87 vs. 1.51, $p < 0.05$) (100). Furthermore, access to beneficial psychological material had shown to reduce PTSD symptoms. A moderate-quality study of the COVID-19 pandemic in Wuhan reported that 17.7% in a sampled group who accessed psychological material had a mean IES-R score of 6.1 ($p < 0.001$) vs. 41.4% in another sampled group who accessed psychological material who had a mean IES-R score of 60.0 ($p < 0.001$) (21). Other predictors of acquiring PTSD from high-quality studies include maladaptive coping strategies (90, 94), attachment anxiety (90), and singlehood (74).

Depression Symptoms

A previous positive history for psychiatric disorders was predictive of developing a mood disorder during an epidemic by one high-quality ($\chi^2 = 8.0$, df = 1, 1, $p < 0.01$) and one moderate-quality study ($\beta = 0.22$, $p = 0.02$) (40, 85). Aside from the aforementioned risk factors for PTSD which have a component of depression, post-epidemic depression was closely linked to workers having traumatic experiences pre-outbreak as highlighted in a high-quality study (87). In this study, a multinomial logistic regression model of having had pre-SARS traumatic experiences revealed an adjusted odds ratio of 3.39 in the high depressive symptom group compared to the low depressive symptom group (CI 1.47–7.84, $p = 0.004$) (87).

Comparing Nurses and Physicians

Nurses showed a higher prevalence for psychiatric symptoms when compared to physicians in a high-quality (depression 7.1 vs. 4.9%, $p = 0.01$) (18) and a moderate-quality (psychological distress OR = 2.2, 95% CI = 0.59–2.07, $p = 0.046$) study, respectively (80). However, two other moderate-quality studies showed that nurses may have had better mental health outcomes due to better working environments and being adequately trained (38, 88). In Taiwan, it is postulated that anxiety in physicians was compounded by local medical disputes and criminal law (38, 88). This is corroborated by a Chinese study which showed higher rates of somatization in physicians than in nurses ($\beta = -0.15$, $p = 0.034$) (38).

Among nurses and doctors, it is worth noting that a recent high-quality COVID-19 study reported significantly higher symptoms of depression (OR = 1.52, 95% CI = 1.112.09, $p = 0.01$), anxiety (OR = 1.57, 95% CI = 1.22–2.02, $p < 0.001$), insomnia (OR = 2.97, 95% CI = 1.92–4.60, $p < 0.001$), and psychological distress (OR = 1.60, 95% CI = 1.25–2.04, $p < 0.001$) in front-line workers compared to second-line workers (18).

Isolation and Stigmatization

The listed causes for workers being in social isolation include being quarantined (104), isolation from family members (77, 80), and voluntary restriction from social contacts (80). In a moderate-quality Taiwanese study, self-isolation caused fatigue, loneliness, frustration, and anxiety, which contributed to higher psychological morbidity (75). From the study in which a survey was distributed after 4 weeks of quarantine with SARS patients, the duration of time in contact with infected patients was closely associated with the negative affectation in mental and emotional health of healthcare workers in major subscales and predicted their mental health outcomes (adjusted $R^2 = 0.069$; $p = 0.038$) (75). They fared worse across domains of emotional role, mental health, and social functioning. These domains were closely associated with increased contact days, contact hours, and contact hours-per-day with SARS patients (75).

Stigmatization of healthcare workers through restriction of social contacts led to increased anxiety symptoms in one high-quality and two moderate-quality studies (45, 80, 93). This stigmatization had therefore resulted in healthcare workers being treated differently (92) and has led to subsequent rejection by their neighborhoods. In the high-quality study, receiving different treatments from the public by virtue of being a healthcare worker was closely associated with higher levels of anxiety symptoms of concern for personal and family health (adjusted OR 1.6, 95% CI = 1.2–2.1) according to a logistic regression analysis (92).

Long-Term Impact

In five studies, psychological morbidity remained prominent post-epidemic in a small proportion of healthcare workers shown by two high-quality and two moderate-quality studies (38, 85, 103, 104). A high-quality study reported a new onset or worsening of panic disorder discovered in a handful of SARS physicians in Canada 13–22 months post-epidemic (85). In Taiwan, while most workers reported no significant sources of daily life stress 3 years after SARS, 15.4% of the sampled workers still displayed psychological symptoms ($\chi^2 = 2.14$, $p = 0.343$). Though statistically significant, a multiple linear regression result by the same study showed that this was associated with daily-life stressors ($\beta = 1.07$, SE = 0.31, $p = 0.001$) rather than the SARS crisis (38). In Beijing, 10% of the sampled workers had high PTSD symptoms (IES-R $\geq$ 20) after 3 years in one high-quality and one moderate-quality study by the same author (103, 104). The latter study attributed this to quarantine during the SARS period (OR = 3.47, 95% CI = 1.93–6.25, $p < 0.0001$), friends or family being affected by SARS (OR = 3.74, 95% CI = 1.83–7.62, $p = 0.0003$), or close contact with SARS patients (OR = 3.11, 95% CI = 1.76–5.49, $p < 0.0001$). Among the individuals with high PTSD, the latter study also identified a higher risk of alcohol dependence in those individuals with high PTSD symptoms in a regression analysis (OR = 1.65, 95% CI = 1.02–2.66) (103).

Patients of the Viral Respiratory Illness

There were 20 studies identified for patients.

Long Term and Short Term

Compared to non-patients, patients of epidemics had worse mental health outcomes in both the short term (26, 31, 65, 108) and the long term (25, 26). It was reported that the PSS scores were significantly higher in patients during the epidemic (mean = 19.8 vs. 17.9, $p < 0.01$) and 1 year after the outbreak (mean = 19.9 vs. 17.3, $p < 0.01$) (31). Even after the epidemics, two moderate-quality studies reported the persistence of psychological distress in survivors at 18 months (25) and 24 months (26) after the outbreak.

Associated Factors

Factors positively associated with symptoms of psychological distress, anxiety, depression, and PTSD extracted from high-quality and moderate-quality studies include female gender (8, 25, 31, 33, 66, 108), patients who were healthcare workers (31, 33, 34, 65, 66, 108), having poor social support (8, 33, 70), perception of being stigmatized during the outbreak (30, 33), knowing someone who had SARS (109), and losing a family member to SARS (108). It was reported that, during the epidemic, females scored higher in PSS (mean = 20.7 vs. 18.0, $p < 0.05$), DASS (depression mean = 13.1 vs. 7.8, $p < 0.01$; anxiety mean = 12.5 vs. 7.0, $p = 0.001$), and IES-R (intrusion mean = 1.6 vs. 1.1, $p < 0.01$; avoidance mean = 1.3 vs. 0.9, $p < 0.05$; hyperarousal mean = 1.4 vs. 0.9, $p < 0.05$) (31). Compared to non-healthcare workers, healthcare workers were reported to have higher scores in DASS (depression mean = 15.1 vs. 9.0, df = 3, 86, $F = 3.9$, $p < 0.01$; anxiety mean = 14.6 vs. 8.2, df = 3, 85, $F = 5.2$, $p = 0.001$) and IES-R (intrusion mean = 2.0 vs. 1.1, df = 3, 85, $F = 5.7$, $p < 0.001$; avoidance mean = 1.5 vs. 0.9, df = 3, 85, $F = 3.5$, $p < 0.05$; hyperarousal mean = 1.7 vs. 1.0, df = 3, 85, $F = 3.5$, $p < 0.05$) (31). In terms of healthcare workers, it was postulated that this was because the healthcare workers' workplace was also where they had such bad experiences as a patient. In addition, healthcare workers may have a lowered self-esteem as they perceive themselves to be "virus spreaders" (108).

TABLE 5 | Newcastle–Ottawa Scale quality assessment for cross-sectional studies ($n = 75$).

References	Selection				Comparability	Outcome		Total score	Quality
	Representativeness of the sample	**Sample size**	**Non-respondents**	**Ascertainment of the exposure (risk factor)**	**The subjects in different outcome groups are comparable, based on the study design or analysis. Confounding factors are controlled**	**Assessment of outcome**	**Statistical test**		**(Low: ≤4; Moderate: 5-6; High: ≥7)**
General population/Students									
Al-Rabiaah et al. (45)	*			**		*	*	5	Moderate
Chan et al. (46)	*	*	*	**		**	*	8	High
Cheung et al. (47)	*	*	*	**		**	*	8	High
Cowling et al. (48)	*	*	*	**	**	*	*	9	High
Elizarrarás-Rivas et al. (49)	*		*	**	**	*	*	8	High
Kang et al. (50)	*			**	**	*	*	7	High
Ko et al. (51)	*	*		**		*	*	6	Moderate
Lau et al. (52)	*	*	*	**	**	*	*	9	High
Lee et al. (53)		*		**	**	*	*	7	High
Lee et al. (37)	*	*	*	**		*		6	Moderate
Leung et al. (54)	*			**	**	*	*	7	High
Li et al. (13)	*		*	**		*	*	6	Moderate
Liu et al. (14)			*	**		*	*	5	Moderate
Peng (55)	*		*	**	**	*	*	8	High
Qiu et al. (15)				**	**	*	*	6	Moderate
Quah and Hin-Peng (56)	*		*	**	*	*	*	7	High
Rubin et al. (57)	*			**	**	*	*	7	High
Sim et al. (58)		*		**	**	*		8	High
Sprang and Silman (59)				**	**	*	*	6	Moderate

(Continued)

TABLE 5 | Continued

References	Selection				Comparability	Outcome		Total score	Quality
	Representativeness of the sample	**Sample size**	**Non-respondents**	**Ascertainment of the exposure (risk factor)**	**The subjects in different outcome groups are comparable, based on the study design or analysis. Confounding factors are controlled**	**Assessment of outcome**	**Statistical test**		**(Low: ≤4; Moderate: 5-6; High: ≥7)**
Wan et al. (60)	*			**		*	*	5	Moderate
Wang et al. (16)				**		*	*	4	Low
Wang et al. (17)			*	**	**	*	*	7	High
Wheaton (61)	*			**	**	*	*	7	High
Wong et al. (62)	*			**		*	*	5	Moderate
Xiao et al. (20)			*	**	**	*	*	7	High
Xu et al. (63)				**	**	*	*	6	Moderate
Patients/Quarantined									
Chua et al. (64)		*	*	**	**	*	*	8	High
Cheng$^{\alpha}$ et al. (65)				**		*	*	4	Low
Cheng$^{\beta}$ et al. (65)	*	*		**		*	*	6	Moderate
Cheng et al. (66)			*	**		*	*	5	Moderate
Hawryluck et al. (7)	*	*		**		*	*	6	Moderate
Jeong et al. (67)			*	**	**	*	*	7	High
Kim (68)	*	*	*	**		**	*	8	High
Kwek et al. (69)	*			**	**	*	*	7	High
Mak WWS et al. (70)				**		*	*	4	Low
Mihashi et al. (71)			*	**		*	*	5	Moderate

(Continued)

TABLE 5 | Continued

References	Selection				Comparability	Outcome		Total score	Quality
	Representativeness of the sample	Sample size	Non-respondents	Ascertainment of the exposure (risk factor)	The subjects in different outcome groups are comparable, based on the study design or analysis. Confounding factors are controlled	Assessment of outcome	Statistical test		(Low: ≤4; Moderate: 5-6; High: ≥7)
Reynolds et al. (72)	*	*	*	**		*	*	7	High
Wang et al. (73)	*	*	*	**	**	*	*	9	High
Wu et al. (8)	*	*		**		*	*	6	Moderate
HCW									
Chan and Huak (74)	*	*	*	**		*	*	7	High
Chen et al. (75)				**	**	*	*	6	Moderate
Chen (76)	*	*	*	**		*	*	6	Moderate
Cheng$^{\alpha}$ et al. (65)				**		*	*	4	Low
Chong et al. (77)	*	*	*	**		*	*	7	High
Chua et al. (78)			*	**	**	*	*	7	High
Fiksenbaum et al. (79)				**		*	*	4	Low
Goulia et al. (80)	*	*		**		*	*	6	Moderate
Ho et al. (81)				**		*	*	4	Low
Jung (82)				**		*	*	4	Low
Kang et al. (21)				**	**	*	*	6	Moderate
Khalid (83)	*	*	*	**		*		6	Moderate
Koh (84)	*	*	*	**		*	*	7	High
Lai et al. (18)	*	*	*	**	**	*	*	9	High
Lancee et al. (85)	*	*		**		**	*	7	High
Liang (19)				**		*	*	4	Low
Lin et al. (86)				**		*	*	4	Low

(Continued)

TABLE 5 | Continued

References	Selection				Comparability	Outcome		Total score	Quality
	Representativeness of the sample	**Sample size**	**Non-respondents**	**Ascertainment of the exposure (risk factor)**	**The subjects in different outcome groups are comparable, based on the study design or analysis. Confounding factors are controlled**	**Assessment of outcome**	**Statistical test**		**(Low: ≤4; Moderate: 5-6; High: ≥7)**
Liu et al. (87)	*			**	**	*	*	7	High
Lu et al. (88)			*	**	**	*	*	7	High
Matsuishi et al. (89)	*	*		**	**	*	*	8	High
Maunder et al. (90)			*	**	**	*	*	7	High
Mishra et al. (91)				**		*	*	4	Low
Nickell et al. (92)				**	**	*	*	6	Moderate
Park et al. (93)		*		**	**	*	*	7	High
Phua et al. (94)				**		*	*	4	Low
Poon et al. (95)	*	*		**		*	*	6	Moderate
Sim et al. (96)				**	**	*	*	6	Moderate
Son (97)	*	*		**		*	*	6	Moderate
Styra et al. (98)	*	*		**		*	*	6	Moderate
Tam et al. (99)				**		*	*	4	Low
Tang et al. (100)				**		*	*	4	Low
Tham et al. (101)				**	**	*	*	6	Moderate
Verma et al. (102)	*	*		**	**	*	*	8	High
Wu et al. (103)		*		**	**	*	*	7	High
Wu et al. (104)				**	**	*	*	6	Moderate
Xiao et al. (22)				**	**	*	*	6	Moderate

[α] *Adjustment outcomes in Chinese patients following 1 month recovery from severe acute respiratory syndrome in Hong Kong.*
[β] *Psychological distress and negative appraisals in survivors of severe acute respiratory syndrome (SARS).*
** = 1 star awarded; ** = 2 stars awarded.*

Factors negatively associated with symptoms of psychological distress, anxiety, depression, and PTSD extracted from moderate-quality and low-quality studies include increased duration after the end of the epidemic (34, 35) and increased education levels of the patient (70). One study reported that, over a period of 30 months, 23 of 53 subjects (43.4%) recovered from DSM-IV psychiatric disorders diagnosed post-SARS (34).

Miscellaneous Outcomes

Several interesting outcomes reported are worth mentioning. A high-quality case–control study of SARS patients with psychosis reported that a family history of psychiatric illness was associated with an increased incidence of SARS-related psychosis in the short term (33 vs. 0%, $p = 0.02$) (43). One moderate-quality study identified chronic fatigue syndrome which persisted at the fourth year of follow-up. Active psychiatric illness was found to be significantly associated with patients with chronic fatigue syndrome. One study reported that 39 of 51 patients (76.5%) with active psychiatric illness had chronic fatigue syndrome (30). Interestingly, one moderate-quality study of patients reported a higher incidence of narcolepsy during and shortly after the influenza A/H1N1 pandemic, independent of H1N1 vaccinations. It was reported that the incidence of narcolepsy following the 2010 pandemic was 3.2 times greater than forecasted ($p < 0.001$) (44).

Significant Comorbidities or Complications

Six studies of varying qualities on SARS and influenza A (H7N9) patients reported that patients with significant comorbidities or complications had higher levels of psychological distress (25, 26, 65, 69), depression symptoms (108), and PTSD symptoms (33).

In the short term, a high-quality, a moderate-quality, and a low-quality study, respectively, reported that pre-existing chronic disease, perceived severity of SARS symptoms, use of steroids for respiratory complications, and ICU admission were associated with higher levels of psychological distress (65, 69) and depression symptoms (108). In the long term, three moderate-quality studies reported that a pre-existing chronic disease, poorer perceived physical health, higher average pain, patients who had acute respiratory distress syndrome, and patients who had avascular necrosis as a complication of steroid treatment were associated with higher levels of psychological distress (25, 26) and PTSD symptoms (33). It was reported that chronic medical illnesses (OR = 7.44, 95% CI = 1.44–38.59, $p = 0.014$) and avascular necrosis (OR = 4.53, 95% CI = 1.41–14.50, $p = 0.010$) were predictors of PTSD (33). ICU admission and having avascular necrosis were postulated to cause psychological distress by resulting in activity restriction and functional impairment in one high-quality and one moderate-quality study, respectively (33, 69).

Interestingly, steroid treatment was associated with short-term psychological distress in a low-quality study (65) and psychosis in a high-quality study (43). The median cumulative dose of hydrocortisone was significantly higher in patients with SARS-related psychosis than in non-psychotic subjects (10,975 vs. 6,780 mg, $p = 0.017$) (43). This is in keeping with the findings that high-dose steroids can cause mood fluctuation and cognitive distortion, even in the absence of physical complications (64, 110).

Quarantined Individuals

Six studies were identified for quarantined individuals. Three high-quality and one moderate-quality study, respectively, reported mental health outcomes during quarantine (7, 67, 72, 73), and two moderate-quality studies reported mental health outcomes after quarantine (27, 71).

Comparison to Non-quarantined Individuals

Only two papers compared the levels of psychological distress and PTSD symptoms among quarantined vs. non-quarantined individuals (71, 73). Both papers, one of high-quality and one of moderate-quality, reported that the mental health outcomes were not significantly different between both groups. Interestingly, quarantined females had lower levels of PTSD symptoms during the epidemic as compared to non-quarantined females in the high-quality study (OR = 0.24, 95% CI = 0.07–0.83, $p < 0.05$) (73).

In two moderate-quality studies, the quarantined individuals, while not shown to be at a higher risk of PTSD as compared to non-quarantined individuals, described a sense of isolation due to the lack of physical contact with family members, activity restriction, and not being able to shop for basic necessities (7, 71). The infection control measures imposed caused physical discomfort, feelings of isolation, and anxiety (7). These factors could have contributed to certain groups of quarantined individuals having poorer mental health outcomes compared to non-quarantined individuals.

During Quarantine

Factors positively associated with symptoms of anxiety in a high-quality paper include having a personal history of psychiatric disorders (RR = 5.3, 95% CI = 2.511.0) and financial loss (RR = 1.9, 95% CI = 1.4–2.6) (111). A longer duration of quarantine is also shown to have worse mental health outcomes in a high-quality and a moderate-quality study, respectively (7, 66). It was reported that IES-R was correlated with a longer duration of quarantine ($\beta = 0.40, p = 0.012$) (72).

After Quarantine

In one moderate-quality study, being female was positively associated with symptoms of PTSD compared to males (IES-Revised-Korean Version sleep disturbance mean = 1.57 vs. 0.46, $p = 0.024$) (27). In another moderate-quality study, the factors positively associated with psychological distress were cessation of work and income reduction (OR = 9.9, 95% CI = 4.4–21.9, $p = 0.000$) (71) and experiencing symptoms related to the epidemics (OR = 7.9, 95% CI = 1.5–41.9, $p = 0.016$) (71). Interestingly, a shorter duration of quarantine was associated with higher levels of PTSD symptoms after quarantine (27), which is the opposite of what was reported during quarantine.

DISCUSSION

Internal and External Validity

The strength of our study lies in our broad search and stringent selection criteria for our papers. In our search, we included all controlled vocabulary and keywords of diagnoses to capture a comprehensive list of psychiatric outcomes. We excluded papers reporting an outbreak before year 2000, which may compromise external validity, papers with potential confounders like vaccination during an epidemic, and papers with unvalidated scales, which may report potentially subjective and inaccurate results.

Most of the studies involving the general public took place during or immediately after the epidemic and are cross-sectional in nature. As such, the long-term psychiatric morbidities in the general public were not well-studied compared to healthcare workers and patients. Cohort studies should be conducted to follow up with these populations to establish if mental health disturbances still persisted after the epidemics.

In general, we note that the scales used are an effective screening tool for mental health conditions but are largely not diagnostic. Different studies adopted different tools for the same mental health outcome. Even among studies using the same scale, different cutoff points for the same disease were reported. This could have accounted for the variability in prevalence of high-risk individuals identified.

Due to the cross-sectional nature of our study, the cause-and-effect relationship between risk factors and mental health outcome is frequently poorly established. The samples in these studies do not have a control population as everyone in the region or nation would have been through the epidemic (112). Furthermore, many studies have been subjected to recall bias. This is considering that, in some studies conducted, there was a substantial time lapse between the epidemic and the time at which individuals reported their psychology during the epidemic. Because an overwhelming majority of the studies considered were voluntary, non-respondent bias could have set in if individuals who responded to the surveys had a significant but unreported difference in psychology compared to those who declined or did not respond to the surveys. In terms of data collection, many studies used written or online questionnaires. Selection bias is present as illiterate and less tech-savvy individuals are unable to complete the questionnaires. Moreover, the severely ill are less likely to participate in the questionnaires. Sampling bias is present as some studies reported using non-randomized sampling methods such as snowball sampling and convenience sampling. Because of social desirability bias, the participants may under-report symptoms or behaviors they deem less socially acceptable during an epidemic.

Multiple studies have examined the effects of respiratory illnesses [e.g., legionnaires' disease (113), community-acquired pneumonia (114), and acute respiratory distress syndrome (115)] on the mental health of patients in non-epidemic settings. Severe psychiatric morbidities were shown in survivors, including PTSD, anxiety, depression, and chronic fatigue syndrome, and in one study, PTSD still persisted at the 8-year follow-up (115). Noting how similar the psychological course of these patients is to patients in respiratory epidemics, it may be worth to investigate a common broad approach toward mental health intervention for all patients who have been through a severe respiratory disease. As a new recommendation, this approach should emphasize heavily on the anticipation and the management of PTSD after the patients had recovered. For example, a comprehensive screening and referral policy by the psychiatry department could be introduced for all patients recovering from severe respiratory illnesses.

Heterogeneity

Many articles during the epidemic variably assessed their participants during its beginning, peak, or tail-end, which can lead to unaccounted differences in mental health responses.

Different levels of prevalence of high-risk scores for PTSD have been reported, with lowest being 7% in COVID-19 (14) and H1N1 (59) and highest being 26% in SARS (58). This could be accounted for by various factors such as transmissibility and varying case-fatality rates between different respiratory viruses (116). The differences in containment efforts and method of information dissemination between countries may account for the variability as well.

Demographics

Females were at a higher risk for the many mental health outcomes aforementioned. In the same vein, a recent study reported that being male is a protective factor for depression and anxiety (117). In terms of social factors, traditional gender roles could be upheld in many countries surveyed which had a conservative, even patriarchal, background (118). Strong child-centric ideals in many of such countries could have meant that mothers had to pay markedly more attention to the well-being of their children and families before themselves. Specifically for PTSD, the higher risk may be attributed to the differences in fear mechanisms (119) between sexes and the higher genetic heritability (111) in females.

Among healthcare workers, youth and inexperience were associated with poorer mental health outcomes (85, 99, 100). We postulate that they face pressure adapting to a new healthcare system and new stressors from an epidemic. One study showed higher resilience in older healthcare workers because of better work–life balance and higher personal accomplishment, possibly leading to better mental health (120).

Conversely, among the general public and the quarantined, old age was associated with worse outcomes. This was postulated to be because older subjects were cognizant of poorer prognosis if infected (64). Higher perception of risk causes them to adopt more protective measures and leads to anxiety (121, 122), which correspond to hyperarousal and avoidant behaviors of PTSD symptoms.

Recommendations for the COVID-19 Pandemic

In view of the aggressive lockdown strategies employed by countries, officials should consider the mental health problems (123) weighing against its epidemiological benefits. In our systematic review, the only two studies that looked at the mental health outcomes between quarantined and non-quarantined individuals reported no significant difference between the groups. Unlike in quarantine, lockdowns have devastating economic impact and are subjected to unexpected extensions.

Recession is a major cause of depression during epidemics as aforementioned (24, 51). COVID-19-related suicides are on the rise (124), with one Pakistan study attributing this to the lockdown-related economic instability and high unemployment rates (5). Financial assistance should also be provided to individuals affected by the market downturn. Social support funds may ease psychological distress and burden for families or businesses.

Drawing on past trends and recent studies, more attention should be given to the vulnerable groups identified at risk of poor mental health outcomes during epidemics, including older individuals, migrant workers, students, and chronically ill patients. We had seen higher suicide rates in the elderly during the SARS epidemic (46, 47), with affective disorders being a significant risk factor in this age group (125). To prevent this, telephone-based or online trauma-focused psychotherapy can be deployed, with strong outreach efforts, to these vulnerable groups.

As shown in our results and discussed above, females are at a higher risk for a psychological disease. Among a small group of females, the increased prevalence of mental health disorders during the COVID-19 pandemic may be accounted for by increased domestic violence because of home isolation (126). Increased surveillance of domestic violence could be enacted *via* frequent checks *via* telemedicine consultations and *via* an increased index of suspicion for females presenting with non-accidental injuries to primary care.

Among the general public, anxiety can be eased with the officials providing accurate and timely information as seen in identified studies (15, 16, 57). To reduce further distress, the relevant authorities should dispel rumors that could spread fear (127). Proper channels for communication *via* appropriate media should be updated with the latest and most accurate information.

Stigmatization of some members of the public and healthcare workers is a pertinent and recurring issue. These individuals, including those of Asian descent in COVID-19 epidemic (128, 129), are allegedly labeled or shunned because they are perceived as culpable of transmitting the virus. This prejudice simply because of race or profession confers a significant psychological burden onto affected individuals. Ending the stigmatization should begin with denouncement of such behavior by governments. In a period of high stress and uncertainty in this rapidly evolving global health crisis, compassion, and empathy, instead of dissent and distrust, will bring better mental health outcomes to the world.

We note that healthcare workers suffering from psychological disorders had a largely positive prognosis, even up to 6 months post-epidemic (101). The resilience of these workers' mental health in past epidemics was buoyed by a positive work culture with mental health support and crisis preparation (20, 36, 74, 78, 94, 101). This encouraging finding highlights the importance of fostering a culture at work that nurtures the mental health of healthcare workers. Proper avenues for workers to seek psychological help to develop better coping strategies should be made available (117, 130). With their psychological needs taken care of, healthcare workers can continue to serve patients compassionately (21). Unity and social support among healthcare workers in the face of crises (20, 78, 96) play a crucial role in helping workers cope effectively. A multimodal approach to crisis preparation using seminars, practical workshops, and simulation exercises could reduce anxiety in physicians should a future epidemic be imminent (91).

CONCLUSION

This study has shown that the general public, healthcare workers, patients, and quarantined individuals in many countries suffer from many stresses during respiratory epidemics that have poor implications on mental health, even long after the epidemic. These psychological symptoms, if not detected and managed early, can progress into full-blown psychiatric conditions. In applying this knowledge to the COVID-19 epidemic, it would be prudent for governments to step up and use resources to implement policies specifically designed for each high-risk group. These policies will serve to relieve the psychological burden and provide better well-being for all.

DATA AVAILABILITY STATEMENT

All datasets generated for this study are included in the article/**Supplementary Material**.

AUTHOR CONTRIBUTIONS

YL, CRC, ZX, RH, and CH contributed to the study design, writing, and approval of the manuscript. YL, CRC, and ZX contributed to the literature search, data extraction, and analysis. All authors contributed to the article and approved the submitted version.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2020.565098/full#supplementary-material

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Workplace Stress, Presenteeism, Absenteeism, and Resilience Amongst University Staff and Students in the COVID-19 Lockdown

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Background: This study explored how the COVID-19 outbreak and arrangements such as remote working and furlough affect work or study stress levels and functioning in staff and students at the University of York, UK.

Methods: An invitation to participate in an online survey was sent to all University of York staff and students in May-June 2020. We measured stress levels [VAS-scale, Perceived Stress Questionnaire (PSQ)], mental health [anxiety (GAD-7), depression (PHQ-9)], physical health (PHQ-15, chronic medical conditions checklist), presenteeism, and absenteeism levels (iPCQ). We explored demographic and other characteristics as factors which may contribute to resilience and vulnerability for the impact of COVID-19 on stress.

Results: One thousand and fifty five staff and nine hundred and twenty five students completed the survey. Ninety-eight per cent of staff and seventy-eight per cent of students worked or studied remotely. 7% of staff and 10% of students reported sickness absence. 26% of staff and 40% of the students experienced presenteeism. 22–24% of staff reported clinical-level anxiety and depression scores, and 37.2 and 46.5% of students. Staff experienced high stress levels due to COVID-19 (66.2%, labeled vulnerable) and 33.8% experienced low stress levels (labeled resilient). Students were 71.7% resilient vs. 28.3% non-resilient. Predictors of vulnerability in staff were having children [OR = 2.23; CI (95) = 1.63–3.04] and social isolation [OR = 1.97; CI (95) = 1.39–2.79] and in students, being female [OR = 1.62; CI (95) = 1.14–2.28], having children [OR = 2.04; CI (95) = 1.11–3.72], and social isolation [OR = 1.78; CI (95) = 1.25–2.52]. Resilience was predicted by exercise in staff [OR = 0.83; CI (95) = 0.73–0.94] and in students [OR = 0.85; CI (95) = 0.75–0.97].

Discussion: University staff and students reported high psychological distress, presenteeism and absenteeism. However, 33.8% of staff and 71.7% of the students were resilient. Amongst others, female gender, having children, and having to self-isolate contributed to vulnerability. Exercise contributed to resilience.

Conclusion: Resilience occurred much more often in students than in staff, although psychological distress was much higher in students. This suggests that predictors

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of resilience may differ from psychological distress *per se*. Hence, interventions to improve resilience should not only address psychological distress but may also address other factors.

Keywords: workplace stress, study stress, COVID-19, presenteeism, absenteeism, mental health, vulnerability, resilience

INTRODUCTION

Background

Since its onset in China in the fall of 2019, the worldwide outbreak of the COVID-19 pandemic has made a tremendous impact on people's lives, health, and livelihood. Many countries have put various levels of social restrictions in place. In the United Kingdom (UK), lockdown, social distancing and shielding of vulnerable people took effect from March 23, 2020. Non-essential shops and business were closed. People were advised to stay home except for essential trips for food, to the pharmacist, or the hospital. Only key workers, who performed essential tasks for society, including NHS employees, were allowed to go to their workplace. All other people were required work from home, if able. Many people lost their job temporarily or permanently and were on furlough, for which the Chancellor of the Exchequer installed a temporary scheme. Nurseries were closed, and children could not go to school, except children of key workers; and parents had to combine remote working with home-schooling and caring for their children.

Universities were closed as well, and examinations were canceled. Students were sent home from campus unless they had no place to go to, which was the case for international students who were unable to fly back home because all no-essential air travel was gradually stopped. These measures were put into effect in a relatively short time and lasted until June 15, 2020 when gradually non-essential shops could reopen again. By July 4, 2020, a further gradual easing of the lockdown started with the opening of pubs, restaurants and cinemas.

However, for University staff and students in the UK, the situation remained the same and laid bare how economically vulnerable the UK Universities were by their reliance on international, mostly Chinese students fees for income (1). The number of Chinese students coming to the UK each year has risen from 25,000 in 2006 to ∼90,000 in 2019. Central funding of Universities by the government has dropped from 50% in 2010 to 25% in 2020 (2). As many Chinese students were confronted with hostility from UK residents in the wake of the COVID-19 outbreak (3, 4) with at least 267 offenses recorded in the first 3 months of 2020 (5), and due to the uncertainty on how teaching would commence again at the beginning of the new academic year, many Chinese students refrained from enrolling in UK Universities (6). Also, UK national students delayed starting their study by an anticipated 20% (7). This has affected job security of University teaching staff, and caused large changes in job content and, at some Universities, also payment for University staff (8).

Both for University staff and students, the rapidly changing work and study arrangements were deemed to cause work or study-related stress, which might be aggravated by personal stressors such as having to work remotely, having to change tasks, and having to combine all of this with home-schooling children and caring for shielding elderly family members or neighbors. This comes on top of having to deal with the general worries and anxieties emanating from the COVID-19 epidemic, deaths, and lack of testing available. Any symptoms that occurred and might be COVID-19 related could not be identified as COVID-19 for the first couple of months, which led to whole families having to self-isolate for 1–2 weeks if a family member had COVID-19 type symptoms. Further, people wondered when and how they would return to the University for work and study, and how they would deal with that. Psychological symptoms such as worries, physical symptom due to stress, especially stress due to remote working and living circumstances might lead to less work productivity related to the COVID-19 outbreak. This can be either sickness absence, termed absenteeism, or working with difficulty to do the tasks at hand, so-called presenteeism (9). Originally coined as "showing up at work while being sick" (10) because of chronic medical conditions (11) or because of work or personal characteristics (10), the emphasis in interpretation has shifted toward worker slowdowns in general and the economic costs associated with that (12). The prevalence of presenteeism is high, amounting to an average of 40% in a survey conducted amongst workers in 34 countries (13–15).

For some University staff and students it might be more difficult to deal with the crisis than for others, depending on factors affecting their resilience. Resilience being defined here as the ability to overcome adversity, which can be shown as experiencing no impact or positive impact on stress levels due to COVID-19, and functioning well in terms of work or study i.e., without presenteeism or absenteeism. From the literature, such factors might be age, ethnicity, living arrangements, job characteristics such as income level, educational background (16), physical fitness (17), psychological fitness, life experiences (18), personality and coping style (19–21). It may be that for some, the crisis brought some benefits as well. Some felt that no longer having to commute and being able to work from a relatively quiet workplace at home was less stressful than their regular working arrangements.

Rationale

Hence, we felt a need to explore the impact of the COVID-19 pandemic on work stress levels and personal stress levels in University staff and students and investigate factors associated with resilience to meet the challenges of the COVID-19 crisis. We planned to explore work arrangements, work productivity and personal life, and mental and physical health and resilience, and investigate the influence of age, gender, living arrangements and ethnicity, such as Black, Asian, and minority ethnic (BAME) groups. BAME members of this group may be particularly vulnerable to COVID-19, more vulnerable to the impact of COVID-19-related regulatory measures, and may also have to deal with COVID-19 outbreak-related hostility in case of Chinese students or more general ethnicity related discrimination.

OBJECTIVES

- To describe stress levels, mental health and physical health in University staff and students at the beginning of the imposed lockdown.
- To describe presenteeism and absenteeism and their association with the above.
- To investigate protective and vulnerability factors for the impact of the COVID-19 outbreak on work-stress and personal stress levels in staff and students. We will explore age, gender, ethnicity, childhood and current living arrangements, job characteristics, educational background, and chronic medical conditions.
- To explore predictors of resilience as the ability to overcome adversity, like experiencing no impact or positive impact on stress levels due to COVID-19, vs. a negative impact.

METHODS

This study followed a cross-sectional design. An online survey was sent to all University of York and Hull York Medical School (HYMS) staff and students. The survey was accessible via an anonymous link distributed via email to staff and students at the University of York and was announced by the Human Resources (HR) department and the student communications departments. The survey was open for 1 month from May 13, 2020 until June 22, 2020, and one email reminder was sent. Results are reported separately for students and staff.

Variables

Variables are shown in **Table 1**.

TABLE 1 | Variables.

Variable	Assessment	Characteristics
Current stress levels	Likert-type scale (22, 23)	Respondents rated their current work and personal stress levels using bespoke Likert-type scales.
Impact of COVID-19 on work and personal life stress	Likert-type scales (22, 23)	Respondents rated the impact of the COVID-19 pandemic on their stress levels using bespoke Likert-type scales. This included whether respondents felt the pandemic had a positive, negative, or no impact.
Perceived Stress	Perceived Stress Questionnaire (PSQ) (24)	A 30-item self-report questionnaire measuring perceived background stress during the past 2 years and circumstances known to provoke disease symptoms. Scores are summarized in a PSQ-Index ranging between 0 (lowest possible level of stress) and 1 (highest possible level of stress) Reliability (Cronbach's α) = 0.85 (25, 26).
Anxiety	Generalized Anxiety Disorder Screener (GAD-7)	The GAD-7 is a reliable 7-item self-report screening tool that measures the severity of anxiety and worry symptoms during the last 2 weeks. GAD-7 scores range from 0 to 21, and cut-off points of $<$ 5, 5–10, and $\geq$ 10 represent normal, subclinical, and clinical levels of anxiety. Reliability (Cronbach's α) = 0.92 (27).
Depression	Patient Health Questionnaire (PHQ-9) (28)	The PHQ-9 is a reliable 9-item self-report questionnaire measuring the severity of depression during the past 2 weeks. Item scores ranged from 0 (not at all) to 3 (nearly every day), and total scores ranged from 0 to 27. Cut-off points of $<$ 5, 5–10, and $\geq$ 10 represent normal, subclinical, and clinical levels of depression. Reliability (Cronbach's α) = 0.89 (28).
Somatic symptoms	Patient Health Questionnaire (PHQ-15)	The PHQ-15 is a reliable somatic symptom severity scale, consisting of a list of 15 somatic symptoms. Reliability (Cronbach's α) = 0.89 (29). In two studies in the occupational health setting in sick-listed employees, higher scores on the PHQ-15 were associated with more disability, longer sickness absence, and higher health-related job loss (30, 31). In a recent review of studies in primary care, the PHQ-15 was found to be equally effective or superior to other brief measures for assessing somatic symptoms and screening for somatoform disorders, with cut-off points of $<$ 5, 5–10, and $\geq$ 10 represent normal, mild, and clinical symptom levels of physical symptoms (32).
Chronic medical conditions	CBS list (33)	A 31 item checklist for chronic medical conditions for which a patient received treatment from a doctor. Conditions are rated as somatic (i.e., known chronic medical conditions such as COPD and diabetes) or functional somatic syndromes (e.g., Irritable Bowel Syndrome (IBS), dizziness and back pain not explained by a known medical condition) Subscales are provided for the checklist.
Work absenteeism and presenteeism, job characteristics	iPCQ (34)	The *i*MTA Productivity Cost Questionnaire (*i*PCQ), is a short generic questionnaire assessing demographic and job characteristics (including education level and hours worked), presenteeism and absenteeism. The iPCQ applies to national and international studies for the measurement of productivity losses.
Job changes	Bespoke questionnaire	A bespoke questionnaire was developed which explored redundancy and furlough, and changes in work situation (such as remote working).
Resilience factors	Likert-type scales (22, 23)	A bespoke questionnaire containing 9 items exploring resilience using a Likert-type scale. Questions explored characteristics outlined in the literature (35) and focussed on access to outdoor space, and exercise levels, and childhood and current living environments.
Demographic questions	Bespoke questionnaire	A bespoke demographic questionnaire providing information on age, gender, ethnicity, nationality, educational level, work situation, relationship status, and living arrangements, including self-isolation.

Dependent Variables

- Stress experienced as measured by a VAS scale, psychological distress (PSQ, GAD-7, and PHQ-9), and absenteeism/presenteeism as in IPCQ are dependent variables.
- The impact of COVID-19 on personal and work stress levels as reported by respondents is taken as an indicator of resilience in this sample.

Predictors

- Age, gender, ethnicity, childhood, and current living arrangements, job characteristics, educational background, chronic medical conditions, personality, and stress reactivity style.

Physical symptoms and chronic medical conditions as known medical conditions and functional somatic syndromes.

Analyses

Data is described descriptively using mean (sd) or n (%).

In order to establish the impact of COVID-19, mean scores of staff and students on screeners of psychological distress were compared to mean scores of normative samples using independent t-tests. The number of subjects with a healthy, subclinical, or clinical score on the dependent variables PHQ-9 and GAD-7 were established with normative values from pre-COVID-19 samples.

To investigate predictors of impact, we performed a hierarchical regression analysis with psychological distress (a composite score on the PSQ, PHQ-9, and GAD-7) as a dependent variable. For the binary dependent variables presenteeism and absenteeism, a logistic regression was performed using the same predictors that had been analyzed with psychological distress as dependent variable.

Subsequently, we divided the sample into two groups: subjects reporting a negative impact of COVID-19 on their stress levels (non-resilient), vs. subjects reporting a positive or neutral impact on their stress levels (resilient). Then an exploratory analysis was performed using regression logistic analysis to find additional vulnerability or protective factors for reported stress. All analyses were done for staff and students to explore if there are different predictors at play in both groups.

All analyses were performed on SPSS (v26). A p-value of $<$ 0.05 was considered to indicate statistical significance.

Other Analyses

We performed correlation analysis to explore associations between stress, mental health, presenteeism and absenteeism in the sample. We explored predictors of presenteeism and absenteeism, and we compared presenteeism and absenteeism in the resilient vs. the non-resilient subgroup.

We explored psychological distress scores and presenteeism and absenteeism scores in Chinese students compared to other Asian students.

We explored distress score differences between female, male, and non-binary genders and predictors of resilience in those gender categories.

RESULTS

Description of the Sample

1,055 of 4,668 University staff (22.6%) and 925 of ∼18,000 students (∼5.1%) completed the survey.

Demographic Characteristics

Table 2 shows the demographic characteristics of the staff and student respondents. The mean age of staff was 45.2 years and 27.5 in students 74% of staff and students were female. Three staff members who responded to the survey were black, and 3% were Asian, vs. 3% black and 11% Asian in students. These

TABLE 2 | Demographic characteristics of the samples.

Characteristics		Staff		Student	
		n	%	*n*	%
Age		45.2 (30.5)		27.5 (31.8)	
Gender	Female	769	73	664	72
	Male	270	26	236	26
	Non-binary	8	1	21	2
Highest level of Education	I have never finished school or training programme	1	0	0	0
	Intermediate vocational secondary school	27	3	7	1
	Higher general secondary education	58	5	471	51
	School for higher vocational education	12	1	0	0
	University	880	83	418	45
	Other	76	7	25	3
Ethnicity	Asian	28	3	101	11
	Black	3	0	26	3
	White	987	94	746	81
	Other	33	3	50	5
Immigration Status	British/Dual Citizen	896	88	667	74
	Non-British/Dual Citizen	125	12	231	26
Chronic Medical Conditions	No CMC	637	60	634	69
	One CMC	247	23	181	20
	Multiple CMC	106	10	59	6
Chronic somatic medical conditions	No	758	71.8	734	79.5
	One	214	20.3	138	15.0
	Multiple	83	7.9	51	5.5
Childhood Environment	Rural Area	215	23	172	23
	Suburban area with access to parks/gardens/green areas	518	56	329	45
	Suburban area without access to parks/gardens/green areas	12	1	9	1
	Urban area with access to parks/gardens/green areas	124	13	152	21
	Urban area without access to parks/gardens/green areas	10	1	15	2
	A mix of the above	54	6	58	8

demographic characteristics are representative of the wider UK University staff and student population (36–38).

A third of staff respondents (33%) and a quarter of students (26%) reported at least one chronic medical condition. A high proportion of staff (92%) and students (89%) had access to green spaces where they lived in childhood.

TABLE 3 | COVID-19 related work and living characteristics in staff and students.

COVID-19 related work and living characteristics		Staff *n*	Staff %	Student *n*	Student %
Have to work from home because of the COVID-19 situation	Yes	913	98	566	78
	No	22	2	164	22
Lost their job because of the COVID-19 situation	Yes	6	1	51	7
	No	923	99	675	93
Missed work in the last 4 weeks as a result of being sick	No	970	93	318	90
	Yes	70	7	34	10
During the last 4 weeks there were days in which they worked but during this time were bothered by physical or psychological problems	No	403	39	186	52
	Yes	636	61	169	48
In social isolation since the outbreak (e.g., due to a suspected COVID-19 infection or because you are at risk of infection)?	Yes	244	26	291	40
	No	687	74	444	60
Children/step-children living with them	Yes	428	41	89	10
	No	624	59	834	90
	Prefer not to say	3	0	2	0
Current Environment	Rural Area	185	20	136	18
	Suburban area with access to parks/gardens/green areas	505	54	323	44
	Suburban area without access to parks/gardens/green areas	8	1	13	2
	Urban area with access to parks/gardens/green areas	212	23	236	32
	Urban area without access to parks/gardens/green areas	14	2	10	1
	A mix of the above	8	1	18	2
Do you have access to an outdoor space at home?	Yes, to a garden	716	76	521	70
	Yes, to a courtyard	117	13	85	11
	Yes, to a balcony	33	4	45	6
	No	70	7	91	12
Compared to the time before COVID-19 social distancing measures were put in place, how much exercise are you currently doing?	A lot less exercise	196	21	210	28
	Somewhat less exercise	230	25	176	24
	About the same amount	240	26	151	20
	Somewhat more exercise	215	23	142	19
	A lot more exercise	55	6	63	8

COVID-19 Related Work and Living Characteristics

The COVID-19 related work and living characteristics are presented in **Table 3**.

A high proportion of the staff (98%) and students (78%) surveyed had their work and study arrangements changed and were working or studying remotely because of the COVID-19 pandemic. 1% of staff and 7% of students lost their job or dropped out of their study. 7% of staff and 10% of students were sick-listed in the last 4 weeks.

A quarter of staff (26%) and 40% of students had experienced problems doing their work or studying because of psychological or physical symptoms (presenteeism).

Regarding living arrangements, 26% of staff and 40% of students were in social isolation due to the COVID-19 outbreak. 41% of staff and 10% of students had children living in with them. Most had access to green space (e.g., a garden). However, 7% of staff and 12% of students had no direct access to a garden or balcony in their home during the lockdown. Participants were asked whether they were exercising more, less or at the same level as they were before the lockdown was put in place. Exercise levels since lockdown were evenly distributed.

Impact on Stress and Mental Health

Psychological Distress

The mean PSQ scores were 0.51 ($\pm$0.2), in students ($n = 788$) and 0.43 ($\pm$0.2), in staff ($n = 965$). Regarding the VAS score indicating the level of personal stress, 79% of staff who completed this question reported elevated stress levels due to COVID-19. 66% reported that COVID-19 raised their work stress level.

Almost a quarter of staff (22.1%) reporting on the GAD-7 ($n = 965$) had anxiety scores indicating probable anxiety disorder (GAD-7 score $\geq$ 10), and 24% reported depression scores indicating probable depressive disorder (PHQ-9 score $\geq$ 10), whereas students reported 37.2 and 46.5%.

TABLE 4 | Proportions of non-clinical, subclinical, and clinical levels for the three dependent variables measuring distress in the present sample.

	Staff				
	Mean	**SD**	**0–4 Non-clinical**	**5–9 subclinical**	**10 or higher clinical level**
Anxiety	6.41	5.36	43.4	34.6	22.1
Depression	6.11	4.93	44.2	31.8	24.0
			0–0.33 Non-clinical	**0.34–0.45 subclinical**	**0.46–1 clinical level**
Stress	0.43	0.19	33.3	20.0	46.7
	Students				
	Mean	**SD**	**0–4**	**5–9**	**10 or higher**
Anxiety	8.31	5.74	28.8	34.0	37.2
Depression	9.87	6.57	25.3	28.2	46.5
			0–0.33 Non-clinical	**0.34–0.45 subclinical**	**0.46–1 clinical level**
Stress	0.51	0.20	19.4	19.1	61.5

Proportions of non-clinical, subclinical, and clinical levels of distress are shown in **Table 4**.

Diagram 1 (below) details the impact of stress and resilience factors on psychological distress.

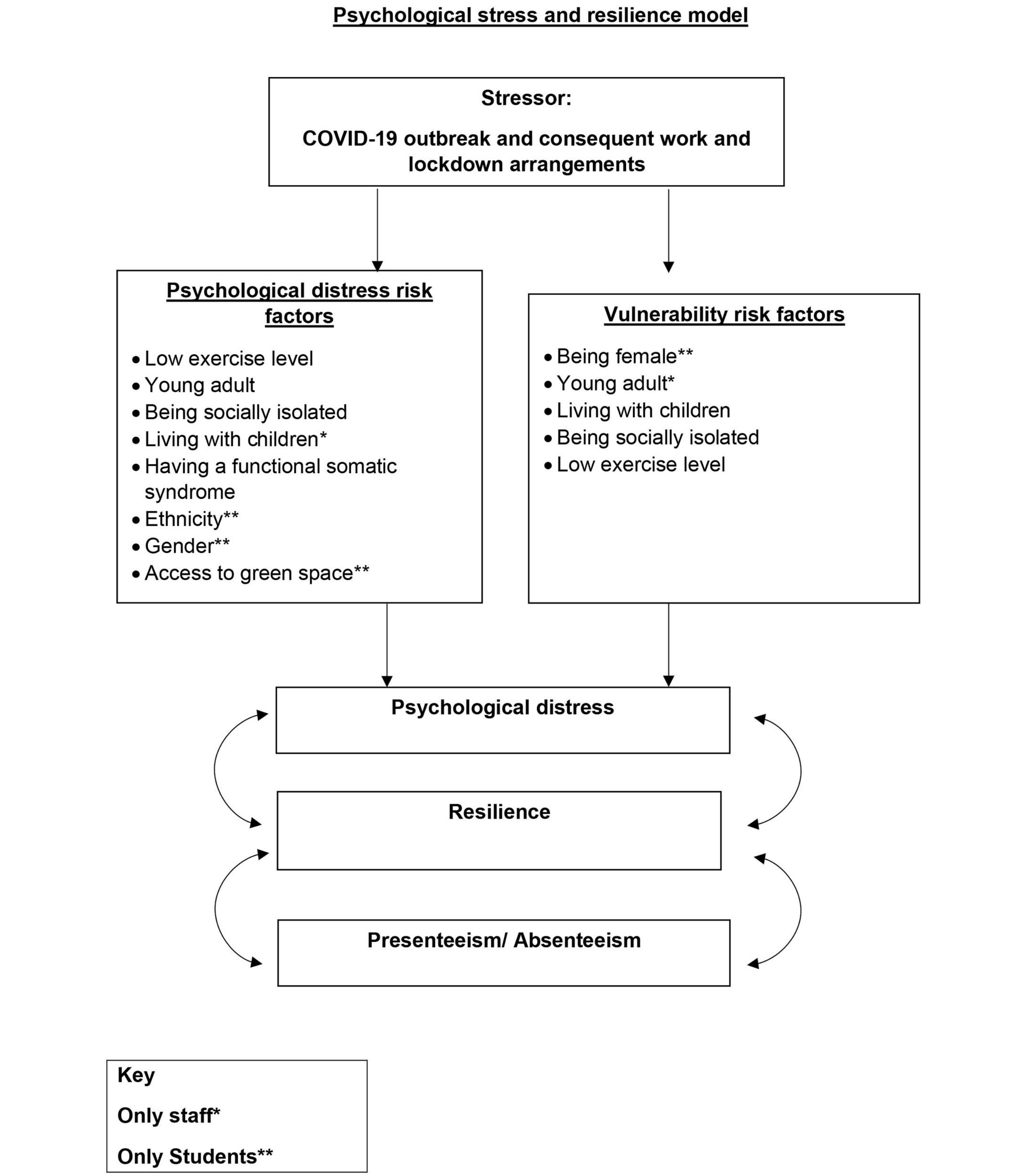

Diagram 1 | Psychological stress and resilience model.

Experienced Stress Levels

Staff

Figure 1 shows experienced stress levels in staff as indicated by the VAS score and reveal a bimodal distribution of scores, with most staff either experiencing high stress levels and or low stress levels and few scoring in between [Mean = 4.9 (±2.5)].

Students

Regarding the VAS score indicating the level of personal stress over the past 2 weeks, 72% of the students who completed this question reported elevated stress levels due to COVID-19. 70% reported that COVID-19 raised their study stress levels.

Figure 2 shows experienced stress levels in the students, as indicated by the VAS score and as with staff, is a bimodal distribution [mean = 5.8 (±2.5)].

Composite Psychological Distress Score

Correlations among scores on the GAD-7, PHQ-9, and PSQ were high: $r_{GAD-PHQ} = 0.78$ for staff (0.77 for students); r_{GAD_PSQ} 0.73 (0.71 for students); $r_{PHQ\_PSQ} = 0.71$ (0.73 for students). With PSS they were somewhat lower); r_{GAD_PSS} 0.58 (0.58 for students); $r_{PHQ\_PSS} = 0.52$ (0.52 for students).

These correlations suggest that the measures assess highly similar constructs and support the construction of a composite measure of the GAD-7, PHQ-9, and PSQ, reflecting an overall level of psychological distress (depression, anxiety, and perceived stress). Thus, scores on the PHQ-9, GAD-7, and PSQ were standardized and combined into a composite score for psychological distress.

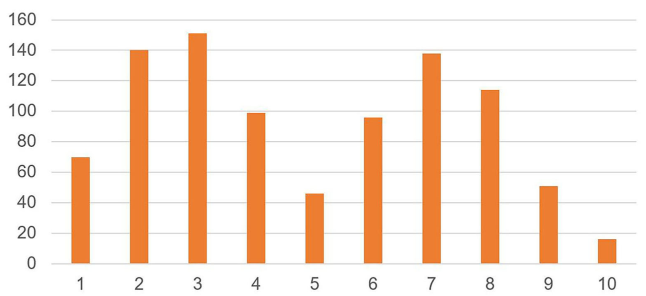

Figure 1 | Experienced stress level in staff ($N = 921$). On a scale of 1–10, where 1 is no personal stress, and 10 is considerable personal stress, how would you score the level of your current personal stress?

Predictors of Psychological Distress

Psychological distress is a condition where a person feels emotional suffering (including feeling anxious, scared, tired, or sadness) due to stressors. Stressors may include health issues, everyday stressors (such as work or personal stress) or traumatic experiences. With multiple regression analysis, we examined separately for staff and students, which predictor variables (listed in **Table 1**) were significantly associated with psychological distress as the dependent variable. Stepwise, forward entry resulted in a model comprising a set of five variables that significantly predicted psychological distress in staff: a lessened current exercise level ($\beta = -0.23$), lower age ($\beta = -0.24$), reporting social isolation ($\beta = -0.13$), more functional somatic syndromes ($\beta = 0.14$), and having (step)children living at home ($\beta = -0.09$), are associated with more distress. The variables combined were associated ($r = 0.40$) with psychological distress, explaining 15.9% of the variance in psychological distress of staff members.

For students, a set of seven variables predicted distress: lower age ($\beta = -0.20$), reporting social isolation ($\beta = -0.17$), not being of Asian descent ($\beta = -0.11$), female gender ($\beta = -0.11$), a lessened current exercise level ($\beta = -0.10$), living in an urban environment ($\beta = -0.09$), and more functional somatic syndromes ($\beta = -0.08$) were associated with more psychological distress. The combination of variables was associated ($r = 0.34$) with distress, explaining 11.3% of

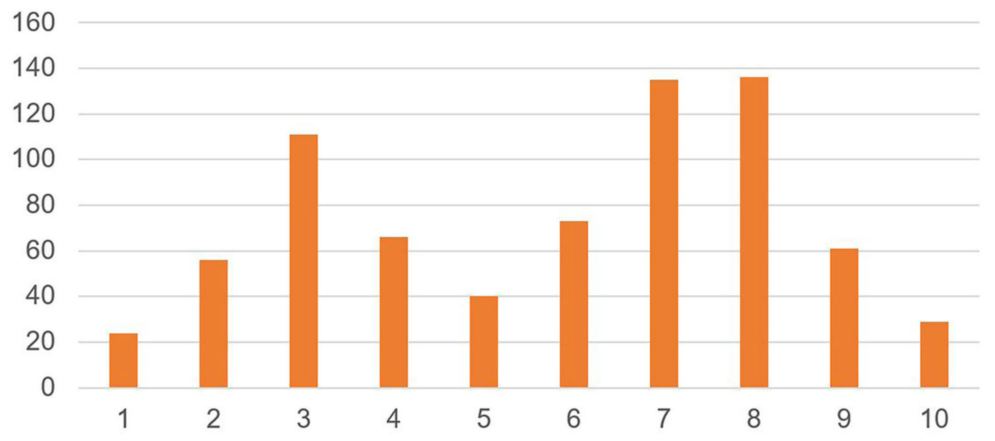

Figure 2 | Experienced stress level in students ($N = 731$). On a scale of 1–10, where 1 is no personal stress, and 10 is considerable personal stress, how would you score the level of your current personal stress?

TABLE 5 | Bivariate correlations between predictors and psychological distress and standardized β's for predictors in a model resulting from multiple regression analyses for staff and students.

		Staff				Students			
Predictor	**Range**	**M**	**SD**	**Bivariate r**	**Stand. β**	**M**	**SD**	**Bivariate r**	**Stand. β**
Age	18–81	44.3	11.4	−0.23***	−0.24	26.5	9.6	−0.19	−0.20
Childhood environment	1–5	2.09	0.96	−0.07*		2.27	1.14	0.05	
Current environment (urban)	1–5	2.31	1.08	0.05		2.53	1.17	0.05	−0.09
Exercise level (lower)	1–5	2.68	1.20	0.23***	−0.23	2.56	1.31	0.10**	−0.10
Outdoor space	1–4	1.42	0.87	0.06		1.60	1.05	0.04	
		N	**%**			**N**	**%**		
Gender	Male	270	36.0	−0.01		236	26.2	−0.10	−0.11
Education	1/2	1	0.1	0.06		7	0.8	−0.11**	
	3					471	52.6		
	5	27	2.6			418	46.7		
	6	58	5.5						
	7	12	1.1						
	8	880	83.4						
White		987	93.6	−0.02		746	80.8	0.06	
Black		3	0.3	0.03		26	2.8	−0.07*	
Asian		28	2.7	0.04		101	10.9	−0.07	−0.13
Other		33	3.1	−0.01		50	5.4	−0.06	
Immigration status	British	896	84.9	0.03				−0.06	
Having Children	YES	428	40.7	0.04	−0.09	89	9.6	0.08*	
IPCQ4 (absenteeism)	YES	70	6.7	−0.04		34	9.7	−0.01	
IPCQ7 (presenteeism)	Yes	636	61.2	0.04		169	47.6	−0.05	
CMC-somatic	None	758	71.8	0.08*		734	79.4	0.02	
CMC-functional	None	956	90.6	0.16***	0.14	867	93.9	0.09**	−0.08
Social Isolation	Yes	244	26.2	0.19	−0.13	291	39.6	0.14***	−0.17

**p* < 0.05; ***p* < 0.01; ****p* < 0.001.

the variance in distress of students. The results are shown in **Table 5**.

We explored further how being a student of Asian descent seemed associated with lower psychological distress by comparing mean PSQ, GAD-7, and PHQ-9 scores between Chinese and non-Chinese Asian students. Forty-seven of the 101 Asian students were Chinese, the other ones were from a large variety of Asian countries (such as Japan, Korea, Singapore, Thailand and Vietnam). The Chinese students had lower scores on the GAD-7 (6.25 ± 4.89) and the PHQ-9 (7.95 ± 6.05) compared to the other Asian students (7.98 ± 6.23 and 9.86 ± 7.37), although this was not a significant difference.

Predictors of Resilience to COVID-19 Related Psychological Distress

A bespoke question was developed to measure the extent of impact of COVID-19 on stress levels. Participants were asked to rate the extent of the impact on a 5 point scale (−2 considerable negative impact to +2 considerable positive impact, with 0 indicating no impact). We created two subgroups: people reporting elevated stress levels due to COVID-19 were coded in the non-resilient, or vulnerable, group. People reporting no impact or positive impact of COVID-19 on their stress levels were coded in the resilient group. This division was based on the logic that resilience would mean the ability to be not impacted by the COVID19 outbreak, or even positively impacted, as resilience is considered the ability to deal with stress and overcome it (16, 18, 21). As stated by Miller-Lewis et al. (39), a gold standard benchmark has not yet been established to operationalise resilience. Although there are a number of ways to operationalise resilience, a binary approach was chosen for this study as this work will involve multiple follow-up data waves collecting a wide range of continuous data, and data-driven methods are more suitable for this process than definition-driven methods (40).

In staff, 565 (66.2%) were non-resilient and 288 (33.8%) were resilient. In students, 485 (71.7%) were resilient vs. N = 191 (28.3%) non-resilient. A logistic regression analysis was conducted to explore predictors of vulnerability/resilience. For staff, a model of four variables predicted vulnerability [$c^2(6) = 5.56$; $p < 0.001$]. Respondents with high vulnerability are younger, have children, report social isolation, and report a low current exercise level. For students, a similar model of four variables predicted vulnerability [$c^2(3) = 32.14$; $p < 0.001$]. Being female, having children, social isolation, and a low current exercise level was associated with higher vulnerability. The results are shown in **Table 6**.

For staff, a model of four variables predicted vulnerability [$\chi^2(6) = 5.56$; $p < 0.001$]. Respondents with high stress are younger [OR = 0.98; CI (95) = 0.97–0.99], have children [OR = 2.23; CI (95) = 1.63–3.04], report social isolation [OR = 1.97; CI (95) = 1.39–2.79], and report a low current exercise level [OR = 0.83; CI (95) = 0.73–0.94].

For students, a model of four variables predicted vulnerability [$\chi^2(3) = 32.14$; $p < 0.001$]. Respondents with higher stress are females [OR = 1.62; CI (95) = 1.14–2.28], have children [OR = 2.04; CI (95) = 1.11–3.72], report social isolation [OR = 1.78; CI (95) = 1.25–2.52], and a low current exercise level [OR = 0.85; CI (95) = 0.75–0.97].

Presenteeism and Absenteeism

Association of Presenteeism and Absenteeism With Psychological Distress

We examined the association between absenteeism and presenteeism and the dependent variables PHQ-9, GAD-7, and PSQ, and their composite. The correlation between psychological distress and presenteeism (0.435) was much higher than the correlation between psychological distress and absenteeism (0.133).

Predictors of Presenteeism and Absenteeism

We performed a logistic regression analysis to explore the predictors of presenteeism and absenteeism.

For staff, a model of six variables predicted presenteeism [$\chi^2(6) = 68.40$; $p < 0.001$]. Predictors of presenteeism are younger age [OR = 0.97; CI (95) = 0.96–0.98], living with a somatic chronic medical condition [OR = 1.34; CI (95) = 1.03–1.74] or a functional somatic syndrome [OR = 2.14; CI (95) = 1.21–3.80], social isolation [OR = 1.53; CI (95) = 1.05–2.23], no access to outdoor space at home [OR = 1.26; CI (95) = 1.04–1.55], and low current exercise level [OR = 0.78; CI (95) = 0.69–0.89].

For students, a model of three variables explained presenteeism [$\chi^2(3) = 36.38$; $p < 0.001$]. Predictors of presenteeism are education level [OR = 2.02; CI (95) = 1.52–2.69], being of Asian ethnicity [OR = 5.03; CI (95) = 1.55–16.29] and childhood environment without access to green spaces [OR = 0.73; CI (95) = 0.57–0.95].

Among staff, a model comprising four variables explained absenteeism [$\chi^2(4) = 29.80$, $p < 0.000$]: lower age [OR = 0.97; CI (95) = 0.95–0.99], living with a somatic chronic medical condition [OR = 1.53; CI (95) = 1.01–2.28], with a functional somatic syndrome [OR = 2.02; CI (95) = 1.10–3.71] and living in social isolation [OR = 2.62; CI (95) = 1.48–4.63].

Among students a model of three variables predicted absenteeism [$\chi^2(3)$ 17.27, p = 0.001]: the presence of functional somatic syndromes [OR = 4.19; CI (95) = 1.50–11.69], living in social Isolation [OR = 2.99; CI (95) = 1.09–8.22], and exercise level [OR = 0.62; CI (95) = 0.34–0.97].

TABLE 6 | Results of logistic regression analyses of predictors for vulnerability, presenteeism, and absenteeism among staff and students.

	Vulnerability		Presenteeism		Absenteeism	
Predictor	**OR**	**CI (95)**	**OR**	**CI (95)**	**OR**	**CI (95)**
STAFF						
Age	0.98	0.97–0.99	0.97	0.96–0.98	0.97	0.96–0.98
Gender (male)						
Education						
Childhood environment						
White						
Black						
Asian						
Other						
Immigration status						
Having Children	2.23	1.63–3.04				
Current environment (urban)						
Exercise level	0.83	0.73–0.94	0.78	0.69–0.89		
Outdoor space			1.26	1.04–1.55		
IPCQ4 (absenteeism)						
IPCQ7 (presenteeism)						
CMC—somatic			1.34	1.03–1.74	1.53	1.01–2.28
CMC—functional			2.14	1.21–3.80	2.02	1.10–3.71
Social Isolation	1.97	1.39–2.79	1.53	1.05–2.23	2.62	1.48–4.63
STUDENTS						
Age						
Gender (male)	1.62	1.14–2.28				
Education			2.02	1.52–2.69		
Childhood environment			0.73	0.57–0.95		
White						
Black						
Asian			5.03	1.55–16.29		
Other						
Immigration status						
Having Children	2.04	1.11–3.72				
Current environment (urban)						
Exercise level	0.85	0.75–0.97			0.62	0.39–0.97
Outdoor space						
IPCQ4 (absenteeism)						
IPCQ7 (presenteeism)						
CMC—somatic						
CMC—functional					4.19	1.50–11.69
Social Isolation	1.78	1.25–2.52			2.99	1.09–8.23

Predictors of Presenteeism and Absenteeism in Resilient or Non-resilient Staff and Students

We created two subgroups: People reporting a negative impact of COVID-19 on their stress levels were coded in the non-resilient group. People reporting no impact or positive impact of COVID-19 on their stress levels were coded in the resilient group.

Presenteeism was significantly lower in resilient staff ($p < 0.001$), but there was no significant difference for absenteeism. None of the factors for students were statistically significant.

Gender

A separate analysis explored psychological distress according to three gender categories. Males (N = 437) reported the lowest distress score (M = −0.08 ± 0.93) of all gender categories. Females (N = 1,251) had higher scores (M = 0.03 ± 0.90) but the non-binary gender group (N = 36) had the highest distress score (M = 0.31 ± 0.94). However, the non-binary gender group did not differ to a statistically significant degree from the others.

We explored if gender was associated with resilience, including non-binary gender. Although the percentages for non-binary gender seem to hint to less resilience than males and females, there were no significant differences between gender categories in staff (p = 0.272) or students (p = 0.635).

We also explored if presenteeism and absenteeism were associated with gender and found no significant differences for staff or students.

Age

We explored if participant age was associated with psychological stress. In the analysis, participants were separated into two groups; aged under 30 years and aged 30 years and above. This is in conjunction with Levinson's (41) theory of adult development stating that the first age of early adulthood is between 28 and 30. It was found that younger adults (aged under 30) were more likely to be suffering from psychological distress (41).

There was a significant difference in the PHQ-9 between younger (M = 7.69, SD = 5.271) and older (M = 6.33, SD = 5.360) staff members; $t_{(936)}$ 2.415, p = 0.016. A significant difference was also found in younger (M = 7.18, SD = 5.008) and older (M = 6.03, SD = 4.907) staff members in the GAD-7; $t_{(949)}$ 2.252, p = 0.025. However, no significant difference was found for the PSQ in younger (M = 0.4196, SD = 0.17959) and older (M = 0.4356, SD = 0.19800); $t_{(949)}$ −0.791, p = 0.429.

Similar to the staff members, there was a significant difference in the PHQ-9 between younger (M = 10.55, SD = 6.42) and older (M = 7.92, SD = 6.636) students; $t_{(747)}$ 4.782, p = 0.00. A significant difference was also found in younger (M = 8.77, SD = 5.789) and older (M = 6.84, SD = 5.288) students in the GAD-7; $t_{(772)}$ 4.235, p = 0.00. For the PSQ, a significant difference was also found between younger (M = 0.5165, SD = 0.18928) and older students (M = 0.4753, SD = 0.21482); $t_{(772)}$ 2.347, p = 0.020.

DISCUSSION

This study found that University staff and students were severely affected by the COVID-19 outbreak, the change in work and study arrangements and the lockdown. A high proportion of the staff (98%) and students (78%) surveyed worked or studied remotely because of the COVID-19 outbreak. 1% of staff and 7% of students lost their job or dropped out of their study. 7% of staff and 10% of students reported sickness absence, and 26% of staff and 40% of the students experienced presenteeism in the last 4 weeks.

Psychological Distress

The mean anxiety levels in staff respondents are twice the mean score than in an N = 5,030 general population study in Germany reported by Lowe et al. (42) and students score almost three times higher. General population levels in a USA study (43) are higher than the German levels. Nevertheless, they are still substantially lower than the anxiety levels found in our samples. For both staff and students, these means differ significantly from the German and US norms. For example, for staff the difference with the German mean (Mdiff = 3.14; $t_{(5,\ 993)} = 24.32$; $p < 0.0001$) and for students (Mdiff = 5.34; $t_{(5,\ 816)} = 36.81$; $p < 0.0001$).

For depression, the mean PHQ-9 scores in our sample are similarly higher compared to a German (N = 5,018) general population study (44), with staff scoring twice as high and students more than three times higher. For example, for staff the difference with the German mean (Mdiff = 3.51; $t_{(5,\ 981)} = 25.86$; $p < 0.0001$) and for students (Mdiff = 6.97; $t_{(5,\ 804)} = 44.86$; $p < 0.0001$). University staff scored higher compared to scores of 1,242 Chinese residents of the Wuhan province collected in the second half of February 2020; among our staff, 56.7% had symptoms of anxiety (GAD-7, ≥5) compared to 27.5% in the Chinese sample. 55.8% had symptoms of depression vs. 29.3% of the Chinese (PHQ-9, ≥5) (45).

British students scored only slightly lower than 340 Brazilian medical students during the COVID-19 epidemic. Their average GAD-7 mean score was 9.18 (± 4.75), and their average PHQ-9 mean score was 12.72 (± 6.62) (46).

Our percentages for clinical caseness for staff coincide well with recent findings during COVID-19 in Austria, where 21.0% scored above the cut off ≥10 points (PHQ-9) and 19.0% scored above the cut-off ≥10 points (GAD-7) for moderate anxiety symptoms (47). The percentage of students in our sample scoring in the clinical range is much higher (37.2% with anxiety and 46.5% with depression). These are concerning percentages as, due to financial constraints, treatment provision, especially for students, is limited.

Regarding the stress scores on the PSQ, based on a Swedish population sample Bergdahl and Bergdahl (48) recommend a score of 0.34 or higher as indicating moderate perceived stress and 0.46 or higher as a high level of perceived stress. 46.5% of the staff and 61.5% of the students score 0.46 or higher. To summarize, the respondents in our sample were substantially affected by the COVID-19 crisis and the measures taken to contain the spread of the virus.

Presenteeism and Absenteeism

Stress levels, anxiety and depression, are correlated and are associated with presenteeism and absenteeism. The correlation between psychological distress and presenteeism (0.435) was much higher than the correlation between psychological distress and absenteeism (0.133) though, suggesting that the drivers for absenteeism may be less related to psychological distress than the drivers for presenteeism.

Presenteeism is high in both groups, and the percentages of absenteeism are much higher than usual in the educational sector. Students are more afflicted than staff, and this may well hang together with their younger age (49), and their being in a transitional phase as adolescents moving from the safe environment of the parental home to a non-permanent residence at University campus to build new networks and obtain grades in order to secure a job in the future. Many students self-fund their study so the insecurity around the suspension of study activities and the economic insecurity may have more influence on them than on staff.

If we look at predictors of presenteeism and absenteeism in staff, we find that young age is a factor. However, the effect size for young age was minimal, with an OR of 0.97, and hence of limited relevance. Factors with higher effect sizes predicting presenteeism in staff were living with a physical chronic medical condition or a functional somatic syndrome, social isolation, having no access to outdoor space at home, and low exercise level. Most of these also are predictors of psychological distress. It might be that the combination of having a chronic medical condition, no access to outdoor space at home and limited exercise options during the lockdown, may have contributed to more physical symptoms and presenteeism. For students, predictors of presenteeism are education level, Asian ethnicity and lack of access to green space in the childhood environment. York, UK (where the University of York is situated) has a wealth of green and blue space, including multiple nature reserves, parks, rivers and lakes. In addition, the area is in close proximity to the Yorkshire Dales, Yorkshire Moors and multiple seaside areas. It can be assumed that a high number of staff and some students taking part in the study live in York and have access to these green and blue spaces. This finding aligns with a study confirming the relevance of long-term exposure to greenery to resilience, although having access to work had more effect on resilience (50).

We found it remarkable that Asian students were much more vulnerable to presenteeism, with an OR of 5, but less prone to report psychological distress. In our study, 46.5% of the Asian students were Chinese, and the remainder came from a variety of countries in Asia. This finding might imply that Chinese students in case of stress may report lower on psychological distress, but experience their stress more in terms of presenteeism. The literature suggests that there may be cultural differences in how Chinese people communicate distress, compared to, for example, people from western culture. Chinese people have been suggested to report physical symptoms rather than psychological symptoms such as depression (51, 52) and anxiety (53), and this tendency might originate from the way people showing psychological distress were treated during the Cultural Revolution (54, 55). Also, more in general, stigma related to mental disorders might play a role in the tendency to under-report psychological distress (56). In such circumstances, presenteeism might be a choice of the individual to deal with psychological distress by working (9), although that was found more difficult to do than normally. Such a mechanism has been proposed in a study in Chinese workers in Japan (57), and it might play a role here as well. In that particular study, an intervention to promote a health-related lifestyle showed good results in terms of presenteeism, work-related stress, and mental health.

Resilience

It is noteworthy that resilience occurred much more often in students than in staff, whereas psychological distress was much higher in students. This suggests that predictors of resilience may differ from psychological distress *per se*. In other words, a person may feel psychological distress and nevertheless be resilient. Hence, interventions to improve resilience should not only address psychological distress but may also address different factors that contribute to resilience, or aim at improving skills to deal with stressors.

The bimodal distribution of the experienced stress levels due to COVID-19 that occurred in both staff and students allowed us to explore vulnerability and resilience factors in both. We found that younger age, lack of exercise, social isolation and having to take care of children while remote working from home predict higher distress levels in staff, and so does social isolation. Also, having functional somatic syndromes is associated. Young age can contribute to vulnerability to psychological distress, and in this particular setting, staff with young age may have less job security as they are more often academics on a temporary contract than older staff. The positive effect of exercise on anxiety and depression levels has been reported widely (58, 59) and was confirmed in this study. The finding that functional somatic symptoms are predictors of psychological distress supports their often being conceived as stress-related symptoms (60, 61). In this sample, they might either be a somatic expression of the high experienced stress levels, or an indicator of a pre-existing stress-related condition as a trait marker for longstanding high stress levels that increase vulnerability. The total variance explained by these predictors taken together amounts to a moderate effect size (62), which is substantial.

Gender

For students, predictors of vulnerability were identifying as female, having children, reporting social isolation, and a low current exercise level and the variance explained also amounts to a medium effect size. Having to look after one's children that were not allowed to go to the nursery or school because of lockdown, obviously would be a significant impediment for trying to study from home and one wonders if the childcare-related tasks might have befallen mostly on female students, possibly having to support the father of the household to work for the family income remotely. This is supported by a recent study conducted by Carroll et al. (63) who explored the impact of COVID-19 on health behaviors and stress, and found that mothers reported higher stress levels (mean 6.8) than fathers (mean 6.0) and mothers reported a greater decrease in current exercise level (59%) than fathers (52%). That might be a gender-related vulnerability factor.

Regarding gender, we found no significant differences between males, females and non-binary gender regarding psychological distress or resilience. The non-binary gender group had the highest distress score and seemed less resilient, but this was not statistically significant. However, that might have to do with their low number.

Limitations of the Study

This is a study based upon a survey amongst staff and students of the University of York. All staff and students received an invitation to participate in the survey, several announcements, and a reminder. 22.5% of the staff responded, and probably this study can be considered representative in terms of the staff. However, only ∼5.1% of the students responded, so there will be an unknown amount of selection bias and representiveness, especially regarding the students. All students were sent home in March 2020 and possibly had limited access to email, especially if they came from lower socioeconomic areas. In addition, students may not have had access to technology or adequate internet access to be able to complete the survey. One could also argue that people who also had caring commitments or were too stressed and overburdened would not fill in the survey; on the other hand, it might as well be that persons who felt well did not feel the need to fill in the survey. With a low response rate, respondents with a more extreme attitude may be overrepresented as having strong feelings about the subject matter will stimulate responding. The generalisability is therefore limited to an unknown degree, and this is the main limitation of this kind of surveys (64).

Regarding the representativeness of the student sample, we compared our sample to recent UK University staff and student demographic statistics. In 2017/18, there were 429,560 UK University employees, with 49% filling academic and research roles (36). One in five University staff members are international, with ∼60% coming from an EU country (38). This is representative of our sample, with 45% of respondents in academic and research roles. Nationally, 76% of UK University staff were aged between 26 and 55 years; 80.7% of UK University staff were white, 2.4% were black, 7.3% were Asian, 1.8% were Mixed, and 1.4% "other." 6.4% did not state their ethnicity (36). These figures are similar to our sample.

In 2017/18, there were 2,801,580 students attending UK Universities, with almost 84% being UK nationals, 5% EU nationals, and 11% from non-EU countries (38). Student ethnicity and age data was not available for non-UK nationals. For UK national students, 41% were aged 20 years or younger, 28% were aged between 21 and 24 years, 11% were aged between 25 and 29 years and 20% were aged 30 years or older. 76% of UK national students were white, 7% were black, 11% were Asian, 4% were mixed and 2% "other" (37). This is in line with our sample. Although the national data is from the 2017/18 academic year, the data suggests that our sample is representative of UK University students and staff members.

In addition, the question focused on exercise levels did not allow us to retrieve data on exercise type or duration and questions focused on green space did not ask participants on how much time they spent outside of their home. There is evidence that COVID-19 transmission mostly occurs indoors (65). It is a limitation of the study that we did not investigate whether those who spent more time exercising or accessing green space were less likely to be social isolating or have contracted COVID-19.

Strengths of the Study

This is a timely survey, taken at the beginning of the upheaval of the outbreak and the lockdown, shortly after staff and students were sent home. It provides a unique insight in psychological distress, presenteeism and absenteeism, and their predictors, in a large, representative sample with both UK and international University staff and students. The substantial samples allowed us to explore interesting associations among the variables in the tertiary education sector that was heavily impacted by the COVID-19 outbreak. This study provides insights in the response of this group to a shared major social event and provides insights that so far were not explored. That can be considered a strength of the study.

Implications for Public Health Interventions

The outcomes of this study suggest that there is scope to support staff and students with psychological distress to deal with that. However, the outcomes show as well that we could go a step further by supporting health promotion lifestyle interventions such as promoting exercise. Furthermore, there is scope to support vulnerable groups such as young female staff and students who have to combine care for young children with remote work and study to provide lenience with study and work deadlines, and to provide support for students and staff living with a disability. Reaching out to small, vulnerable groups such as non-binary gender groups, or BAME staff or students who are known to be more vulnerable to the virus, and enquire if they would need any help, might be warranted. Furthermore, Chinese students might be in need of support directed at them in a culturally adapted way.

Implications for Further Research

This study shows that there is scope to explore vulnerability and resilience to a major social event inflicting on the work and study situation by a longitudinal design. As several of the strategies suggested above may have been (partly) implemented over time, the impact of that support might be explored in a longitudinal study. Also, more in-depth exploration of factors contributing to vulnerability and resilience would be needed.

CONCLUSION

It is noteworthy that resilience occurred much more often in students than in staff, whereas psychological distress was much higher in students. This suggests that predictors of resilience may differ from psychological distress *per se*. In other words, a person may feel psychological distress and nevertheless be resilient. Hence, interventions to improve resilience should not only address psychological distress but may also address different factors that contribute to resilience, or aim at improving skills to deal with stressors.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because the participants did not consent to share their raw data. However, interested parties will be able to obtain data upon request as follows. Researchers can submit a research plan, which describes the background and methods of a proposed research question, and a request for specific data of the database used for this study to answer the research question. After approval of the research plan by the principal investigator and the University of York research governance board, a deidentified minimal dataset can be obtained. Information can be requested by contacting the principal investigator. Requests to access the datasets should be directed to CF-C christina.vanderfeltz-cornelis@york.ac.uk.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by University of York Department of Health Sciences Research Governance Board. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

CV obtained funding and ethical approval for the study and wrote the study protocol. DV developed the survey, programmed it in Qualtrics, and extracted the data. CV, DV, VA, and EB designed the study, analysis plan, and analyzed the data. CV wrote the first draft. All authors contributed to the article and approved the final version.

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COVID-19 Outbreak Can Change the Job Burnout in Health Care Professionals

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Background: The outbreak of COVID-19 in China was a sudden bio-disaster, which may bring a negative impact on the job burnout of health care professionals (HCPs).

Objective: We aim to find out the association factors, especially those closely related to this outbreak, of job burnout in Chinese HCPs.

Method: The cross-sectional survey about HCPs' job burnout based on a network platform was conducted in high and low infection regions during the COVID-19 outbreak in China. The demographic characteristics, medical-work-related factors, risk of getting infected due to occupational exposure, and family factors were collected by the self-reported questionnaire. The Chinese version of the Maslach Burnout Inventory (CMBI) and the Trait Coping Style Questionnaire (TCSQ) were employed in this study to evaluate the job burnout and coping style, respectively. Furthermore, statistical analysis was done to find out the associated factors of job burnout.

Results: We collected 880 complete questionnaires from doctors and nurses from February 9, 2020 to February 11, 2020. In this study, the positive rates of three dimensions of burnout (emotional exhaustion, depersonalization, and reduced personal accomplishment) and overall burnout were 9.09, 50.57, 56.59, and 73.98%, respectively. After the statistical analysis, we found that several factors can independently affect the dimensions. Working in the high infection region and negative coping styles can affect all three dimensions at once. More night shift quantity and having symptoms could increase emotional exhaustion and depersonalization, while higher work intensity and senior title could increase emotional exhaustion and reduce personal accomplishment, respectively.

Conclusion: The rate of moderate and severe burnout had increased due to the outbreak. More attention should be paid to burnout in HCPs, especially those with negative coping. There were some potential ways to reduce burnout, such as reducing their workload and providing better protection from the virus.

Keywords: SARS-CoV-2 (2019-nCoV), coping style, health care professional, COVID-19, job burnout

WHAT IS NEW?

Key Findings

This study showed the effect of several factors related to work, family, and individual characteristics on job burnout symptoms in Chinese health care professionals.

What this adds to what is known: This study focused on the status of job burnout in the pandemic of COVID-19 in Chinese health care professionals. We conduct this study to add evidence to what impact the public health emergency can bring to job burnout symptoms of health care professionals, which has been rarely studied before.

What is the implication and what should change now: More attentions need to be paid to the phenomenon of job burnout in Chinese health care professionals. Reducing workload, providing more job resources, and carrying out psychological interventions for those with negative coping style may be the potential ways to alleviate job burnout.

INTRODUCTION

At the beginning of 2020, COVID-19 spread across China. The outbreak of COVID-19 was adding to the pressure on Chinese health care professionals (HCPs), already overburdened by a large population and growing health awareness in recent years. A large number of doctors and nurses were on the front line in the fight against this highly contagious virus, facing increased workload, high risk of infection, and the pressure of isolating from family members. Those stressors caused by this public health disaster may arise negative emotions and even job burnout in HCPs.

Burnout was defined as a syndrome of emotional exhaustion (EE), depersonalization (DP), and reduced professional accomplishment (PA) that occurs among various people-oriented professions, including doctors and nurses (1). Emotional exhaustion was a key aspect of the syndrome and refers to the feeling that a person's emotional resources were overextended and depleted. Depersonalization refers to negative, cynical, cold, and impersonal attitudes and feelings toward others. Finally, decreased personal accomplishment refers to a person's decreased sense of competence and a tendency to negatively evaluate oneself, especially in terms of cooperation with others (2).

According to previous studies, job burnout symptoms were common in health system practitioners (3–6). Job-related pressure and personal characteristics contributed to the development of job burnout symptoms together. Besides, moral distress and stress related to physical and mental environments are also thought to contribute to burnout (7). The most direct impacts of job burnout on HCPs were the high rate of turnover and the low efficiency in daily work (5). It meant that patients would receive medical service in poor quality, and the national health system needs to pay extra expenses for the replacement of new physicians, which was not a small cost (8, 9). There was evidence that job burnout was associated with multiple mental disorders, including anxiety, depression, and a decrease in self-esteem (5, 10). The relationship between job burnout and physical symptoms, such as insomnia and headache, has also been reported (6). By contrast, finding and implementing ways to reduce burnout must help both HCPs and patients.

Coping styles were considered as stable strategies that can overcome or tolerate external and internal pressures or stresses (11). Based on Lazarus and Folkman's model, coping was defined as "constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of a person (12)." Some people react to stress actively, while others react passively. Positive coping styles were behavioral or psychological responses (such as using emotional supports and positive reframing) designed to change the nature of the perspective of the stressor (13). Negative coping strategies could cause people to engage in activities (such as drinking) that prevented them from dealing directly with stressful events (14). What is more, personality characteristic of a negative coping style was identified as risks and a positive coping style as protective against some mental disorders, including anxiety, depressive, adjustment, and somatoform disorders (15). Individuals' coping behaviors help explain why they are exposed to the same environment that may cause job burnout in some subjects, but not in others (16). Previous studies had shown that the coping style played the mediator and mediating role in the development of burnout and could be a positive resource against burnout (17, 18).

HCPs must take care of themselves before they could provide care for their COVID-19 patients. Given the current high intensity of work, work exposure risks, different coping strategies, and isolation from family members, we needed to understand the situation of burnout and elucidate the association between job burnout and those factors among Chinese HCPs. Meanwhile, many experts were also calling attention to the problem of burnout among HCPs (19, 20). The good news was that experts have come up with some effective micropractices to prevent burnout since the outbreak (21). However, in this pandemic of COVID-19, the situation of job burnout has not been fully investigated in China. For calling more attention to the job status of HCPs who were fighting the virus, we designed this cross-sectional study to observe the prevalence of job burnout and analyze its risk factors.

METHOD

Design

A cross-sectional survey based on the Internet was conducted from February 9 to February 11, 2020, and was approved by the Ethics Committee of Union Hospital, Tongji Medical College. By self-reported questionnaires, we identified our target respondents (doctors and nurses) and collected the information we need while protecting their privacy.

The e-questionnaire was distributed on the online platform, and before the questionnaire starts, the respondents could see our self-introduction, our research purpose, and the introduction of the questionnaire content. Only after the respondents choose to agree to the survey the content of the questionnaire would be launched; otherwise, the survey would be terminated directly. Respondents could terminate the questionnaire at any time and choose whether to submit it or not after completing the questionnaire. So, respondents' right to know would also be protected, and the questionnaires we received were approved by them. There were no privacy issues, and the questionnaire was anonymous. The questionnaire was written in Chinese, and each question was interpreted to avoid ambiguity. By setting up the network platform, we only allowed one respondent to fill in one questionnaire, and only the completed questionnaire would be collected.

Questionnaire

The information collected by the questionnaire could be divided into the following six aspects: (a) demographic characteristics; (b) working factors during the outbreak; (c) risk assessment of SARS-CoV-2 infection; (d) family factors; (e) coping style assessment by TCQS; and (f) job burnout assessment by CMBI.

The demographic characteristics included age, sex, occupation (doctor, nurse, or others), and the title of occupation (primary title, senior title, none). Primary title included medic, resident doctor, attending doctor, primary nurse, and primary nurse practitioner; senior title included associate chief physician/associate professor, chief physician/professor, nurse-in-charge, deputy chief nurse, and senior nurse.

Working factors included working hours per week during the COVID-19 outbreak, the number of night shifts per week during the same period, and self-reported work intensity (higher than that before the outbreak or unchanged). Therefore, the change in work intensity measured in this article referred to the change due to the recent COVID-19 pandemic.

Risk assessment of SARS-CoV-2 infection included the common COVID-19 symptoms (fever and respiratory symptoms), whether COVID-19-related tests (CT scan and Viral nucleic acid test) had been conducted, the results, whether working in Hubei province, China, and whether working in the front line (directly contacting with confirmed COVID-19 patients at work). HCPs who reported nucleic acid positive or CT positive would not be included in the study because they would be quarantined and removed from work, as our research focused on people who were fighting the virus in hospitals. During the survey period, more than 31,000 people were diagnosed in Hubei province, compared with a national total of about 42,000 (22). Therefore, we defined Hubei province as the high infection region, and other areas in China were defined as the low infection region.

Family factors referred to whether HCPs were isolated from family members because of their work exposure.

Assessment of Coping Style

The 20-item Chinese Trait Coping Style Questionnaire (TCSQ) was chosen in this study to assess the coping style (positive coping or negative coping) of respondents. In terms of the two coping styles, the questionnaire set 10 multiple-choice questions for evaluation, and these 10 questions were presented to the interviewees in an interwoven order. Each question was rated on a scale at five levels (one score for definitely no, and five scores for definitely yes) (17, 23, 24). The score of coping tendency was equal to the score of positive coping dimension minus the score of negative coping dimension. A positive score meant positive coping style, while a negative score or zero means negative coping style (10, 17). The TCSQ was proved to be valid and reliable in the Chinese population (25). In this study, the Cronbach's α value for both coping styles was 0.858. As a rule of thumb, this α value meant that the questionnaire had a good internal consistency (26).

Assessment of Job Burnout

The 15-item Chinese Maslach Burnout Inventory (CMBI) revised by Li et al. (27) was used in this study. The CMBI scale consisted of three dimensions of burnout: emotional exhaustion (EE) (five items), depersonalization (DP) (five items), and reduced personal accomplishment (RPA) (five items). The projects were rated on a seven-point scale, ranging from 1 (never) to 7 (every day). The five items about reducing individual achievement were reversely coded (17). The cutoff scores for the three dimensions (EE, DP, and RPA) were 25, 11, and 16, respectively, according to the evaluation criterion (17, 28). The CMBI scale's good reliability and validity, especially in the Chinese population, were proved by many studies (28–30). In this study, the Cronbach's α value for the whole scale was 0.832. Meanwhile, the α values were 0.936, 0.912, and 0.931 for EE, DP, and RPA, respectively. This α value also indicated that the internal consistency of the scale was good (26).

In this study, according to the positive (higher than the cutoff score of the dimension) number of respondents in three dimensions, we divided job burnout into four levels: no burnout (all the three dimensions are negative); mild burnout (only one of the three dimensions is positive); moderate burnout (arbitrary two of the three dimensions are positive); and severe burnout (all the three dimensions are positive) (31, 32).

Statistical Analyses

It was just the questionnaire that the doctor or the nurse fills out that would be included in our study. Data of questionnaires were cleaned, coded, and double-entered using EpiData software 3.1. Another software, STATA 14.0 (http://www.stata.com), was used for data analysis. Two-sided $P < 0.05$ was considered statistically significant.

Continuous variables were analyzed employing Student's t-test or Wilks' lambda test when required. Categorical variables were compared via the chi-square test or Fisher's exact test as appropriate. Stepwise binary logistic regressions were used to determine the effect of the independent factors on the job burnout in the three dimensions separately.

RESULT

All the 880 questionnaires completed by HCPs were collected through the online platform, of which 564 were doctors and 316 were nurses (**Table 1**). Although some of the HCPs interviewed were tested (CT or nucleic acid), none came back positive, which indicated that there was no confirmed diagnosis among them. Overall, 80 (9.09%) respondents had emotional exhaustion (EE), 445 (50.57%) had depersonalization (DP), and 498 (56.59%) had reduced personal accomplishment (RPA) (**Figure 1**). The

TABLE 1 | Distributions of dimensions of burnout in categorical items.

Aspects	Items	*N*	EE yes/no (%)	DP yes/no (%)	RPA yes/no (%)
Demographic characteristics	**Age group**		$P = 0.343$	$P = 0.015^*$	$P = 0.069$
	20–29	198	16/182 (8.08%)	98/100 (49.49%)	128/70 (64.65%)
	30–39	406	43/363 (10.59%)	225/181 (55.42%)	224/182 (55.17%)
	40–49	191	17/174 (8.90%)	90/101 (47.12%)	101/90 (52.88%)
	≥50	85	4/81 (4.94%)	32/53 (37.65%)	45/40 (52.94%)
	Occupation		$P = 0.673$	$P = 0.594$	$P = 0.333$
	Doctor	564	53/551 (9.40%)	289/275 (51.24%)	326/238 (57.80%)
	Nurse	316	27/289 (8.54%)	156/160 (49.37%)	172/144 (54.43%)
	Gender		$P = 0.271$	$P = 0.655$	$P = 0.649$
	Male	279	21/258 (7.52%)	138/141 (49.46%)	161/118 (57.71%)
	Female	601	59/542 (9.82%)	307/294 (51.08%)	337/264 (56.07%)
	Title		$P = 0.354$	$P = 0.006^{**}$	$P = 0.013^*$
	Primary	328	26/302 (7.93%)	146/182 (44.51%)	168/160 (51.22%)
	Senior	552	54/498 (9.78%)	299/253 (54.17%)	330/222 (59.78%)
Working factors	**Working hours**[#]		$P = 0.008^{**}$	$P = 0.621$	$P = 0.378$
	Yes (mean ± SD)		52.86 ± 3.07	46.71 ± 1.02	45.72 ± 0.98
	No (mean ± SD)		45.68 ± 0.80	45.94 ± 1.19	47.12 ± 1.26
	Work intensity		$P < 0.001^{***}$	$P = 0.967$	$P = 0.658$
	Higher	406	62/334 (15.27%)	205/201 (50.49%)	233/173 (57.39%)
	Basically unchanged	474	18/456 (3.80%)	240/234 (50.63%)	265/209 (55.91%)
	Night shift quantity		$P < 0.001^{***}$	$P = 0.005^{**}$	$P = 0.891$
	0–1	475	22/453 (4.63%)	217/258 (45.68%)	266/209 (56.00%)
	2–3	358	51/307 (14.25%)	204/154 (56.98%)	206/152 (57.54%)
	≥4	47	7/40 (14.89%)	24/23 (5.11%)	26/21 (5.53%)
The potential risk of infection	**Symptom**		$P < 0.001^{***}$	$P = 0.008^{**}$	$P = 0.738$
	Asymptomatic	698	44/654 (6.30%)	337/361 (48.28%)	397/301 (56.88%)
	Symptomatic	182	36/146 (19.78%)	108/74 (59.34%)	101/81 (55.49%)
	Working place		$P < 0.001^{***}$	$P = 0.294$	$P = 0.011^*$
	High infection region	395	58/337 (14.68%)	192/203 (48.61%)	205/190 (51.90%)
	Low infection region	485	22/463 (4.54%)	253/232 (52.16%)	293/192 (60.41%)
	Contact with patients		$P < 0.001^{***}$	$P = 0.338$	$P = 0.135$
	Direct	258	45/213 (17.44%)	124/134 (48.06%)	136/122 (52.71%)
	Indirect	622	35/587 (5.63%)	321/301 (51.61%)	362/260 (58.20%)
Family factor	**Family life**		$P < 0.001^{***}$	$P = 0.919$	$P = 0.822$
	Isolation from family	199	36/163 (18.09%)	100/99 (50.25%)	114/85 (57.29%)
	Live with family	681	44/637 (6.46%)	345/336 (50.66%)	384/297 (56.39%)
TCQS	**Coping style**		$P < 0.001^{***}$	$P < 0.001^{***}$	$P < 0.001^{***}$
	Negative coping	276	39/237 (14.13%)	195/81 (70.65%)	182/94 (65.94%)
	Positive coping	604	41/563 (6.79%)	250/354 (41.39%)	316/288 (52.32%)

$^*p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

[#]Working hours is a continuous variable, so "yes" means that the corresponding dimensions are positive, and "no" means that the corresponding dimensions are negative.

proportions of job burnout were showed mild with 34.77%, moderate with 36.14%, and severe with 3.07%.

Factors Affect the Three Dimensions of Burnout

Demographic characteristics, working factors, potential risk of infection, family factor, the result of the TCQS, and distributions of each dimension of burnout in categorical items were shown in **Table 1**.

EE differed across working hours per week ($P = 0.008$), work intensity groups ($P < 0.001$), night shift quantity groups ($P < 0.001$), all the potential risk of infection items ($P < 0.001$), family factor ($P < 0.001$), and coping styles ($P < 0.001$). DP differed across age groups ($P = 0.015$), title groups ($P = 0.006$), night shift quantity groups ($P = 0.005$), symptom groups ($P = 0.008$), and

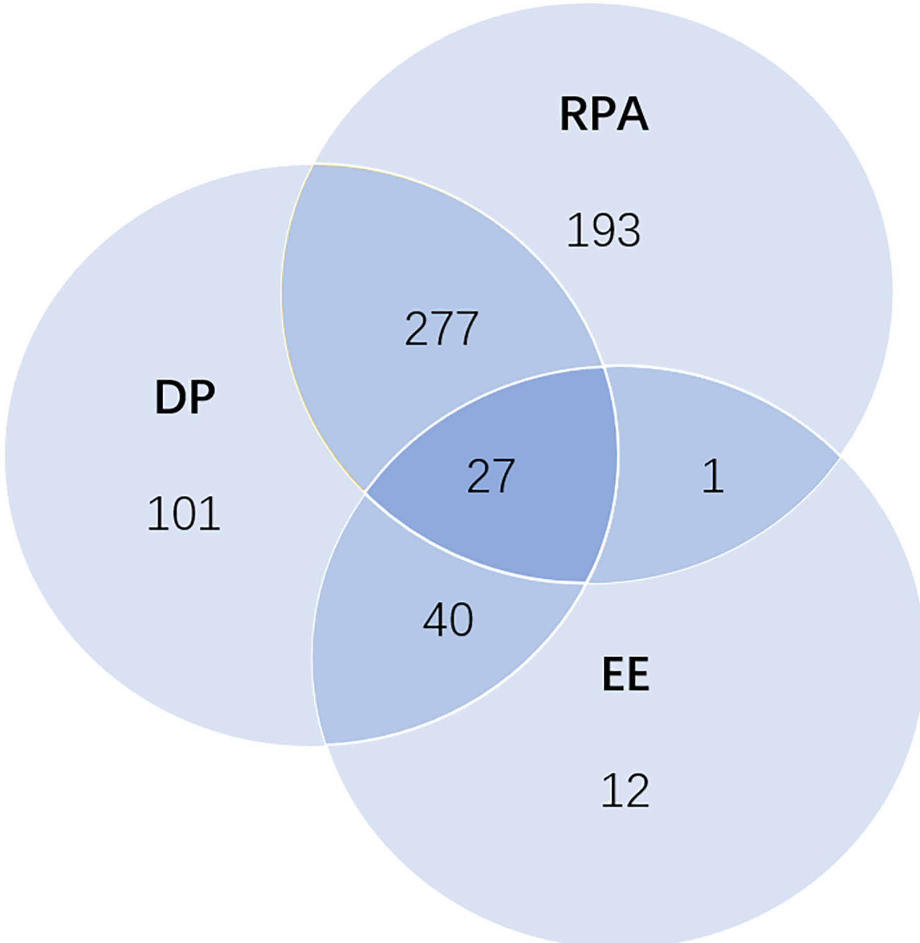

FIGURE 1 | Venn diagram of the distribution of three dimensions: emotional exhaustion (EE), depersonalization (DP), and reduced personal accomplishment (RPA). The numbers for each region represent the number of health care professionals in different situations; 27 of them had all three dimensions; 318 of them had two dimensions, including 40 for EE and DP, 277 for DP and RPA, and 1 for EE and RPA. The number of health care professionals who had only EE, only DP, and only RPA were 12, 101, and 193, respectively.

coping styles ($P < 0.001$). About RPA, title groups ($P = 0.013$), working place groups ($P = 0.011$), and coping styles ($P < 0.001$) may be associated factors.

There was no statistical difference between the three dimensions in gender and occupational groups. Meanwhile, working place (high or low infection region) and coping style could affect the positive distribution of three dimensions simultaneously. Other factors played different roles in different burnout dimensions.

Independent Influencing Factors of the Three Dimensions

After statistical analysis of collinearity among those factors, no significant collinear variables were found. Therefore, stepwise binary logistic regression was used to select the independent influencing factors from all column factors in **Table 1**. In logistic regression, the dependent variables were EE, DP, and RPA, respectively (**Table 2**). Firstly, higher work intensity (OR = 3.30, 95%CI: 1.86–5.58), more night shift quantity (OR = 2.08, 95%CI: 1.38–3.15), having symptoms about COVID-19 (OR = 3.29, 95%CI: 1.98–5.48), working in the high infection region (OR = 2.20, 95%CI: 1.28–3.78), and negative coping style (OR = 1.99, 95%CI: 1.21–3.26) were associated with a higher incidence of EE. Secondly, working in the high infection region (OR = 0.70, 95%CI: 0.53–0.94) was associated with a lower incidence of DP. But senior title (OR = 1.35, 95%CI: 1.00–1.82), more night shift quantity (OR = 1.32, 95%CI: 1.03–1.69), having symptoms (OR = 1.52, 95%CI: 1.07–2.17), and negative coping style (OR = 3.47, 95%CI: 2.54–4.73) were associated with higher DP. Thirdly, two items were associated with a higher incidence of RPA: senior title (OR = 1.43, 95%CI: 1.08–1.90) and negative coping style (OR = 1.82, 95%CI: 1.35–2.45). On the contrary, HCPs working in the high infection region (OR = 0.66, 95%CI: 0.51–0.87) tended to show a lower incidence of RPA.

Working in varying degrees of infection regions was proved to be the independent influencing factors in all three dimensions.

TABLE 2 | Stepwise binary logistic regression for the three dimensions (EE, DP, and RPA).

Items	EE		DP		RPA	
	OR (95%CI)	P	OR (95%CI)	P	OR (95%CI)	P
Senior title	\	\	1.35 (1.00 1.82)	0.050*	1.43 (1.08 1.90)	0.012*
Higher work intensity	3.30 (1.86 5.85)	<0.001***	\	\	\	\
More night shift quantity	2.08 (1.38 3.15)	0.001**	1.32 (1.03 1.69)	0.026*	\	\
Having symptoms	3.29 (1.98 5.48)	<0.001***	1.52 (1.07 2.17)	0.019*	\	\
Working in high infection region	2.20 (1.28 3.78)	0.004**	0.70 (0.53 0.94)	0.016*	0.66 (0.51 0.87)	0.003**
Negative coping style	1.99 (1.21 3.26)	0.007**	3.47 (2.54 4.73)	<0.001***	1.82 (1.35 2.45)	<0.001***

$p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.
\, Some factors did not come into the stepwise binary logistic regression.

TABLE 3 | The score of three dimensions in different working place and coping style group.

Items	EE (mean ± SD)	DP (mean ± SD)	RPA (mean ± SD)
Working place	$P < 0.001$***	$P = 0.443$	$P = 0.008$**
High infection region	12.80 ± 0.35	5.58 ± 0.25	12.47 ± 0.39
Low infection region	12.23 ± 0.24	5.34 ± 0.19	13.85 ± 0.34
Coping style	$P < 0.001$***	$P < 0.001$***	$P < 0.001$***
Negative	13.49 ± 0.37	7.44 ± 0.30	15.25 ± 0.45
Positive	10.42 ± 0.24	4.53 ± 0.17	12.30 ± 0.30

$p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

Working in the high infection region may be a protective factor in DP and RPA but a risk factor in EE. Some items in the four aspects were also the independent influencing factors in one or two dimensions. More night shift quantity and having symptoms about COVID-19 may play as risk factors in EE and DP. The senior title could cause an increased rate in RPA.

The Score of Three Dimensions in Different Working Place and Coping Style Group

The scores of three different dimensions were calculated by grouping the two factors (working place and coping style) and presented as the mean plus or minus one standard deviation (**Table 3**). Except that the workplace could not significantly change the score of EE ($P = 0.443$), the scores of the three dimensions all showed a significant difference in groups categorized by these two factors, respectively.

DISCUSSION

Main Findings and Previous Experience From China

This study investigated job burnout and the relationship between related factors and the three dimensions of burnout in HCPs across China against the backdrop of the epidemic of COVID-19. Chinese HCPs experienced multiple prevalent burnout symptoms in different dimensions. Higher work intensity due to the epidemic of COVID-19, senior title, more night shift quantity, having symptoms, and negative coping styles could increase the risk of job burnout. The effects of working in a high incidence area on different burnout dimensions were somewhat paradoxical.

In this study, the job burnout (which included mild, moderate, and severe burnout) rate in HCPs was 73.98%; among them, the sum of moderate and severe job burnout ratio is 39.20%. We compare these results with some studies, which also selected CMBI to assess burnout, in China in recent years during non-epidemic periods. The most recent study started in November 2018 and ended in March 2019. The study contained 514 intensive care unit physicians and nurses, 56.03% of whom reported varying degrees of burnout (33). Next, a cross-sectional study of 2,502 nurses conducted in 2017 showed that the prevalence of job burnout was 64.06%, with 30.14% being moderate and severe combined (34). In 2016, a study found that the overall prevalence of all degrees of burnout was 85.79%, and the breakdown according to severity is as follows: 40.0% mild, 27.2% moderate, and 7.4% severe burnout among 2,617 participating Chinese doctors (35). A study that took place in 2013 containing 1,435 nurses from two large general hospitals showed that the overall prevalence of all degrees of burnout was 74.6%, with 40.0% mild, 27.2% moderate, and 7.4% severe burnout (17). From December 2009 to February 2011, a questionnaire survey across China showed that of 2,530 physicians, 34.2% were experiencing moderate burnout and 5.5% were experiencing severe burnout (36). Taking all the above studies together, we concluded that the proportion of Chinese medical workers suffering from moderate to severe burnout did increase during the epidemic. It is worth noting that previous studies had shown a long-term psychological and occupational effects of SARS (severe acute respiratory syndrome coronavirus) that it could even significantly increase the level of burnout among health care workers who cared for SARS patients compared to those who did not after 13 to 26 months (37). Perhaps COVID-19, which is similar to SARS, will have a similar effect, which needs further study.

Anyway, in the context of a viral pandemic, many clinicians had a heavy medical burden; the high rate of job burnout in China, which was associated with poor HCPs' health and decreased quality of medical care, was not optimistic (38, 39).

Other Studies Addressing Burnout During the COVID-19 Pandemic

As of November 2020, the epidemic is still widespread. Several studies on burnout among HCPs in COVID-19 have been published. These studies also revealed that burnout was common among HCPs in many different countries. A cross-sectional study about burnout between normal ward workers and frontline workers in COVID wards in Romania showed that 76% of the sample reported burnout (40). Another cross-sectional study in Northern Italy also revealed that 76% of health professionals working in an institution had been burned out (41). A large sample survey in the USA found that HCPs who contracted COVID-19 reported higher levels of burnout (42). All of these studies used the Maslach Burnout Inventory. Therefore, the situation of burnout among health care workers around the world is serious and is of concern.

Risk Factors of Burnout

Risk factors for job burnout have been widely studied. It is agreed that the level of job burnout varies from different occupations and different countries (5, 43). Younger is widely believed to have an association with higher burnout levels since new employees have less experience in dealing with problems at work (5). This study was a cross-sectional study, but there was an underlying chronological relationship between internal factors (except coping style) and burnout. It showed that age had an impact on the level of DP in HCPs according to univariate analysis. Among a great number of studies, there are a few to compare the differences between doctors and nurses on job burnout levels. We performed this comparison and found no statistical difference in three dimensions of burnout between these two occupations. The same result was observed in the factor of gender.

Working factors, assessed by three factors in this study: long working hours, high work intensity, and more night shift, contributed to the occurrence of job burnout together, especially in the EE dimension. Stepwise logistic regression confirmed the impact of these work-related stressors. The high workload can drain employees' mental and physical strength and may cause exhaustion through the process of health impairment (6, 44). Based on the classical job demands–resources model of job burnout, one solution to this dilemma is to provide more job resources for HCPs, such as social support, potential promotion, and learning opportunities (45, 46). HCPs who were isolated from family members may not be able to undertake the obligation of taking care of the elderly and children as well as daily housework. This kind of work–family conflict had been proved to harm job burnout (47), which had also been detected in our study. On the other hand, isolation from the family caused a lack of emotional support that also could elicit burnout (48, 49).

Due to the high infectivity of COVID-19, HCPs who were directly contacted with patients had a higher level of EE, and those who had suspicious symptoms were more susceptible to EE and DP. However, the influences of working place on three dimensions of job burnout were not consistent. HCPs working in the high infection region have a higher level of EE but a lower level of DP and RPA than those working in the low infection region. Such results seemed to be contradictory but may have a possible explanation. Short-term exposure to this epidemic may inspire the dedication of medical individuals and compassion for patients, as well as a sense of pride, leading to the decline of DP and RPA symptoms. However, we were not able to figure out the long-term effect of this exposure on job burnout due to the limitations of the cross-sectional study.

Coping Style and Burnout

Our research has confirmed a strong link between job burnout and coping styles, and negative coping can increase the score and the corresponding positive incidence in three dimensions. This result was consistent with many studies (17, 18). The process of medical behavior is full of challenges, requiring HCPs to solve one problem after another. If the problem is not solved successfully, HCPs might have negative emotions (e.g., sadness, despondency, irritation, or hopelessness) (50). When these negative emotions are repeated among HCPs, they gradually become emotionally exhausted. Thus, the HCPs who tend to choose positive coping strategies are less likely to develop burnout. Of course, the mechanism for the link between coping style and burnout should be complex. The positive coping style of problem-focused coping was even linked to improved psychological health (such as depression and anxiety) (51). There was a study focused on cognitive-behavioral and psychoeducational intervention on coping strategies, and it showed that the higher use of active coping strategies resulted in a decrease in levels of burnout (52). In such an emergent bio-disaster, guiding HCPs to adjust on their coping styles in positive and rational ways may help them reduce the occurrence of job burnout.

Three Dimensions of Job Burnout

As mentioned above, the positive rates of the three dimensions of burnout (emotional exhaustion, depersonalization, and reduced personal accomplishment) were 9.09, 50.57, and 56.59%, respectively, in our study. It was very interesting but difficult to explain the phenomenon that there was a large difference in the positive rate between the EE dimension and the remaining two. According to Maslach et al., there is a hypothesis about these three dimensions: it is a different sequential progression over time; the occurrence of one dimension precipitates the development of another. According to this model, emotional exhaustion occurs first, leading to the development of depersonalization, which leads subsequently to reduced personal accomplishment (5). So, the high level of DP and RPA might indicate that burnout among HCPs has been developing over time. The lower proportion of EE may be due to the impact of this outbreak. During the outbreak, the Chinese people and the government paid more attention to doctors, and many heart-warming events about HCPs happened, like the fact that many insurance companies offered free coverage to some HCPs. To some extent, the pride and emotional needs of HCPs were greatly satisfied.

Limitations

The study also had the following limitations. This study was cross-sectional in design. Coping styles and job burnout were measured simultaneously. Therefore, it was impossible to draw a causal relationship between them. Selection bias cannot be avoided. More risk factors and their mechanisms should be investigated in further studies. The study did not include any infected health care workers, but their job burnout and psychological status were also highly worth studying.

CONCLUSION

There was a certain degree of job burnout among Chinese HCPs during the COVID-19 outbreak. The rate of moderate and severe burnout had increased compared to non-epidemic periods. And some of the factors (higher work intensity, more night shift quantity, having symptoms, working in the high infection region) associated with this outbreak had been shown in our study to be closely related to burnout. We should continue to pay attention to the status of job burnout among HCPs and take preventive interventions in advance. Public health interventions should be taken to reduce the working intensity, the number of night shifts, and the risk of infection of HCPs; psychological interventions should also be taken to help more HCPs adopt the positive coping style, which would help to reduce job burnout.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author/s.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee of Union Hospital, Tongji Medical College, Wuhan China. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

XLiu, JC, and TB were responsible for draft writing, conceived the idea for the article, analyzed the data of this study by software, and wrote the final manuscript. DW, XLi, EW, YJ, YM, and CY contributed to data collection in the fieldwork and gave suggestions for data analysis. CLu, LZ, CLi, and YZ assisted in entering raw data into statistical software. LY and JS contributed to check the analyses, and critically reviewed the manuscript. TB and XH contributed to design the study, supervise, and make the final decision to contribute to the article. All authors contributed to and approved the final report.

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SUPPLEMENTARY MATERIAL

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The Psychological Pressures of Breast Cancer Patients During the COVID-19 Outbreak in China—A Comparison With Frontline Female Nurses

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Objective: During the outbreak of the COVID-19 epidemic in China, breast cancer (BC) patients and healthcare workers faced several challenges, resulting in great psychological stress. We measured the psychological status of BC patients and female nurses and compared the severity within the two groups at the peak time-point of the COVID-19 outbreak.

Methods: A total of 207 BC patients and 684 female nurses were recruited from Wuhan. They completed an anonymous questionnaire online using the most popular social media software in China, WeChat. The psychological status of BC patients and of female nurses was measured using the Chinese versions of the 9-item Patient Health Questionnaire (PHQ-9), the 7-item Generalized Anxiety Disorder scale (GAD-7), the 7-item Insomnia Severity Index (ISI), and the 22-item Impact of Event Scale-Revised (IES-R) for evaluation of post-traumatic stress disorder (PTSD). The differences between the two groups were analyzed.

Results: The scores of BC patients and frontline female nurses for the four scales were significantly higher than those of non-frontline female nurses (P <0.001). There were similar scores between BC patients and frontline female nurses for PHQ-9, GAD-7, and IES-R ($P = 0.789$, $P = 0.101$, $P = 0.158$, respectively). Notably, the scores of BC patients for ISI were significantly higher than those of the frontline female nurses ($P = 0.016$). A considerable proportion of BC patients reported symptoms of depression (106/207, 51.2%), anxiety (130/207, 62.8%), insomnia (106/207, 51.2%), and PTSD (73/207, 35.5%), which was more severe than that of female nurses.

Conclusions: BC patients experienced great psychological pressure during the COVID-19 outbreak. The incidents of symptomatic anxiety, depression, sleep disorders, and PTSD were significantly comparable to that of frontline female nurses, and episodes of insomnia among BC participants were more serious than for frontline female nurses.

Keywords: breast cancer, female nurses, COVID-19, anxiety, depression, insomnia, post-traumatic stress disorder

INTRODUCTION

Since the end of 2019, a novel coronavirus, COVID-19, caused by the virus SARS-CoV-2, began to spread in Wuhan, China. This new disease, defined as the Coronavirus Disease 2019 (COVID-19) by the World Health Organization (WHO) on 11 February 2020, spread all over the world (1, 2). The Chinese government placed a lockdown on the epicenter city of Wuhan and quickly conducted powerful and effective measures to fight the pandemic.

All healthcare workers joined in and fought against the pandemic without hesitation. During the initial phase of the pandemic, healthcare workers faced great challenges, such as limited information about COVID-19 and effective drugs, rapidly increasing numbers of patients, and limited resources and protective supplies. At the same time, the non-COVID-19 patients had to discontinue or delay their normal therapy owing to the lockdown policies, limited medical resources, and the predicted increased risk of infection, especially for patients with cancer. Therefore, the outbreak of COVID-19 led to significant increases in the psychological burden of healthcare workers and patients with cancer, especially those with breast cancer (BC).

Our recent investigation showed that healthcare workers suffered great psychological pressure during the COVID-19 pandemic, especially frontline nurses (3). In addition, we evaluated the effects of the pandemic on the psychological status of breast cancer (BC) patients (4). However, there are few comparisons of the psychological status between different groups in the literature. Therefore, in this study, we focused on the severity of psychological problems in BC patients and compared them with that of female nurses in the epicenter of the pandemic, in Wuhan, China. We measured the psychological status of BC patients and nurses at the peak point of the COVID-19 outbreak by using the Generalized Anxiety Disorder Questionnaire (GAD-7), Patient Health Questionnaire (PHQ-9), Insomnia Severity Index (ISI), and Impact of Events Scale-Revised (IES-R) for PTSD evaluation.

METHODS

Patients

BC patients from the epicenter of COVID-19 in China, Wuhan Hubei Province, were enrolled in this survey study. Female nurses from a tertiary hospital in Wuhan were selected as the control group. The study was sponsored by the Renmin Hospital of Wuhan University. All enrolled patients and nurses signed a digital informed consent form before accessing the questionnaire online. The questionnaire was designed to include demographic characteristics and four validated psychological assessment scales. The clinical features and current treatments were additionally recorded for patients with BC. The four scales included the Generalized Anxiety Disorder Questionnaire (GAD-7), Patient Health Questionnaire (PHQ-9), Insomnia Severity Index (ISI), and Impact of Events Scale-Revised (IES-R). All participants were asked to answer the questionnaire online by using the most popular social media software in China, Wechat. We issued the questionnaire in the WeChat groups from February 1 to 19, 2020, when the daily number of confirmed cases was at its peak. The daily pandemic curve showed that the number of reported cases increased rapidly after January 10, reaching the pandemic peak on February 5, after which point it declined slowly (5).

Participants who completed the entire questionnaire in <5 min or more than 60 min were excluded. BC patients whose date of diagnosis was before 2015 and male nurses were excluded. After the evaluation of questionnaires for eligibility, 891 participants were enrolled for analysis, including 207 BC patients and 684 female nurses. The female nurses were divided into a frontline and a non-frontline group. The nurses from the emergency department, fever clinics, or the medical unit for COVID-19 patients were identified as frontline nurses, and the others were non-frontline nurses. The flowchart of patient and nurse selection is shown in **Figure 1**. This study protocol was approved by the Institutional Ethics Committee of Renmin Hospital of Wuhan University.

Psychological Status Evaluation

We used four questionnaire scales to evaluate the psychological status of BC patients and nurses during the epidemic, including the PHQ-9, GAD-7, ISI, and IES-R. The validity and reliability of depression on the PHQ-9 scale (6, 7) and generalized anxiety on the GAD-7 scale (8, 9) have been demonstrated previously. The PHQ-9 with nine items and the GAD-7 with seven items were rated from 0 ("almost never") to 3 ("almost always"). Based on the scores obtained on these scales, the severity of anxiety or depression for participants was divided into normal (0–4), mild (5–9), moderate (10–14), and severe (>15).The respondents whose scores were higher than 4 in PHQ-9 or GAD-7 were thought to have depressive or anxiety symptoms.

The ISI (10) is a seven-item instrument for insomnia assessment utilizing a 5-point Likert scale (0–4, not at all to extremely). The insomnia status was divided into no sleep difficulties (0–7), mild (8–14), moderate (15–21), and severe insomnia (22–28). The respondents whose scores were higher than 7 in ISI were thought to have sleep problems.

The IES-R scale (11) was used to assess Post-traumatic Stress Disorder (PTSD) symptoms based on DSM-IV criteria. Each item was rated using a five-point Likert scale ranging from 0 (not at all) to 4 (very much), for a total score ranging from 0 to 88. Participants with a score of more than 34 were defined as having PTSD.

Statistical Analysis

All statistical analyses were carried out using IBM SPSS Statistics (Version 26.0). One-way ANOVA, independent-samples T-test, and Chi-square-test were used to compare differences in the psychological status of BC patients and female nurses, based on the PHQ-9, GAD-7, ISI, and IES-R. A corresponding 95% confidence interval (CI) was calculated, and the statistical significance level was set at $P < 0.05$.

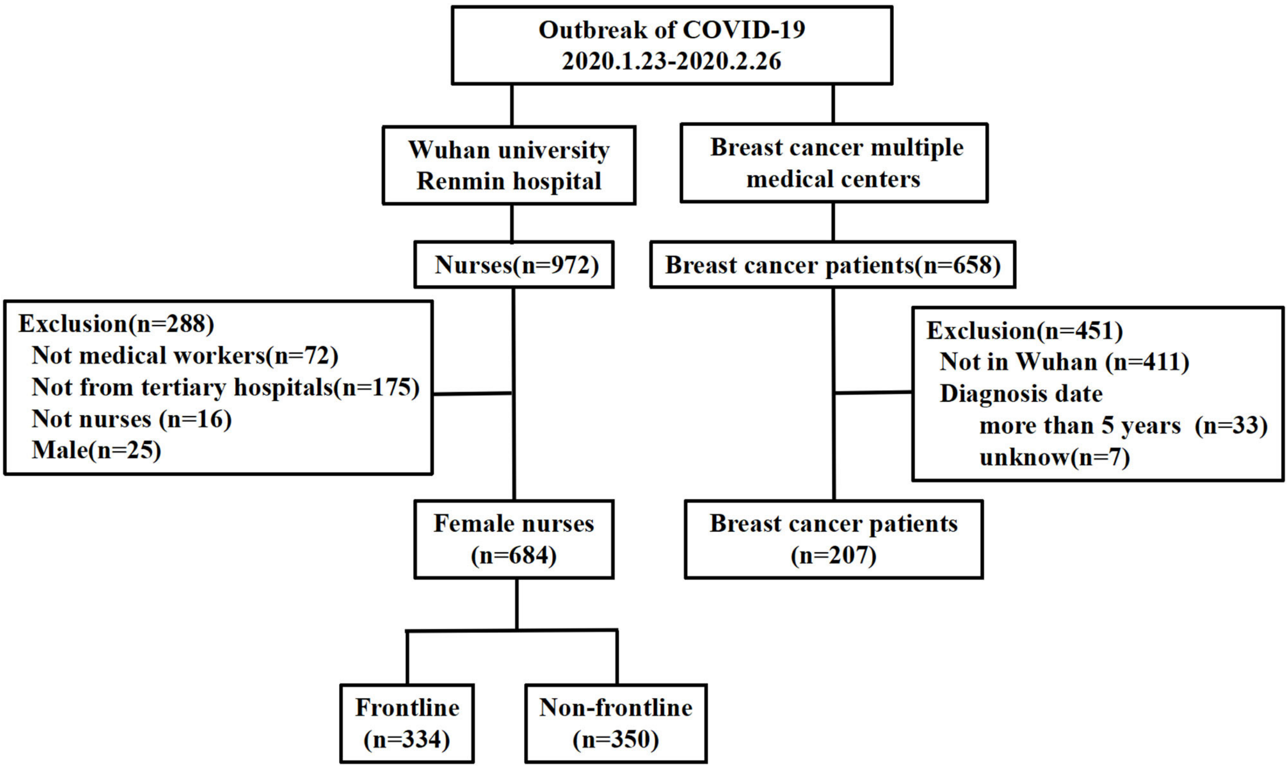

FIGURE 1 | Flowchart of the recruitment of the patients and nurses.

RESULTS

Characteristics of BC Patients and Female Nurses in Wuhan

A total of 207 BC patients were collected in this study, including 113 cases (54.6%) within 1 year of their BC diagnosis. The majority of the patients were married (81.2%), younger than 55 years old (72.0%), had no bachelor's or higher degree (66.2%), and earned an annual income of <\$15,000 (154/207; 74.9%). Most of the patients identified themselves as having presented with a good or average physical condition in the past. There were 73.4% of participants with early-stage BC disease, 59.9% who reported a history of prior breast surgery (194/207; 93.7%), and 79.7% who were advised to undergo BC treatment during COVID-19. The baseline characteristics of the BC patients are shown in **Table 1**.

A total of 684 questionnaires completed by female nurses were received. Three hundred and thirty-four (48.4%) were from the frontline. Most of the nurses had a college education (96.9%) and identified themselves as being in good or average health (96.8%) in the past. The majority of nurses (86.4%) were <40 years old. More than half of the nurses were married (53.2%). Nurses with a primary professional title constituted 57.9% and 58.3% felt uncertain about fighting against the pandemic. The baseline characteristics of the nurses are shown in **Table 2**.

The Scores of BC Patients and Female Nurses in the Four Scales

The scores of the BC patients in PHQ-9, GAD-7, ISI, and IES-R were 6.56 ± 6.044, 6.30 ± 4.879, 8.99 ± 6.359, and 29.12 ± 17.656 respectively; the scores of the frontline female nurses in PHQ-9, GAD-7, ISI, and IES-R were 6.68 ± 5.378, 6.53 ± 4.946, 7.77 ± 6.221, and 27.05 ± 17.377 respectively; the scores of the non-frontline female nurses in PHQ-9, GAD-7, ISI, and IES-R were 4.53 ± 4.305, 3.92 ± 4.127, 5.33 ± 4.378, and 20.08 ± 15.021 respectively. The psychological scores of the BC patients, frontline female nurses, and non-frontline female nurses for the four questionnaires are shown in **Figure 2**. Scores from the four scales administered to the BC patients were all significantly higher than for the scores of female nurses on the PHQ-9, GAD-7, ISI, and IES-R (P = 0.035, $P < 0.0001$, $P < 0.0001$, and $P < 0.0001$, respectively). The scores of BC patients and those of the frontline female nurses for the four scales were significantly higher than those of non-frontline female nurses ($P < 0.001$). There were similar scores between BC patients and frontline female nurses for PHQ-9, GAD-7, and IES-R ($P = 0.789$, $P = 0.101$, P = 0.158, respectively). Notably, the scores of BC patients on the ISI were significantly higher than those of frontline nurses ($P = 0.016$).

TABLE 1 | The baseline characteristics of breast cancer patients and nurses in Wuhan.

		No. (207)	%
Age (years)	<40	43	20.8
	40–55	106	51.2
	>55	58	28.0
Highest level of education	Elementary school or less	10	4.8
	Middle school	36	17.4
	High school	91	44.0
	Bachelor's degree or higher	70	33.8
Marital status	Unmarried	15	7.2
	Married	168	81.2
	Divorced/widowed	24	11.6
Annual income (US dollars)	<$7500	91	44.0
	$7500–$15,000	64	30.9
	$15,000–$43,000	46	22.2
	>$43,000	6	2.9
General health condition by self-identification	Well	74	35.7
	Average	78	37.7
	Poor	55	26.6
Someone infected with COVID-19 around breast cancer patients	Yes	24	11.6
	No	18	8.7
	N/A	165	79.7
Breast cancer diagnosis time	Within 1 year	113	54.6
	More than 1 year	94	45.4
Breast cancer stage	Early	124	59.9
	Advanced	40	19.3
	Unknown	43	20.8
Molecular subtype of breast cancer	TNBC	36	17.4
	Luminal	55	26.7
	HER2	68	32.8
	Unknown	48	23.1
History of breast cancer surgery	Yes	194	93.7
	No	13	6.3
Recommend anti-cancer therapy	Yes	165	79.7
	No	42	20.3
Discontinued anticancer therapy	Endocrine therapy	103	53.4
	Targeted therapy	30	15.5
	Chemotherapy	47	24.4
	Radiotherapy	5	2.6
	Traditional Chinese medicine	8	4.1

N/A, Not provided or not available.

The Proportion of Psychological Problems Identified on the Four Scales for BC Patients and Female Nurses

The proportions of psychological problems identified on the four scales in BC patients and female nurses are shown in **Table 3**. More than half of BC patients and frontline female nurses revealed incidents of depression and anxiety. The scores associated with these factors were significantly higher than those of the non-frontline female nurses. The sleep problems for BC patients and frontline female nurses were significantly higher than those of the non-frontline female nurses. More than one-third of BC patients and frontline female nurses endured a significantly higher proportion of PTSD symptoms than did the non-frontline female nurses.

DISCUSSION

During the COVID-19 outbreak, rapidly rising numbers of infected cases put both the local healthcare system and the citizens in Wuhan, as the epicenter of COVID-19 in China, under tremendous stress. The Chinese government quickly took powerful and effective measures to fight against the COVID-19 pandemic, such as the lockdown of Wuhan city, integration of personal and medical resources, and the construction of Fangcang shelter hospitals (12). Under this unique circumstance, patients with cancer and healthcare workers experienced significant mental stress. In this study, we focused on the psychological status of BC patients and female nurses in Wuhan city at the peak time-point of the COVID-19 outbreak. Our survey showed that more than half of BC patients had symptoms of depression, anxiety, and insomnia, and over one-third of BC patients endured distress. The proportion of psychological problems in BC patients was comparable to that of frontline female nurses.

Because of limited medical resources, a higher risk of infection with COVID-19, and the possibility of experiencing worse outcomes after infection, the BC patients had to delay or discontinue their planned anti-cancer treatments, increasing the psychological pressure on these individuals. Our study showed that more than half of BC patients suffered from depression (51.2%), anxiety (62.8%), and sleep problems (51.2%), and over one-third of BC patients experienced PTSD symptoms (35.3%). These proportions of psychological problems were higher than those from previous reports in normal situations. BC patients already have a lot of psychological stress as a result of the diagnosis and treatment of the tumor in their bodies. Recent systematic studies have summarized the prevalence of psychological problems in BC patients (13, 14). The results showed that nearly one-third (32.2%) of BC patients experienced depression (13) and nearly 10% of patients (9.6%) had PTSD (14). However, the prevalence of depression, anxiety, insomnia, and PTSD displayed great discrepancies from previous studies (13–17), partly due to the utilization of different definitions, measurements, populations, and the timing of assessments. Therefore, we compared the severity of the psychological problems of BC patients with those of female nurses in the same place and during the same period of the pandemic.

In the face of COVID-19, healthcare workers have taken an active part in fighting the pandemic, regardless of their own safety. Many health care workers suffered great psychological pressure during the outbreak of the pandemic. Many studies have shown that healthcare workers, especially nurses, endured significantly high psychological problems during the outbreak

TABLE 2 | The characteristics of female nurses in Wuhan during the outbreak.

		Female nurses $N = 684$		Frontline female nurses $N = 334$		Non-frontline nurses $N = 350$	
		No.	**%**	**No.**	**%**	**No.**	**%**
Age/years	18–25	171	25.0	87	26.0	84	24.0
	26–30	236	34.5	115	34.4	121	34.6
	30–40	184	26.9	102	30.5	82	23.4
	>40	93	13.6	30	9.0	63	18.0
Marital status	Unmarried	310	45.3	163	48.8	147	42.0
	Married	364	53.2	166	49.7	198	56.6
	Divorced or widowed	10	1.5	5	1.5	5	1.4
Highest level of education	Junior college degree	4	0.6	2	0.6	2	0.6
	Bachelor's degree	648	94.7	321	96.1	330	94.2
	Master's degree or higher	32	4.7	11	3.3	18	5.2
Professional title	None	94	13.7	46	13.8	48	13.7
	Primary	396	57.9	204	61.6	192	54.9
	Junior	185	27.0	79	23.7	106	30.3
	Senior	9	1.3	5	1.5	4	1.1
Change of physical condition by self-identification	Similar	477	69.7	214	64.1	263	75.1
	Worse	207	30.3	120	35.9	87	24.9
Uncertainty of fighting against the epidemic	Yes	399	58.3	211	63.2	188	53.7
	No	285	41.7	123	36.8	162	46.3

of SARS or MERS (18–21). In our recent study, we assessed the magnitude of mental health outcomes and associated factors among 1,257 healthcare workers for COVID-19 patients in multiple regions of China (3). The results showed that a considerable proportion of healthcare workers reported experiencing symptoms of depression, anxiety, insomnia, and distress. This was especially true for frontline female nurses from the epicenter, Wuhan. We accordingly deduced that frontline female nurses in Wuhan are under the most severe psychological pressure. In this survey, more than half of frontline female nurses suffered from depression (202/334, 60.5%) and anxiety (186/334, 55.7%), and over one-third of female nurses experienced sleep problems (154/334, 46.1%) and PTSD (111/334, 33.2%). The proportions of symptomatic depression, anxiety, insomnia, and PTSD in frontline female nurses were significantly higher than those in non-frontline female nurses. However, our results showed that BC cancer patients were under psychological pressure comparable to that of the frontline female nurses at the peak of the COVID-19 outbreak in Wuhan, China. This is the first report offering a direct comparison of psychological status between patients and nurses during the pandemic. BC patients, in fact, were found to suffer worse symptoms of insomnia than female frontline nurses. These results indicate that more attention should be paid to the psychological problems experienced by BC patients and that more effective intervention measures need to be taken during future epidemics.

There were significant differences in age, marital status, and levels of education between the BC patients and female nurses. They were all women living in Wuhan, who had to go to hospitals while being at a greater risk of infection with COVID-19. Nurses are at the forefront of fighting the pandemic, and their psychological state easily attracts public attention. By comparing the psychological status of BC patients with that of nurses, we were able to obtain a greater understanding of the psychological state of the BC patients. It is important to pay attention to the psychological status of people with chronic illnesses during the outbreak of a pandemic.

During the outbreak, a number of modifications to standard treatment paradigms were implemented for BC patients. However, in addition to obtaining support through online or offline services from professional health care workers (22), necessities from social volunteers, BC patients also need to receive more support from their families. This is crucial because most remained at home during the pandemic. Several reports have demonstrated the importance of family support for patients. A prospective study with a long-term follow-up for patients showed that family support was associated with both low levels of, and quick improvement from, depression (23). For BC patients aged more than 55 years, family support from adult children might decrease their levels of anxiety and depression (24). Kamen et al. (25) showed that family support was related to less severe insomnia at baseline in BC patients. Additionally, one previous study demonstrated that family support could avoid or alleviate certain mood difficulties in BC patients in the Chinese population (26). Therefore, people need to be educated regarding the importance of providing support for BC family members, especially during epidemic outbreaks.

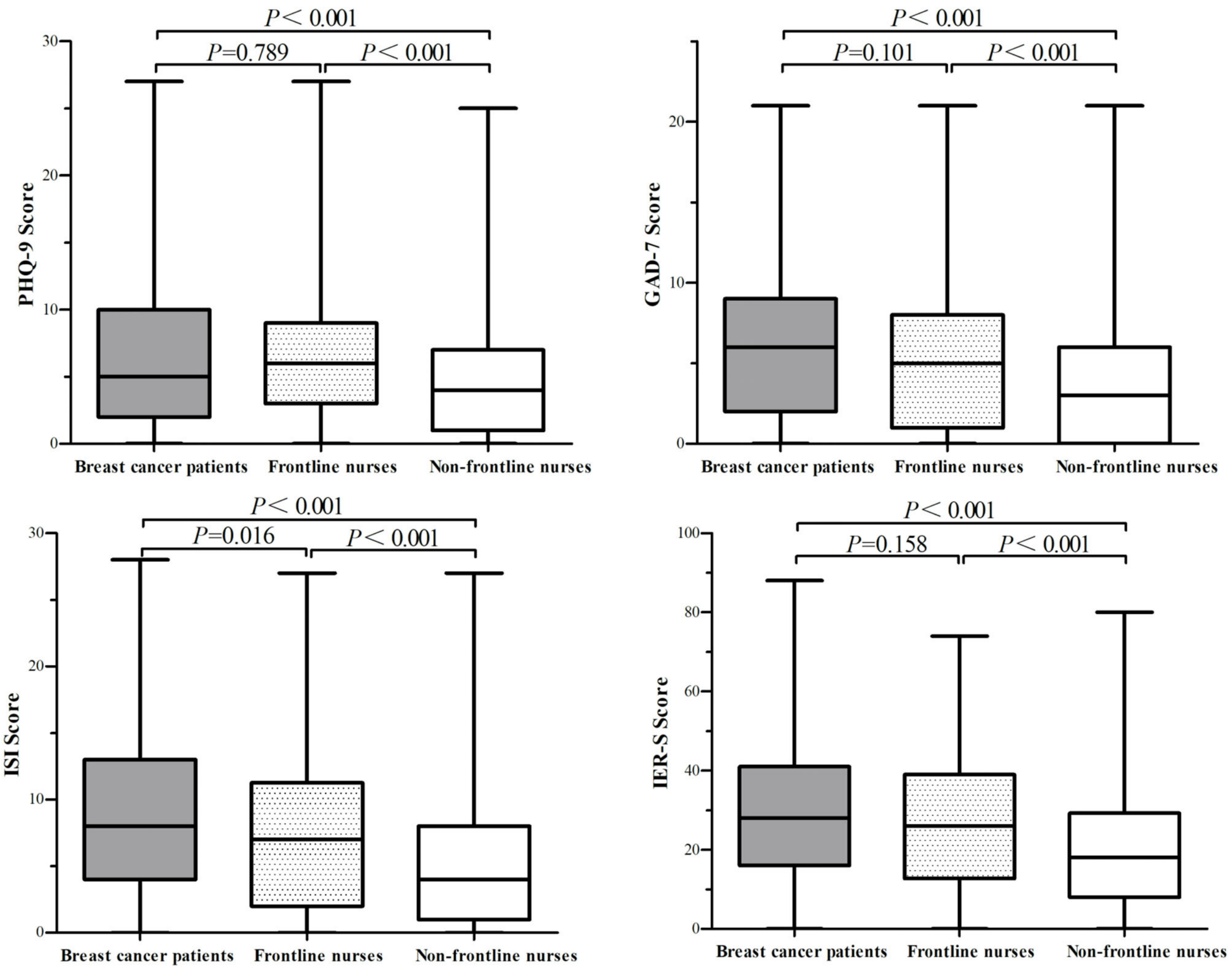

FIGURE 2 | The scores of the breast cancer patients, frontline nurses, and non-frontline nurses in PHQ-9, GAD-7, ISI, and IES-R. PHQ-9, Patient Health Questionnaire; GAD-7, Generalized Anxiety Disorder Questionnaire; ISI, Insomnia Severity Index; IES-R, Impact of Events Scale-Revised.

TABLE 3 | The abnormal proportion of four scales in nurses and breast cancer patients.

		Frontline nurses $N = 334$		Non-frontline nurses $N = 350$		Breast cancer patients $N = 207$		
		No.	**%**	**No.**	**%**	**No.**	**%**	***P*-value**
PHQ-9	Normal	132	39.5	190	54.3	101	48.8	0.001
	Abnormal	202	60.5	160	45.7	106	51.2	
GAD-7	Normal	148	44.3	213	60.9	77	37.2	<0.001
	Abnormal	186	55.7	137	39.1	130	62.8	
ISI	Normal	180	53.9	245	70.0	101	48.8	<0.001
	Abnormal	154	46.1	105	30.0	106	51.2	
IER-S	Normal	223	66.8	284	81.1	134	64.7	<0.001
	Abnormal	111	33.2	66	18.9	73	35.3	

P-value was calculated using the Chi-square-test.
PHQ-9, Patient Health Questionnaire; GAD-7, Generalized Anxiety Disorder Questionnaire; ISI, Insomnia Severity Index; IES-R, Impact of Events Scale-Revised.

We acknowledge some shortcomings in our study. First, our study is a cross-sectional study that only extracts data from one point in time. The changes in the psychological status of BC patients should be investigated at different periods of the pandemic. Second, the sample size of BC patients was small. Third, the direct comparison of psychological pressures between BC patients and nurses might not be appropriate because of different influencing factors in the two distinct groups. However, our findings indicated that when BC patients were forced to delay or discontinue treatment due to the pandemic, their psychological pressures increased greatly. The differences in psychological status among other populations, such as the normal population, BC patients more recently diagnosed from other areas, and patients with other chronic diseases, should be evaluated in future. Moreover, effective measures for alleviating the psychological pressures of BC patients, both during and after the pandemic, should be investigated.

CONCLUSIONS

In summary, our study showed that BC patients were under great psychological pressure as compared to frontline female nurses in the COVID-19 epicenter, Wuhan, China. BC patients suffered worse incidents of insomnia than frontline female nurses who treated COVID-19 patients. These results indicate that effective measures should be taken to alleviate the psychological problems of BC patients during pandemics. The importance of family support in relieving psychological stress in these patients is also emphasized.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Institutional Ethics Committee of Renmin Hospital of Wuhan University. The ethics committee waived the requirement of written informed consent for participation.

AUTHOR CONTRIBUTIONS

QC: validation, formal analysis, writing—original draft, and visualization. ZC: conceptualization, methodology, validation, formal analysis, resources, data curation, and supervision. ZL: methodology, project administration, and funding acquisition. JL: formal analysis and investigation. SS: investigation, resources, and project administration. CC and GW: conceptualization, writing-review and editing, visualization, supervision, and funding acquisition. All authors contributed to the article and approved the submitted version.

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Acceleration of Anxiety, Depression, and Suicide: Secondary Effects of Economic Disruption Related to COVID-19

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The SARS-CoV-2 (COVID-19) pandemic has contributed to increasing levels of anxiety, depression and other symptoms of stress around the globe. Reasons for this increase are understandable in the context of individual level factors such as self-isolation, lockdown, grief, survivor guilt, and other factors but also broader social and economic factors such as unemployment, insecure employment and resulting poverty, especially as the impacts of 2008 recession are still being felt in many countries further accompanied by social isolation. For those who are actively employed a fear of job and income loss and those who have actually become ill and recovered or those who have lost family and friends to illness, it is not surprising that they are stressed and feeling the psychological impact. Furthermore, multiple uncertainties contribute to this sense of anxiety. These fears and losses are major immediate stresses and undoubtedly can have long-term implications on mental health. Economic uncertainty combined with a sense of feeling trapped and resulting lack of control can contribute to helplessness and hopelessness where people may see suicide as a way out. Taking a macro view, we present a statistical model of the impact of unemployment, and national income declines, on suicide, separately for males and females over the life cycle in developed countries. This impact may reflect a potent combination of social changes and economic factors resulting in anomie. The governments and policymakers have a moral and ethical obligation to ensure the physical health and well-being of their populations. While setting in place preventive measures to avoid infections and then subsequent mortality, the focus on economic and social recovery is crucial. A global pandemic requires a global response with a clear inter-linked strategy for health as well as economic solutions. The models we have constructed represent predictions of suicide rates among the 38 highly industrialized OECD countries over a period of 18 years (2000–2017). Unemployment has a major effect on increasing suicide, especially in middle-aged groups. However, the impact of economic decline through losses of national income (GDP per capita) are substantially greater than those of unemployment and influence suicide throughout the life course, especially at the oldest ages.

Keywords: COVID-19, economy, suicide, depression, national income loss, unemployment, recession, Great Recession

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INTRODUCTION

The current epidemic of SARS-CoV-2 (COVID-19) has altered the way populations deal with stressors and resulting worries. The pandemic has affected directly or indirectly every individual on the planet but with varying individual and country responses. The impact of the pandemic on health is crucial but it also affects economic, educational and political aspects of life globally. Not surprisingly, the pandemic has led to a massive number of publications and research observations from cross-sectional to observational data on people in quarantine, self-isolation, shielding and others. A considerable and increasing number of professional society warnings and academic papers strongly suggest that the COVID-19 pandemic has resulted in anxiety- and depression-related illness, and potentially, suicide (1–7). These suggestions and assertions reflect both a fear of COVID-19 and resulting mortality as well as lockdowns and social distancing (this is a regrettable misnomer as the point is about physical distancing but socially we need ever more than before to be closer) intended to reduce infectious contact. Physical distance is needed to stop the infection but we do need to be socially closer to each other to support each other so that vulnerable people do not feel alone and isolated. Unfortunately, the term social distancing has taken off creating almost an egotistical validation of staying away from each other, thus we are using the term physical distancing (8). Those measures to reduce contact are well-recognized to cause damage to routine social relationships, internal family contacts and severely reduced interaction with the elderly and groups beset with compromised health due to chronic disease. But the intention of this article is to examine an entirely different aspect of the COVID-19 pandemic—namely, the indirect mental health effects of the major national and international recessions that have resulted from the attempt to contain COVID-19. Most obviously these recessions have involved an increase in United States unemployment of ∼30 million jobless workers (collecting unemployment benefits) (9) and on an international level the result of potentially 400 million unemployed (10) and, at least equally important, declines in global economic output by $8.5 trillion over the next 2 years (11). The importance of the international recession and its implications for anxiety, depression, and suicide has as of yet not been clearly addressed in either the journalistic or scientific literatures. The impact of the previous recession from 2008 is still being felt in very many countries. This article specifically concentrates on the corollary, indirect mental health effects, especially suicide, resulting from the international recession, quite apart from the "direct" effects of COVID-19 on anxiety and depressive results. It is important to recognize that for many psychiatric disorders, symptoms themselves can be identified and used erroneously as diagnosis. For example, symptoms of feeling anxious or feeling low cannot and should not be seen as clinical anxiety or depression. However, a fair amount of research on Covid-19 has presented self-reported symptoms as clinical diagnosis.

In this paper, our focus is mainly on the mental health effects of this corollary to COVID-19 based strictly on damage to the economy. However, it is still too early to ascertain either what the intensity and duration of COVID-19 will ultimately be, or how it will affect national economies (12). In this paper we attempt to point out the types of factors that will be necessary to take into account when public health, and specifically mental health, service planners, in their attempt to create scenarios of optimal management of the mental health consequences of COVID-19 should consider. It will not be a simple matter to separate the direct mental health consequences of COVID-19, from the indirect, corollary effects of COVID-19 as it has brought considerable unemployment and income decline now and in the near and long-term future to national populations. For this reason, we have looked at a period of time, close to the COVID-19 era, namely the Great Recession of 2007–2010, and its aftermath, to examine how, "in an extraordinary recession," economic decline in and of itself (i.e., absent major infectious epidemic) ordinarily produces extreme effects of anxiety and depression which have been associated with suicide. It is well-recognized that a recessional economy is related to heighted suicide for both sexes across the entire age spectrum, from at least age 15 to the end of the recorded life cycle. Most powerful are the effects of income loss which influence suicide at all ages, especially over 70, in contrast to the observable effects of unemployment which apparently influence increased suicide from age 15 throughout the life span apart from the most elderly populations of both sexes. These findings pertain to industrialized countries of the Organization for Economic Cooperation and Development (OECD), though it may well be that the observable effects are even more intense for low-income and middle-income emerging economies where the effect of the COVID-19 epidemic and corollary economic damage and mortality may be even more pronounced. Thus, the findings of this study on implications of economic loss to suicide serve as a hypothetical example as to what might happen in a worst case scenario for industrialized countries in trying to understand the corollary implications of COVID-19 to national economies, where suicide is the sentinel mental health outcome (13). Evidence is beginning to emerge that rates of psychiatric disorders such as anxiety and depression are rising in younger generations partly because of inter-generational inequalities where younger people feel that they are being left behind on a number of material parameters in addition to other factors such as urbanization and industrialization. We must acknowledge that this is a fast moving field of research and observations as well as interpretations are changing rapidly.

There has, rightly, been considerable epidemiological and media attention to the highly differential effects of COVID-19 as well as its economic implications on ethnic minorities and low socioeconomic populations in the industrialized world (14, 15). It is clear, from the epidemiology, as from economic analyses, that the populations most directly and severely affected by both the infectious disease and the corollary economic recession and its income/employment implications are "communities of color" and workers of relatively low income and education. In thinking about how efficiently and effectively public health and economic administrators should advance policy to minimize damage to mental health, it is clear that the immediate focus should be on these vulnerable populations. As in virtually all mental health and economic problems influencing national populations, epidemiology and economic analysis teach us the same lesson. It is that in virtually all major causes of illness and mortality, the health of lower socioeconomic groups, and especially lower socioeconomic ethnic minorities, the problems are most immediate and severe. This is partially a reflection of the sustained, and indeed increasing economic inequality that has been much the source of health disparities in industrialized countries (16).

Study Aims

The principal aim of this paper is to identify the secondary effects of economic disruption in relationship to COVID-19 as these effects accelerate anxiety, depression and, especially, suicide. A statistical model of the impact of unemployment and national income declines on suicide, separately for males and females over the life cycle in developed countries during 2000–2017 will be central to the pinpointing of secondary effects of abrupt national recession. Suicide, in this case, is taken as a classic empirical indicator of anxiety, depression and anomie. This model thus provides the basis for estimating the potential simultaneous and lagged impact of unemployment and economic decline on suicide that accompanies the economic recession (and continues to be) intensified by COVID-19. Such a model allows us to anticipate the "purely" economic effects of COVID-19 on suicide, without considering the direct mental or physical health consequences of the COVID-19 infection. This permits consideration of the separate effects of economic recession that are amenable to policy mitigation through e.g., income support of the unemployed (especially long-term or permanent), small and large businesses that are damaged or terminated, and nationally financed investment in healthcare and educational personnel and social welfare. This analysis provides a structural basis for economic and health policy makers to take into account the mental health consequences of their prospective decisions. At the same time, the statistical models provide a basis for understanding the economic and political foundations of national-level suicide rates and their relations to official mental health-based diagnoses of elevated mortality, anxiety and depression. An additional aim is to provide an overview of the epidemiological history of national economic and unemployment risk factors to suicide. Finally, we offer suggestions as to psychiatrically-oriented policies that could be used to mitigate the current mental health effects related to the economic accompaniments of COVID-19 in The Way Forward.

MATERIALS AND METHODS

The general theme garnered among reporters and some writing in professional journals is that there are two clear implications for harm to mental health resulting specifically from the COVID-19 epidemic. The first is that people are simply "fearful" of going to work and appearing in public gatherings for fear of infection and mortality—especially among those with chronic cardiovascular, diabetic or asthmatic conditions as well as persons over 65. Additionally, there is the active and palpable fear of job and income loss, not only by those who are concerned about returning to normal social life, but those who have actually become ill or lost family and friends to illness and mortality in the COVID-19 pandemic as well as those who had insecure jobs in the first place. There is beginning to be some subjective reportorial literature pertaining to grief, without reference to the very extensive academic literature on stress, but with tacit or implicit knowledge that such fears and losses pertaining to health are major immediate stresses and can have long-term implications on mental health, analogous to those of what is now understood to be a classic PTSD series of events. In days of lockdown, with the loss of family members and inability to attend their funerals or even say goodbye itself can be seen as traumatic events.

But how can we reasonably predict—even in scenario terms—what the effects of COVID-19, and its corollary mental health disturbances would really look like? It is necessary to get answers to this in order to plan for public health, medical, economic, and specifically mental health policies.

Lack of Statistical Data on Mental Health Outcomes

However, in none of these suggestive articles are there any statistical analyses (4–6, 17, 18). These very effusive and "common sense" observations by the press and mental health professionals seem to be considered so obvious as to not require further substantiation through statistical data, despite the fact that elaborate attempts have been developed by major universities, the Centre for Disease Control (CDC), and the World Health Organization (WHO) to provide statistical background and forecasting in the development of the COVID-19 epidemic itself. Part of the reason that statistical data on mental health implications on COVID-19 have not been forthcoming is that the typical sources of such data, including epidemiological studies and nationally recorded suicide rates, have required from 1 to 3 years before such data are actually gathered, and sufficiently refined and validated in order to be peer reviewed or located in national databases. As a result, despite considerable sentiment in the press and in initial suggestions in scientific literature of assertions of major mental health effects, the data have not been available to substantiate the prevalence, or intensity or the lethality of such mental health effects. These types of mental health effects have often been found in emergency calls to requests for urgent mental health counseling, interpersonal violence, threat to personal and friendship relationships, accidents, heavy use of alcohol and drugs as well as suicide attempts.

Research Approaches in Recession and Suicide

The principal intellectual challenge for this paper is to produce evidence that will allow us to develop scenarios as to how the most current recession, based on shutdown of national economies in relation to COVID-19, will ultimately influence population mental health. Once again, it has been seen as "obvious" in journalistic accounts that the main mental health effect would arise out of *fear* of the COVID-19 infection itself and related mortality, as well as of potential losses of employment and income associated with that infection. Entirely missing thus far, however, has been data that would deal with a recent period of time where recessional economic losses have quantitatively influenced mental health without the influence of a major infectious pandemic. We would thus need to develop an empirical basis for understanding how, in the COVID-19 pandemic era, a significant proportion of measures of disturbed mental health would be influenced by deterioration of the economy—apart from what the COVID-19 implications of fear of infection and mortality would separately have on mental health.

This is not such an unusual problem, but rather one that has been more recently discovered as a potential epidemiological quagmire. We find this problem of separation of effects in virtually all major disaster research, where the primary research impulse is to identify the earliest short term influence of the disaster (e.g., floods, hurricanes, earthquakes, etc.) on those who immediately experience the disasters in terms of their on-the-spot threat to their lives and health. However, the losses of homes, occupations, family relations, and the elements of civilization surrounding the disaster have often been assessed in terms of their implication for mental health but not with COVID−19. This is the case, although it has been clear from the beginnings of research on life events, that these secondary, or corollary, phenomena influencing the direct economic and social relations consequences of the disaster, could have at least equal impact on the longer-term health situations (19). These corollary effects greatly concern persons indirectly subject to disasters and those in the larger surrounding communities which also feel the subsequent effects of those disasters, though not the immediacy of the natural events.

Problem of Suicide Definition

In this paper we use suicide as a mental health outcome that would provide a sense of how mental health would be influenced by the economic implications of the COVID-19 recession. Because the inherent problems of measurement in suicide epidemiology are so complex, researchers have generally shied away from trying to "control" for the complicating effects of the measurements themselves. We acknowledge that there are clear problems in definitions and measuring rates of suicide. In the present research, we try to adjust, wherever possible, for some of the more important issues in the measurement of suicide. The first problem, given the available data is the issue of definition. When national figures on suicide rates are given in official records, can we assume that such suicide rate measures give us a reasonably accurate estimate of the volume of true suicides in the population at any historical point? It is well-known that many sources of mortality recorded, such as unintentional accidents, poisonings, drownings, mortality due to alcohol, and substance abuse, may all contain considerable elements of suicidal intent. How shall the medical examiner determine in a given case, for example, whether the single car accident embodied suicidal intent, or for the other categories of accidental or unintentional deaths mentioned above? There is, of course, the major national or legal element of the designation of a death as a suicide, in that the society is concerned that the reputation of the person identified as a suicide will be greatly harmed through stigma or long-term psychological damage to friends, parents, and offspring. In many countries, suicide remains an illegal act so families will do everything in their power to present the act as an accident. Furthermore, it is difficult to know whether the suicide is a result of infection (as a few cases have been reported in the media) or a result of economic pressures. Add to this the common assumption among epidemiologists that all deaths are the subject of multicausal factors, and comorbidities, and under the best of circumstances determination of an overall causal risk of mortality due to suicide is fraught with intellectual and societal problems.

Further, exacerbating this issue of definition lies in trying to determine time sequences. Thus, the heightened risk of suicide due to alcohol abuse may result in mortality that is not easily attributable to suicide, but the reaction of a loved one to such mortality could eventuate in suicide. Such reactions are not uncommon in the case of widow or widower suicides upon learning of the deaths of a spouse, for example (20–22). And a similar literature has been reported for adolescents (23). It is frequently difficult to ascertain whether illness or disturbed life circumstances due to alcohol or drug abuse or accidents or other trauma, themselves embody suicidal intent—or result in reactions of persons closely related who then go on to actually suicide.

The ultimate definitional question then is to what degree do deaths attributable to factors such as accidental poisoning, traffic accidents, or drug abuse represent suicides and need to be added to the category of suicides, perhaps in a broader concept such as "deaths of despair." Another complicating factors is what Durkheim called anomie (in this case caused by the pandemic) and deserves further detailed study.

Estimation Methods Related to Cultural Distinctions

An additional estimation problem arises when, as in the current analysis, we deliberately include different countries, so as to try to bring about a general understanding of the factors influencing suicide as a human problem, rather than one confined to suicide in a given country. These issues may be distinct from those of definition or other cultural or legal determinants which make suicide more or less likely in a specific society. The key problems here are cultural determinants of suicide including such elements as honor, bravery, social integration, individualism, meritocracy, and—perhaps especially—religion and its taboos with respect to taking one's own life. A related issue of cultural determination arises in discussion of gender differences in suicide. Here, considerations are generally given to masculinity and/or its assumed attributes of risk taking, bravery or dominance.

Multivariable Estimation

Combined with economic factors and a sense of feeling entrapped and consequently a lack of control can contribute to helplessness and hopelessness seeing suicide as a way out thereby combining the impact of social changes due to anomie and economic changes as a result of the pandemic.

As yet, no statistical evidence exists for the very recent effect in the COVID-19 era of the radical increase in unemployment (e.g., 20% unemployment)—without the direct effects of COVID-19. There have been extensive qualitative discussions of the impact of unemployment on mental health outcomes in journalistic reports and academic papers very recently. These accounts have made reference to anecdotal data through interviews and literature reviews, and typically have made reference to how this might be playing out in real time, considering the great magnitude of such potential effects given a potential 15–20% unemployment rate. Several of these references made inferences from the most recent dramatic increase in unemployment occurring in the Great Recession of 2007–2009, when no major infectious disease epidemic occurred. Rather, the period just prior during, and following, the Great Recession was one which coincided with several mental disorder-related trends in industrialized societies. These include epidemic-like movements in alcohol consumption and abuse, drug abuse, drug poisonings, unintentional accidents, divorce rates, and other indications of family instability such as inter-personal gender based violence, child abuse etc. On the other hand it is recognized that high body mass index often attributed to behavioral factors can make people more vulnerable to COVID-19 related deaths (24, 25). BMI trends worldwide, but especially in industrialized countries have, in recent literature, been increasingly associated with disturbances to mental health, and, potentially, to increases in clinical depression (26) and also with increased likelihood of mortality due to COVID-19. These journalistic and scientific reports often melded, perhaps unintentionally, recent reports of psychological distress with the outcome of such trends, bearing in mind the long-term economic damage of the Great Recession. But, most recently, the damaged mental health assumptions emanating from this type of literature has found its way into the accurate reports of COVID-19 mental distress, focusing particularly on fear and loss related to infection, potential infection and actual COVID-19 mortality. This has given us a rather mixed picture of the blending of mental health trends of various origins with the anxiety and depression assumed to arise from the COVID-19 pandemic.

Thus, multifactorial origins of several damaging mental health trends, from the potential mental health effects of COVID-19 itself start to emerge. However, in the current COVID-19 era these journalistic reports and scientific papers have almost uniformly failed to recognize the major distinction between the mental health sequelae of COVID-19 as an infectious disease process from the accompanying massive recessional effects brought about by efforts to contain the pandemic. Yet, familiarity with the mental health effects of national economic disturbances should very quickly have focused researchers' attention on the potential and great magnitude of anxiety and depression implications of massive national unemployment rates and losses of income and wealth arising out of losses in GDP per capita, wages, and social welfare outlays. It is entirely possible that countries often have clear economic plans and strategy but do not have a mental health plan or policy as Bhugra et al. in a survey of Commonwealth countries reported that less than half of the members had a mental health policy (27).

Effects of Recession Without COVID-19 Impact

How can we develop an estimate of the potential separate and indirect effects of COVID-19 recessional losses on mental health—being a corollary effect of COVID-19—from the direct effects of the pandemic itself on compromised mental health? The easiest way to accomplish this is to examine the most recent period of large-scale employment and income losses on mental health, in the absence of the COVID-19 pandemic. That reference would be to the Great Recession and its aftermath, with large-scale economic damage, but over (what is now in the COVID-19 era) a shorter period.

In having a numerical estimate of the effects of the Great Recession on mental health outcomes, it would be possible to make a comparison to that of national economic disturbance during varying periods (i.e., lengths of time) of the COVID-19 pandemic. The challenge then would be to estimate, for example, the numerical implications of an increase in unemployment during the Great Recession with a similar actual numerical increase in unemployment during the COVID-19 era.

Estimating Major Effect of GDP per Capita

In developing such estimates of the actual vs. the potential impact of national recession on mental health outcomes, it is, in our view, of great importance to additionally separate the effects of short- and long-term losses of employment from the effects of income loss. The reason is that even in very major recessions only a minority of the population suffers employment loss, while actually a substantial majority of the population suffers losses of income and wealth. To put the income issue in broader perspective, it should simply be pointed out that virtually any goal of individual persons in their ordinary life adaptation and behavior, from food security, poverty minimization, and obtaining the worthwhile things in life in a market economy, requires finances. At the national level, income per capita also involves government revenues which are essential to the provision of health care, education, scientific and technological investments—often in the biomedical sphere. And for the younger population, the income base is essential for career development, social mobility and family formation that are fundamental goals. Interestingly, there have been very few studies that have separately examined the effects of income loss in the short term, and especially in the long term given government policies of austerity, on mental health implications apart from employment losses. An intermediate literature, lying between company losses and employment losses has in the last several years been concerned with firm downsizing—especially in the wake of the Great Recession (28). This managerial approach to occupational mental health has almost uniformly been able to demonstrate damage to mental health outcomes, for small and large businesses. A more remarkable finding in this literature is that in the downsizing process even workers who remain employed appear to show increased disturbances to mental health (29).

The absence of attention to GDP declines in previous literature on the effects of recession on mental health is particularly problematic, since welfare payments, including unemployment payments and assistance to firms in maintenance of jobs, as well as health care access and expenditures, have suffered considerably with the decline in government revenues which have been the basis of austerity budgets. These have been largely evident in Europe but have also been documented in North America (30, 31).

Control for Education and Other Confounders

Added to the most visible outcomes of government austerity on poverty minimization are declines in government investment in education. This has not only had very serious effects on the ability of younger workers to develop careers in times of recession, but have led to longer-term effects on life time earnings and loss of productivity gains. The latter point of productivity growth diminution is estimated to have important implications for at least the next generation of workers and governments (32, 33).

Further compounding previous analyses of mental health effects due to recession has been the lack of use of multivariable models predicting, e.g., suicide, but taking into account other major sources of risks than the immediacy of recession, such as alcohol and drug abuse or accidental mortality. And, as indicated earlier, the lack of control for such potential risks often hide significantly the inherent suicidal intent (or actuality), of suicidal behavior represented by such risks. Thus, the absence of control for such factors, at the very least, increases the risk of misestimation of the actual level of suicide that is contingent upon economic damage.

A perennial problem in the analysis of suicide, since at least the time of Durkheim, has been the population samples on the basis of which suicide is estimated or predicted (34). On the one hand, one would prefer, on statistical grounds, to have as large and representative a multicultural population as possible. In this way, it becomes easier to make general statements about the effects of particular risk factors, such as unemployment, on the broad nature of mental health. On the other hand, since it is widely acknowledged that cultural factors are of distinctive value in developing models to predict suicide, it is of special importance to focus one's statistical analysis on culturally homogenous societies where, cultural norms, values and beliefs can be controlled more easily. Fortunately, more recent approaches in epidemiology, often referred to as "econometric" allow the analyst to control for such cultural factors in a multisocietal framework by using "dummy" or binary variables to identify geographic or politically identified ecological areas (i.e., specific geographical areas = 1 other areas = 0). All in all, it is now feasible to construct models predicting mental health outcomes, which can include not only major national economic events, but control, within the same model for risk and definitional factors as well as regional distinctions which discriminate cultural and political attributes of regions (35).

Country Differences and Opportunity Costs of Policy

Nevertheless, the choice of overall region to be the subject of statistical analysis remains fundamentally important. This is particularly true in the case of psychiatric outcomes, where, among the world's societies, there are large distinctions as to the psychiatric reliability of a suicidal diagnosis. In this paper, we therefore focus on uniform data available from the OECD, which is largely based on data from the most highly industrialized societies. The presumption is that data from these societies on suicide are likely to respect the psychiatric and scientific conventions of mental health diagnoses, and less likely to be heavily influenced by religious or other societal stigmas that would serve to contaminate criteria for coroners or medical examiners (official reports) (36).

Welfare, Unemployment Benefits, Aid to Businesses

In modeling the prediction of suicide in industrialized societies, it is clearly important to take into account the variety of beneficial factors that might influence societal anxiety and depression. Important in this regard are professional social welfare efforts usually through government expenditure, to manage societal mental health problems. This is especially true since the relation between lower socioeconomic status and poor mental health is so widely acknowledged it is of special importance to concentrate on issues of poverty, homelessness, unemployment or insecure employment and long-term psychiatric disability in minimizing suicide. Thus, societies are faced with the usual issues of opportunity cost as they face political decisions involving physical and mental health. To what degree does the society concentrate on basic support of material living conditions and education as distinguished from more highly medicalized attempts to improve overall health or mental health levels. This involves intense political discussions which are important here but are not the direct subject of this paper. Nevertheless, in the statistical modeling process, one needs to bear in mind not only the level of society's overall income and wealth, but rather the specific monies allocated to promote differential societal goals that also promote health. This is clearly a limiting factor in the use of the GDP per capita as a primary source of influence on mental health; yet, with a reduced GDP per capita there is less governments can achieve, regardless of their competing policies. It is clear, then, that the sheer magnitude of GDP per capita is a prime limiting factor in how much governments can accomplish in order to improve mental health.

Potential Effects of Mental Health Services

It is worth looking at the impact of COVID-19 on mental health in stages. For example, first stage of quarantine, self-isolation may bring with it certain stressors especially if individuals are living by themselves or nuclear family settings in many high income countries. Second stage will be of infection and isolation either at home or in hospital. Bereavement as a result of death of a loved one and inability to attend funerals in lockdown situations will affect coping with grief and may well-lead to abnormal grief reactions. In many countries an inability to perform rituals after a death can further add to distress and resulting depressive feelings. Some individuals may go on to experience survivor guilt. Each of these observable stages will affect mental health and well-being of individuals. In low income countries which may be socio-centric, additional pressures may play a role. Thus, the fear of catching the infection can lead to avoidance anxiety, the sense of being entrapped can lead to depression and grief reaction due to loss and bereavement followed by managing survivor guilt and each of these conditions can contribute to increased likelihood of self-harm or suicide. In all the preparations for dealing with the pandemic, the emphasis initially was on prevention and then treatment, the focus on mental health emerged later. In dealing with mental ill-health the focus must be on individual, family, community, and then national and global responses.

Statistical Analysis

Pooled Cross-Sectional Time Series (PCSTS) Analysis

It is common that for some observational studies, observations are available over a sequence of points in time, e.g., countries and years as in our case. Taking into account only one dimension, i.e., space or time, would restrict us to perform classical cross-sectional or time series regression analysis. Using more advanced techniques (37, 38), i.e., pooled cross-sectional time series analysis, allows us to model simultaneously the space and time dimension. The usefulness of the PCSTS approach for health care systems analysis is described e.g., in Reibling (39).

The PCSTS method combines two approaches. The more familiar is cross-sectional analysis, where, in this case, countries of the OECD are the units of analysis (i.e., 38 countries). We examine multiple cross-sectional analyses corresponding to the 18-year period-—2000–2017 for which all of the data representing the individual variables are available for the OECD countries. All variables used in these PCSTS analyses are based on aggregated data—i.e., population rates rather than individual-level data (40)[1]. In addition to the cross-sectionality of this procedure, the technique simultaneously entails time-series analysis, involving variations over time in the individual predicted variables and the outcome variable, suicide (41).

PCSTS models can be regarded as extensions of a common linear regression model where for the pooled observations the error term is split up in a unit specific term and a stochastic remainder disturbance. Different assumptions about the stochastic properties of the unit specific term raise two main PCSTS models: the fixed effects and the random effects estimator. The fixed effects model assumes that the unit specific term is non-stochastic and constant over time. The random effects model treats the unit specific term as a stochastic entity. Methodological details for both models and the estimation techniques are provided in Baltagi and Wooldridge. Disadvantages of the fixed effects estimator are that it cannot deal with variables that do not change over time and that it provides imprecise estimates when variables change only slowly over time (42). As our models include dummy variables which cover specific effects of selected countries, the random effects estimator is used for all models.

PCSTS is a well-established procedure in economics over the last 30 years and has recently been introduced in health service research and epidemiology (43, 44). The findings are easily replicable with enclosed data sources by a statistician using STATA.

Key Variables

Three types of variables included in this model are dependent, independent, controls.

Dependent

Age-adjusted suicide in international WHO database, according to coroner's and/or medical examiner's, ICD code separately by sex and age—for each OECD industrialized country.

Independent

Macroeconomic and unemployment variables. These are the basis of our hypothesis—as related to recession of 2008-10, depending on country.

Control

Divorce, etc.; unintended injuries (now the third highest cause of death in the United States 2020); accidents (especially automobile; single car); self-poisonings; drug overdoses; fire/burns; drownings.

These above control variables could actually represent suicides but for factors relating to stigma, or classification "error" given the specifications of the ICD code, these "causes" of death may in many instances be actual proximal mechanisms of suicidal death, where the mental "intent," e.g., a state of depression, might be the true psychological state which underlay (i.e., were foundational to) these mechanisms of death (e.g., drug overdoses)—and may in fact represent suicidal behavior.

From a methodological point of view we want to hold constant other risks of suicide that could also be correlated with both economic changes and officially identified suicides. Without these controls, the effects of economic change could either be underestimated or overestimated.

Forecasting of Effects of COVID-19 Recession on Mental Health and Suicide

The statistical models demonstrating the sheer implications of unemployment increases and national income (GDP per capita losses) over 2000–2017 provide the basis for understanding, and ultimately estimating, the potential future mental health and suicidal impact of the recessional phenomena during the ongoing, and rapidly continuing—in terms of its consequent production of economic recession. But at this point we do not know how intense or lengthy the COVID-19 recession will be among industrial democracies of the OECD. Equally important, we have no foreknowledge of what the individual governments may invest in unemployment, business, welfare, health care, and educational relief and stimulus to maintain economic stability and mitigate poverty as COVID-19 and its sequelae proceed. It is clear that different governments are responding in different

[1]See discussion of the use of aggregated data in epidemiological analysis in Szklo and Nieto.

ways. Further, the epidemiological literature indicates that the economic impact of employment and income loss and poverty may lag over a range of at least 5–10 years, if not a generation. Therefore, the coefficients showing twenty-first century relations between income and employment loss and mental health, must, in practical policy discussions, be stated in terms of scenarios that refer to potential policy decisions on the part of governments.

RESULTS

The Suicide Models for Industrialized Countries

The models we have constructed represent predictions of suicide rates among the 38 highly industrialized OECD countries over a period of 18 years (2000–2017) (see **Tables 1**, **2**). There are two sets of models, for males and females that separately demonstrate relations for 5-year age groups over the life course. All models contain at least three basic variables. These are the two economic variables representing the effect, firstly, of changes (fluctuations and trends) in GDP per capita, with a 5-year lag. The 5-year lag is intended to capture especially the effects of innovations in pharmaceuticals and medical procedures, generally effectuating lower mortality rates across the age spectrum. The GDP per capita is also the principal factor that is identified by economists to represent changes in the business cycle, where a decline in GDP over at least 2 quarters by definition represents recession. The other major economic variable, perhaps more famous journalistically for its representation of recession, is the unemployment rate as a proportion of the total labor force of workers over the age of 15.

The third variable common to all models (irrespective of gender and age groups) is the mortality rate for substance use disorders (i.e., mental and behavioral disorders due to psychoactive substance use death rates [ICD-10 F10-F19]). This ICD categorization of mortality typically represents addictive behavior or abuse of especially alcohol and illicit drugs being used for psychopharmacological reasons in mood alteration, generally not under the regulation and prescription of medical personnel. The literature is unable to fully discriminate between the effects of substance abuse that is the product of suicidal intent, from the effects of substance abuse that causally results in suicide (but which may not have been originally intended). We include the substance abuse disorder/death rate as a means of controlling for the fact that the nationally designated suicide rate may insufficiently refer to the substance abuse death rate that involves suicidal intent or consequences.

Additional variables predicting suicide among the industrialized countries are differentiated between males and females (see **Table 5**). Especially important for males is the ICD category poisonings death rate, which often results from inadvertent overdose of various poisonous substances (45), including opioids which often involve abuse of pharmaceutically prescribed drugs for pain and psychophysiological reasons, including opioids. Once again, it is not evident whether a large proportion of these drug poisonings imply suicidal intent, or whether a suicidal outcome may result from overdosing of these substances. It is not at all clear, theoretically, why male populations should be more subject to the poisoning death rate as it may relate to suicide data, but our initial observations have been that the male poisoning death rate is especially correlated with the overall male suicide rate, whereas the female poisonings death rate is not significantly associated with the female suicide rate. On the other hand, the diagnostic category "adverse effects of medical treatment" death rate of females is highly correlated with the female suicide death rate—especially for younger age groups—but these adverse effects of medical treatment are not significantly related to male suicide rates. It is not immediately evident how gender for these diagnostic categories of mortality should differentially affect male and female suicides. However, there are indications in the literature that females in industrialized countries with mental disorders, and especially with suicidal attempts, are more likely to receive medical/psychiatric treatment than males (46, 47). It is also possible that females, evidencing suicidal intent in their use of prescription drugs, may be more likely to be classified as suicides than males. Once again, it would require careful analysis to determine whether, and to what degree, the overuse of pharmaceutical drugs implies suicidal intent or, rather, that the pharmaceutical drug overuse results in suicide.

The number of potential suicide-related categories that significantly predict suicide are somewhat longer in the case of male populations as compared to females. In the case of males, the death rate category of "road traffic injuries" is significantly correlated with male suicide, as are, in addition, death rates associated with "fire, heat, and hot substances." The literature, here again, is not very clear as to why these categories of death should be more closely associated with male suicide. However, there are studies of suicide patterns that generally indicate that males are considerably more likely to use violent means in suicidal acts, whereas female suicides are more typically associated with relatively passive methods, including substance abuse and drug overdose (48, 49).

Life Cycle Distribution

Male and female suicides differ considerably in their pattern of relationship to the principal economic phenomena GDP per capita and unemployment (see **Figures 1**, **2** and **Tables 3**, **4**). Males at every single one of 14 age groups 15–19 through 80+ show highly significant inverse relations to GDP per capita. As GDP per capita rises, male suicides inevitably decline. The first portion of the life cycle at which the inverse relationship between GDP per capita and suicide declines is between 20–24 and 40–44, with the peak of these inverse relationships at 35–39 and 40–44. The youngest period of life during which male suicides strongly decline in relation to economic growth is in early middle age, i.e., 30–44. In other words, economic damage caused by decline in national income and wealth has an especially powerful damaging effect on elevating male suicides in early middle age.

The second period in which male suicides are highly sensitive to economic changes is after the age of 60. That sensitivity is moderately strong between 60 and 74, but rises to a peak in the ages over 75 (75–79 and over 80). Once again, this means that the period of life for males during which declines in material well-being are most likely to be associated with increased suicide are

TABLE 1 | Prediction of suicide death rate (intentional self-harm, ICD-10 X60-X84) in male population.

Predictor	Coef.	*P*-value	95% CI lo	95% CI hi
Five year lag of GDP per capita at PPP in '000 of 2011 international dollars	−0.176	0.000	−0.226	−0.126
Unemployment rate as % of total labor force age 15+	0.126	0.000	0.074	0.177
Mental and behavioral disorders due to psychoactive substance use death rate (ICD-10 F10-F19)	0.294	0.000	0.209	0.380
Road injuries death rate (ICD-10 V01-V89)	0.132	0.000	0.072	0.192
Exposure to fire, heat, and hot substances death rate (ICD-10 X00-X19)	0.883	0.000	0.664	1.102
Accidental poisoning by and exposure to noxious substances death rate (ICD-10 X40-X49)	2.064	0.000	1.522	2.605
Regional dummy (1 = Greece and Turkey, 0 = rest of the world)	−13.367	0.000	−18.369	−8.366
Regional dummy (1 = Central America, 0 = rest of the world)	−11.078	0.000	−16.083	−6.073
Regional dummy (1 = Eastern Asia, 0 = rest of the world)	14.605	0.000	9.601	19.609
Regional dummy (1 = Western Europe, 0 = rest of the world)	5.859	0.000	2.854	8.863
Regional dummy (1 = Slovenia and Hungary, 0 = rest of the world)	11.795	0.000	6.836	16.755
Constant	15.555	0.000	12.877	18.232

Random-effects pooled GLS regression for 38 OECD countries and 18 years (2000–2017), strongly balanced data. Overall R-square 0.82. All death rates are age-adjusted per 100,000 male population.

TABLE 2 | Prediction of suicide death rate (intentional self-harm, ICD-10 X60-X84) in female population.

Predictor	Coef.	*P*-value	95% CI lo	95% CI hi
5 year lag of GDP per capita at PPP in '000 of 2011 international dollars	−0.129	0.000	−0.143	−0.116
Unemployment rate as % of total labor force age 15+	0.031	0.003	0.010	0.051
Mental and behavioral disorders due to psychoactive substance use death rate (ICD-10 F10-F19)	0.434	0.000	0.355	0.513
Adverse effects of medical treatment death rate (ICD-10 T36-T50, T80-T88)	0.161	0.416	−0.228	0.551
Regional dummy (1 = Greece and Turkey, 0 = rest of the world)	−2.816	0.008	−4.897	−0.734
Regional dummy (1 = Central America, 0 = rest of the world)	−3.492	0.001	−5.624	−1.359
Regional dummy (1 = Eastern Asia, 0 = rest of the world)	9.396	0.000	7.304	11.487
Regional dummy (1 = Western Europe, 0 = rest of the world)	3.959	0.000	2.533	5.385
Regional dummy (1 = Australia and New Zealand, 0 = rest of the world)	2.302	0.030	0.225	4.378
Regional dummy (1 = Slovenia and Hungary, 0 = rest of the world)	2.967	0.005	0.884	5.049
Regional dummy (1 = Scandinavia, 0 = rest of the World)	3.871	0.000	2.308	5.434
Regional dummy (1 = Switzerland and Luxembourg, 0 = rest of the world)	3.324	0.006	0.973	5.676
Constant	6.157	0.000	5.237	7.077

Random-effects pooled GLS regression for 38 OECD countries and 18 years (2000–2017), strongly balanced data. Overall R-square 0.72. All death rates are age-adjusted per 100,000 female population.

over the age of 60, and especially over 75. The age of retirement varies across countries.

This is in contrast with the age specific pattern of suicide for women. In the case of females, we find, remarkably, what is virtually a linear, dose-response relationship between age and suicide. The older the age of the female population, the more likely is the occurrence of suicide in relation to declines in GDP per capita. Somewhat similar between the sexes is the unusually strong increases in suicide in the later stages of the life cycle, 75–79 and over 80 years of age. Thus, especially for women, losses of income appear increasingly important with increases in aging. And the most powerful effect of income loss in relation to female suicide is in the very late ages of life.

Unemployment and Suicide Over the Life Cycle

In contrast to the relation of suicide to GDP change, for males the relationship between unemployment and suicide is highest in early and late middle age (40–64) and disappears entirely after the age of 70 (see **Figure 3**). This presumably reflects the duration of the usual working life and being laid off later in life, when there is little potential to find new employment. In the case of women, the relation between unemployment and suicide is generally weaker than that for men. The peak of the female relationship between ages 40–54 to unemployment nevertheless remains strong even in the ages 65–74 (see **Figure 4**), while, as in the case of males it disappears entirely after the age of 75.

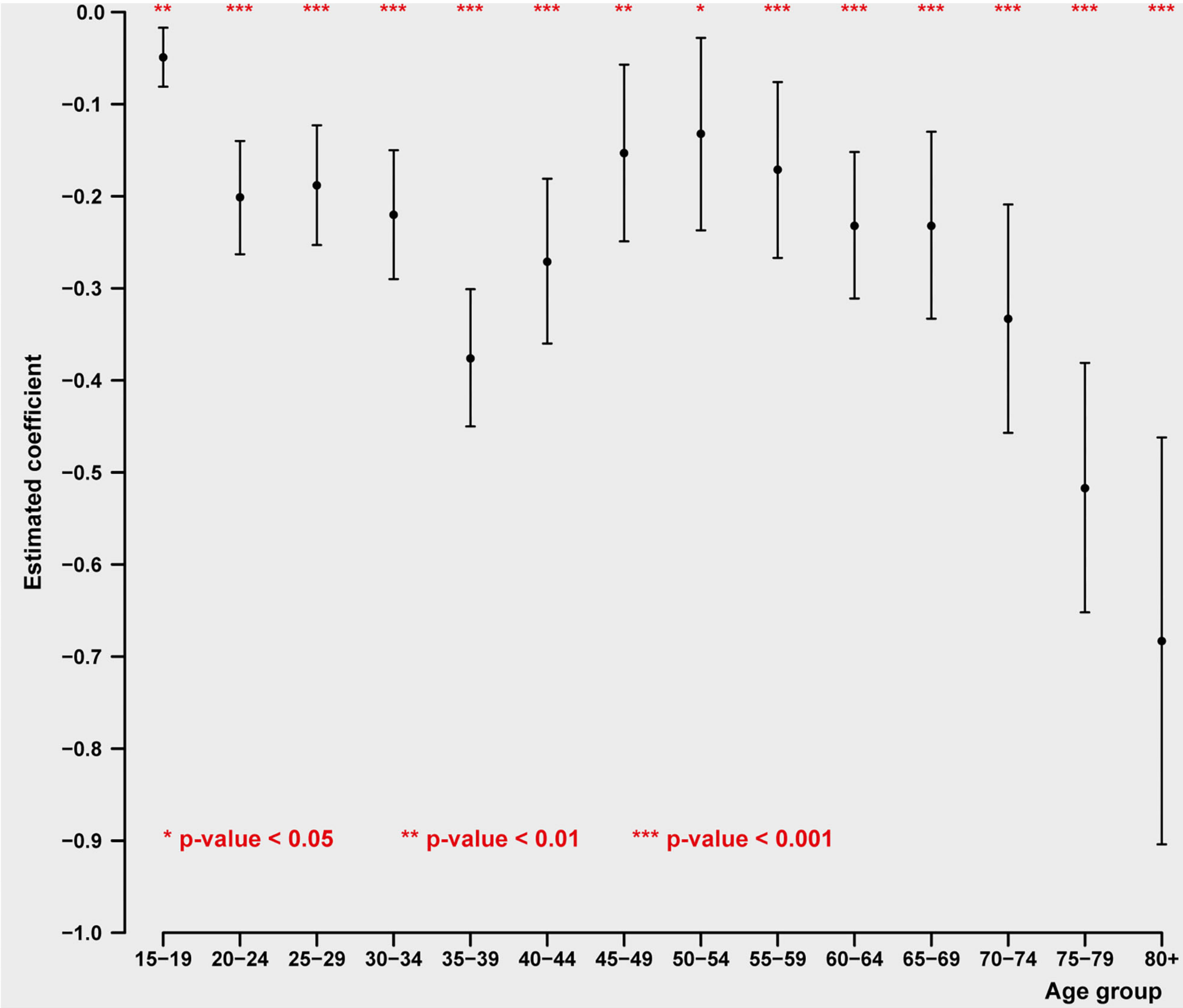

FIGURE 1 | Impact of GDP pc on age-specific male intentional self-harm (ICD-10 X60-X84) death rate (pooled cross-sectional time series regression, 38 OECD states, years 2000–2017). Estimated coefficients with 95% confidence intervals. Adjustment variables: unemployment rate, mental, and behavioral disorders due to psychoactive substance use (ICD-10 F10-F19) death rate, road injuries (ICD-10 V01-V89) death rate, exposure to fire, heat, and hot substances (ICD-10 X00-X19) death rate, accidental poisoning by and exposure to noxious substances (ICD-10 X40-X49) death rate, regional dummies.

General Life Cycle Relations to "Deaths of Despair"

In principle, as shown in **Tables 3**, **4** the major effects of income loss should occur at two key stages in the life cycle. The first is at "middle age" of ∼35–55 age groups; this represents both the height of job earnings as well as the period after which it is most difficult to find work following job loss.

The period over 65 encompasses the ages presumably least expected to be influenced by unemployment, since unemployment is lowest at this period. At the same time, the ages over 70 are those with the highest rates of poverty in industrialized countries (50). And we do find, for both sexes, at ages over 70, when suicide responds the most sensitively—i.e., in terms of the greatest increase—to declines in income per capita.

If we now examine the relations of potential mechanisms of suicide to nationally identified suicide rates, we find similar patterns. For male substance abuse and road injury (death rates), the relation of mortality to identified suicide (death rates) come to a broad peak level at 35–54 (see also **Table 5**). Fire, heat and hot substances, as well as poisonings, mortality are related to suicide mortality at somewhat later middle ages of ∼55–69 and 40–74. Apart from this pattern for males, youthful mortality for substance abuse; fire, heat, and hot substances; and poisoning deaths also occur at another general peak at a range of 15–19 through age 35.

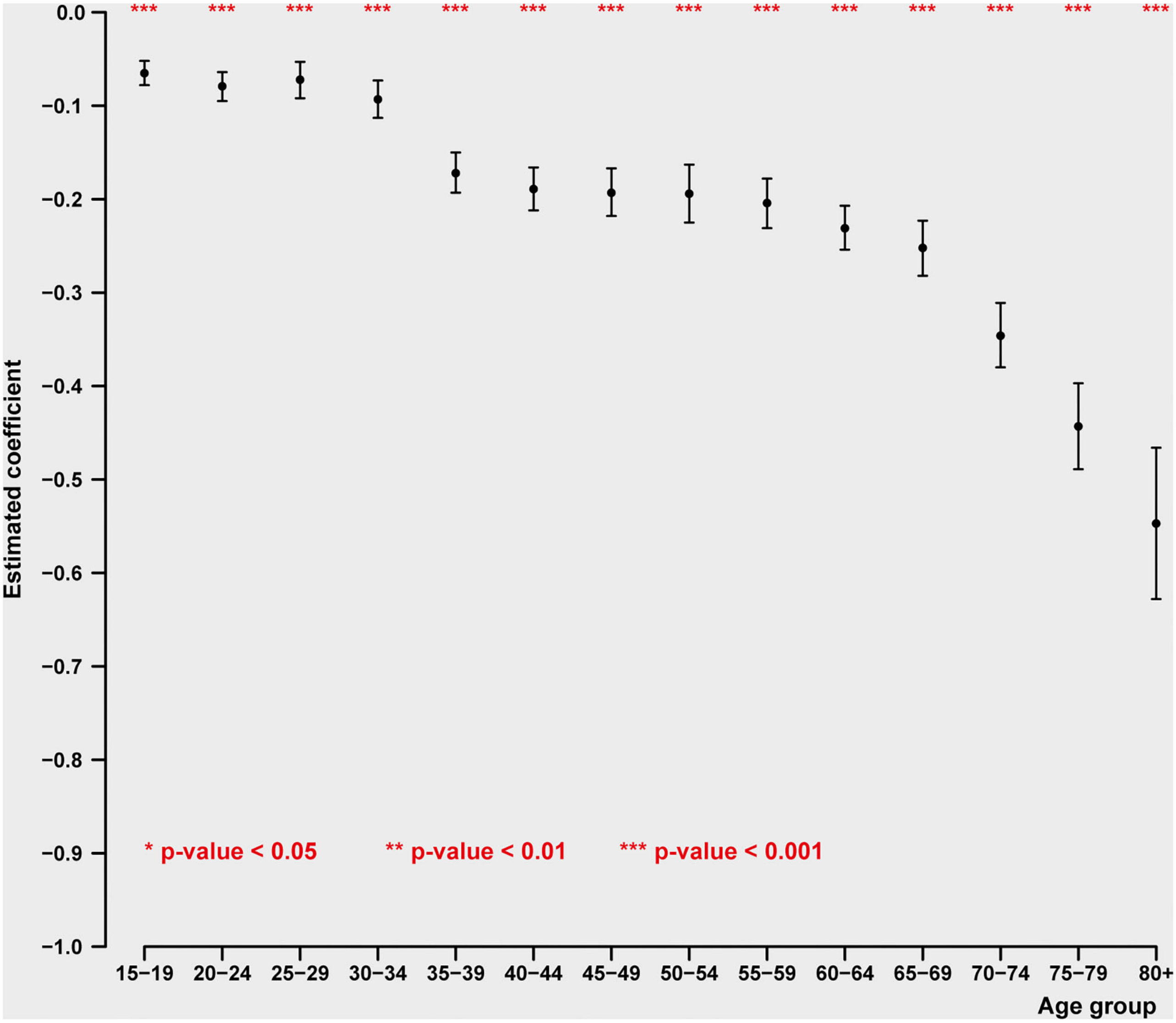

FIGURE 2 | Impact of GDP pc on age-specific female intentional self-harm (ICD-10 X60-X84) death rate (pooled cross-sectional time series regression, 38 OECD states, years 2000–2017). Estimated coefficients with 95% confidence intervals. Adjustment variables: unemployment rate, mental, and behavioral disorders due to psychoactive substance use (ICD-10 F10-F19), adverse effects of medical treatment death rate (ICD-10 T36-T50, T80-T88), regional dummies.

For women, a middle-age high level range in substance abuse mortality, correlated with female suicides, occurs at 35–39 through 60–64. But additionally high levels of substance abuse mortality related to suicide occur at the younger ages of under 19 through 30, and at the very high age range of 65–69 through 75–79. Perhaps most remarkable are the very strong correlations between female mortality identified with adverse effects of medical treatment and official female suicide rates. Unusually strong relations are found under age 30, with relatively strong relationships between the "standard" 30–54 (middle-aged) suicide rates, but no significant relations after age 54. There is a considerable likelihood that these strong relationships to suicide mortality are consequences of adverse relations to pharmaceuticals of which over 200 have been identified (51).

DISCUSSION

Relation of Findings to the Literature

There is, certainly, an extensive and lengthy set of literature in psychiatry, psychology and the newer field of psychoneuroimmunology on stress as a source of mental health disturbances of many different varieties and, especially, of anxiety, depression, and suicide (52–54). This gives rise, on a scientifically professional level, to theoretical considerations that it is very likely that conditions such as COVID-19, and its direct ramifications for stress, will be sources of frank mental illness and suicide. But, surprisingly, this initial set of journalistic and professional suggestions for a stress basis of mental health disorders, resulting from COVID-19, heavily concentrate on

TABLE 3 | Impact of key economic variables (5 year lag GDP pc, unemployment rate) and key mortality rates [substance use (ICD-10 F10-F19), road injuries (ICD-10 V01-V89), fire/heat (ICD-10 X00-X19), and poisoning (ICD-10 X40-X49)] on male intentional self-harm (ICD-10 X60-X84), total age adjusted mortality and 14 age groups.

	5 year lag GDP		Unemp rate		Substance use		Road injuries		Fire, heat		Poisonings	
	Coeff.	***P*-value**	**Coeff.**	***P*-value**	**Coeff.**	***P*-value**	**Coeff.**	***P*-value**	**Coeff.**	***P*-value**	**Coeff.**	***P*-value**
Total age adjusted	−0.176	0.000	0.126	0.000	0.294	0.000	0.132	0.000	0.883	0.000	2.064	0.000
15-19	−0.049	0.003	0.070	0.000	0.960	0.000	0.114	0.000	4.129	0.000	2.443	0.000
20-24	−0.201	0.000	0.093	0.000	0.370	0.000	0.137	0.000	3.389	0.000	2.990	0.000
25-29	−0.188	0.000	0.042	0.022	0.192	0.000	0.170	0.000	1.905	0.000	4.216	0.000
30-34	−0.220	0.000	0.103	0.015	0.178	0.000	0.209	0.000	1.620	0.000	1.845	0.000
35-39	−0.376	0.000	0.167	0.000	0.384	0.000	0.162	0.000	1.203	0.000	1.078	0.004
40-44	−0.271	0.000	0.352	0.000	0.474	0.000	0.324	0.000	0.328	0.012	1.990	0.000
45-49	−0.153	0.002	0.457	0.000	0.382	0.000	0.386	0.000	0.639	0.000	1.636	0.000
50-54	−0.132	0.013	0.479	0.000	0.303	0.000	0.206	0.001	0.211	0.067	3.340	0.000
55-59	−0.171	0.000	0.062	0.000	0.207	0.000	0.007	0.895	1.077	0.000	2.168	0.000
60-64	−0.232	0.000	0.235	0.000	0.090	0.007	0.029	0.445	0.749	0.000	1.380	0.000
65-69	−0.232	0.000	0.122	0.061	0.019	0.700	0.193	0.000	0.661	0.000	1.371	0.000
70-74	−0.333	0.000	0.000	0.998	−0.261	0.000	0.082	0.089	0.000	0.000	2.453	0.000
75-79	−0.517	0.000	0.027	0.718	−0.455	0.000	0.109	0.016	0.876	0.000	−2.943	0.000
80+	−0.683	0.000	0.093	0.460	−0.737	0.000	0.052	0.385	0.391	0.003	0.212	0.773

Pooled cross-sectional time series regression, 38 OECD states, years 2000–2017. Estimated coefficients and P-values.

fear of the infectious implications of COVID-19. The most surprising implication, however, is that very little attention appears to have concentrated on actual losses, emanating from the radical termination of jobs (especially in the industrialized world, and most especially in the United States), and even less attention seems to have been given to financial losses of income and wealth in the short and long term. This is rather surprising in view of the fact that much of the professional literatures on stress, life events, and economic losses, have concentrated for generations on both the mental and extensive "physical" effects—especially in illnesses that have been classically linked to acute and long-term stress, such as cardiovascular symptoms and mortality. Indeed, given the volume of chronic disease and accidental mortality, one might wonder whether the potential burden of illness and mortality resulting from economic losses might not be greater from those that are more directly affected than are assumed to follow from the fear of COVID-19 infection and mortality.

Loss, Anxiety, and Depression

The scientific literature is now fairly extensive on the distinction between short and long-term effects of stress, especially as it would pertain to anxiety, depression and psychophysiologic changes. In particular, very short term stresses have been thought to actually be a source of beneficial stress—i.e., "eustress" as originally formulated by Selye (55). In the acute stress situation, under the assumption that it is indeed short term and will pass, the elevation of physiologic responses would tend to increase the likelihood that the subject can cope successfully, or deflect the stress itself so that its duration remains limited. On the other hand, longer-term, or chronic stress, including "daily hassles" (56) are generally thought to be sources of considerable mental health damage, and extensive harm to physiological function, through the emergence and sustained pattern of chronic disease (57). It is this depiction of long-term stress that is often associated with declines in population longevity.

Individual vs. Population Approaches to Anxiety, Depression

From the earliest days of psychiatric epidemiology (58–60), the evidence has been robust and clear that lower socioeconomic groups evidence higher rates of mental disorder in a dose-response, relatively linear gradient. This traditional literature has often been interpreted in materialistic terms, but more analytical researchers such as Hollingshead and Redlich (61) and Leighton (62) have focused on psychological stress interpretations of the social class-mental health relationship.

Since the period of the Great Depression, Marie Jahoda, Peter Warr, and other sociologists (63, 64) have focused on the disintegrative social and psychological effects of losses of employment and its meaning in terms of damage to identity, self-esteem, social relations, and social support. Following the epidemiological studies of Hollingshead and Redlich in New Haven, Brenner found that, for over a century and a half, mental hospitalization coincided with decreases in employment in New York State (65). This early macroeconomic study, explicitly looking at national and regional economic changes, gave rise to the work of more localized studies with smaller samples of the effect of economic loss on mental health indicators, especially by Catalano and Dooley (66, 67). The latter researchers

TABLE 4 | Impact of key economic variables (5 year lag GDP pc, unemployment rate) and key mortality rates [substance use (ICD-10 F10-F19), adverse effects of medical treatment (ICD-10 T36-T50, T80-T88)] on female intentional self-harm (ICD-10 X60-X84), total age adjusted mortality and 14 age groups.

Total age adjusted	5 year lag GDP pc		Unemployment rate		Substance use		Adv effects med treatment	
	Coeff.	***P*-value**	**Coeff.**	***P*-value**	**Coeff.**	***P*-value**	**Coeff.**	***P*-value**
	−0.129	0.000	0.031	0.003	0.434	0.000	0.161	0.416
15–19	−0.065	0.000	0.018	0.000	1.138	0.000	12.650	0.000
20–24	−0.079	0.000	0.021	0.000	0.431	0.000	12.288	0.000
25–29	−0.072	0.000	0.031	0.055	0.237	0.000	10.119	0.000
30–34	−0.093	0.000	0.019	0.251	0.216	0.000	5.026	0.000
35–39	−0.172	0.000	0.055	0.020	0.341	0.000	5.532	0.000
40–44	−0.189	0.000	0.085	0.000	0.403	0.000	3.268	0.000
45–49	−0.193	0.000	0.105	0.000	0.405	0.000	4.191	0.000
50–54	−0.194	0.000	0.088	0.000	0.448	0.000	3.689	0.000
55–59	−0.204	0.000	0.066	0.003	0.439	0.000	0.009	0.979
60–64	−0.231	0.000	0.050	0.014	0.408	0.000	0.198	0.335
65–69	−0.252	0.000	0.070	0.005	0.311	0.000	0.243	0.100
70–74	−0.346	0.000	0.069	0.015	0.357	0.001	−0.130	0.188
75–79	−0.443	0.000	0.050	0.181	0.697	0.000	−0.081	0.294
80+	−0.547	0.000	0.057	0.379	0.303	0.034	−0.028	0.535

Pooled cross-sectional time series regression, 38 OECD states, years 2000–2017. Estimated coefficients and P-values.

TABLE 5 | Variables used to predict elevated suicide rates.

Predictor variables	Data sources	Countr.	Time period
Self-harm death rate per 100,000 of male age adjusted population	IHME Global Health Data Exchange	192	2000–2017
5 y/lag of GDP per capita, PPP (constant 2011 international $)	World Bank, International Comparison Program database	191	1990–2017
Unemployment rate (%) in total population 15+	ILOstat	189	1991–2017
Substance use disorders death rate per 100,000 of male age-standardized population	IHME. Global Health Data Exchange. GBD Results Tool	192	2000–2017
Road injuries death rate per 100,000 of male age adjusted population	IHME. Global Health Data Exchange. GBD Results Tool	192	2000–2017
Fire, heat, and hot substances death rate per 100,000 of male age adjusted population	IHME. Global Health Data Exchange. GBD Results Tool	192	2000–2017
Poisonings death rate per 100,000 of male age adjusted population	IHME. Global Health Data Exchange. GBD Results Tool	192	2000–2017
Self-harm death rate per 100,000 of female age adjusted population	IHME. Global Health Data Exchange. GBD Results Tool	192	2000–2017
Substance use disorders death rate per 100,000 of female age-standardized population	IHME. Global Health Data Exchange. GBD Results Tool	192	2000–2017
Adverse effects of medical treatment death rate per 100,000 of female age adjusted population	IHME. Global Health Data Exchange. GBD Results Tool	192	2000–2017

particularly concentrated on the potential circular relationship of the effects of prior mental disorder on job loss, potentially leading to subsequent effect of job loss on deteriorating mental health. At the population level this would mean that the mentally ill-compromised would be more vulnerable to potential job losses during recession, and find it more difficult to retrieve employment when economic recovery subsequently emerged. This duality of approach currently seems to be the more consensual frame of reference in psychiatric epidemiology. Nevertheless, an even more current literature has emerged since the Great Recession, focusing on the downsizing of firms, where it appears clear that job reduction heightens mental health problems (28). And even more novel is the observation that downsizing also has damaging mental health effects on those who remain in employment as recession envelops a firm (29).

Socioeconomic Status Approaches, Especially Income in Relation to Mental Health

In the history of Western epidemiology, socioeconomic status is perhaps the single most consistent explanatory factor in terms of understanding the distribution of mental health problems.

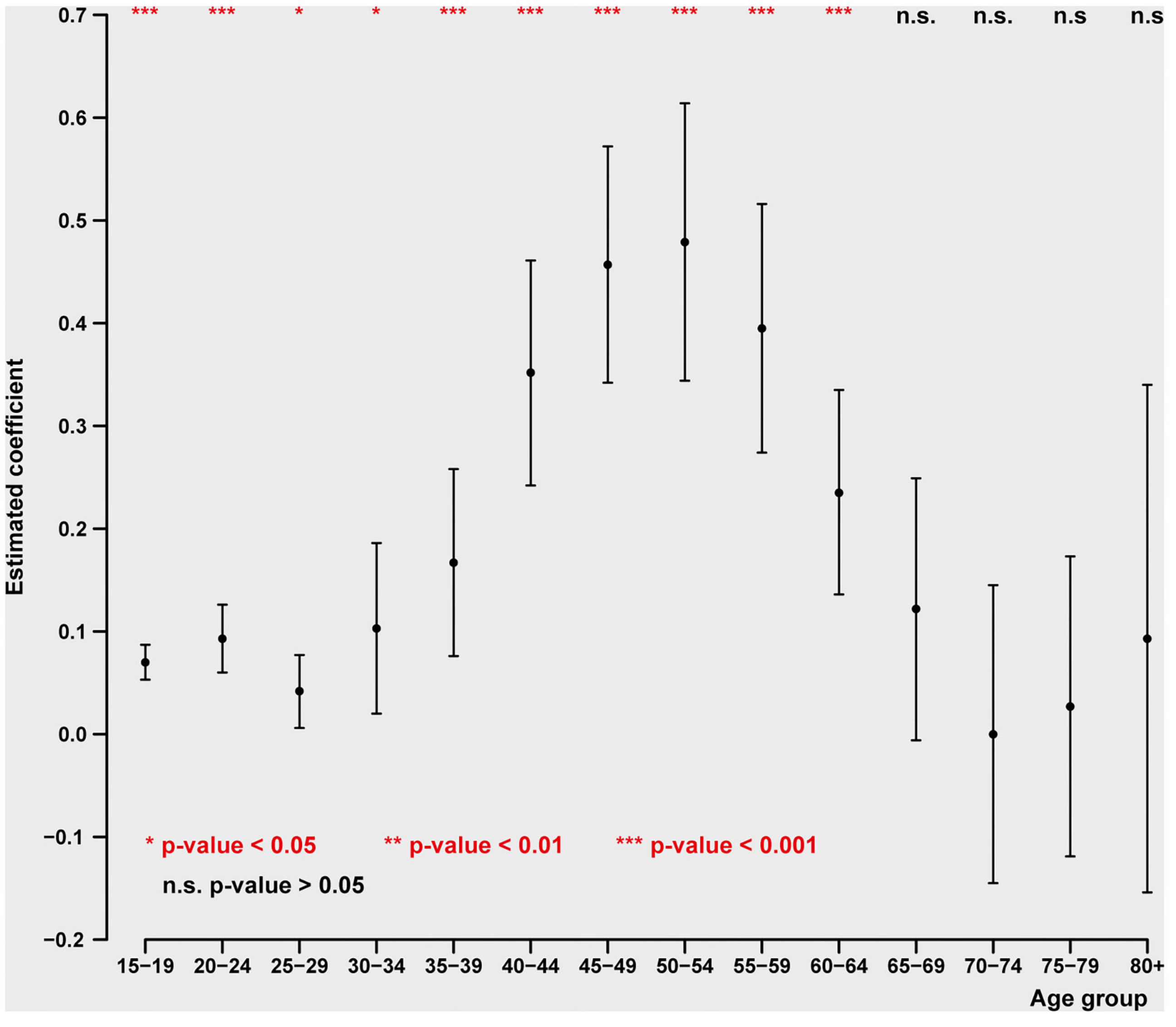

FIGURE 3 | Impact of unemployment rate on age-specific male intentional self-harm (ICD-10 X60-X84) death rate (pooled cross-sectional time series regression, 38 OECD states, years 2000–2017). Estimated coefficients with 95% confidence intervals. Adjustment variables: GDP pc, mental, and behavioral disorders due to psychoactive substance use (ICD-10 F10-F19) death rate, road injuries (ICD-10 V01-V89) death rate, exposure to fire, heat, and hot substances (ICD-10 X00-X19) death rate, accidental poisoning by and exposure to noxious substances (ICD-10 X40-X49) death rate, regional dummies.

Social determinants have always played a major role in the genesis of physical ill-health but increasingly this is being focused on mental illnesses (68). One of the more detailed recent reviews of the literature demonstrating the interaction of low social class in relation to disturbed mental health, on the one hand, and the influence of the recent industrialized country recession and subsequent austerity policies examines the effect of the Great Recession on a large literature covering multiple industrial country societies in relation to mental health outcomes (69). This review covered 11 studies of alcohol abuse and 8 studies of drug abuse and other addictions; in all of these types of mental health outcomes the very great majority showed elevation of poor mental health coping mechanisms in the face of the recession.

Over the years of development of psychiatric epidemiology, income, occupational skill level and educational level have been successfully used to understand the distribution of a wide variety of mental disorders, from those which have a more definitive genetic and physiological basis, such as schizophrenia, bipolar depression and dementia to those with a broader emotional spectrum, including anxiety, depression, and PTSD. The usual inference has been toward a new interpretation involving traumatic life events, including especially health concerns and financial disturbances as well as harm to social relations, especially those involving family and close friends. These findings for psychiatric illnesses had begun to be developed in the 1930s, coinciding with the Great Depression, which is not unlike the

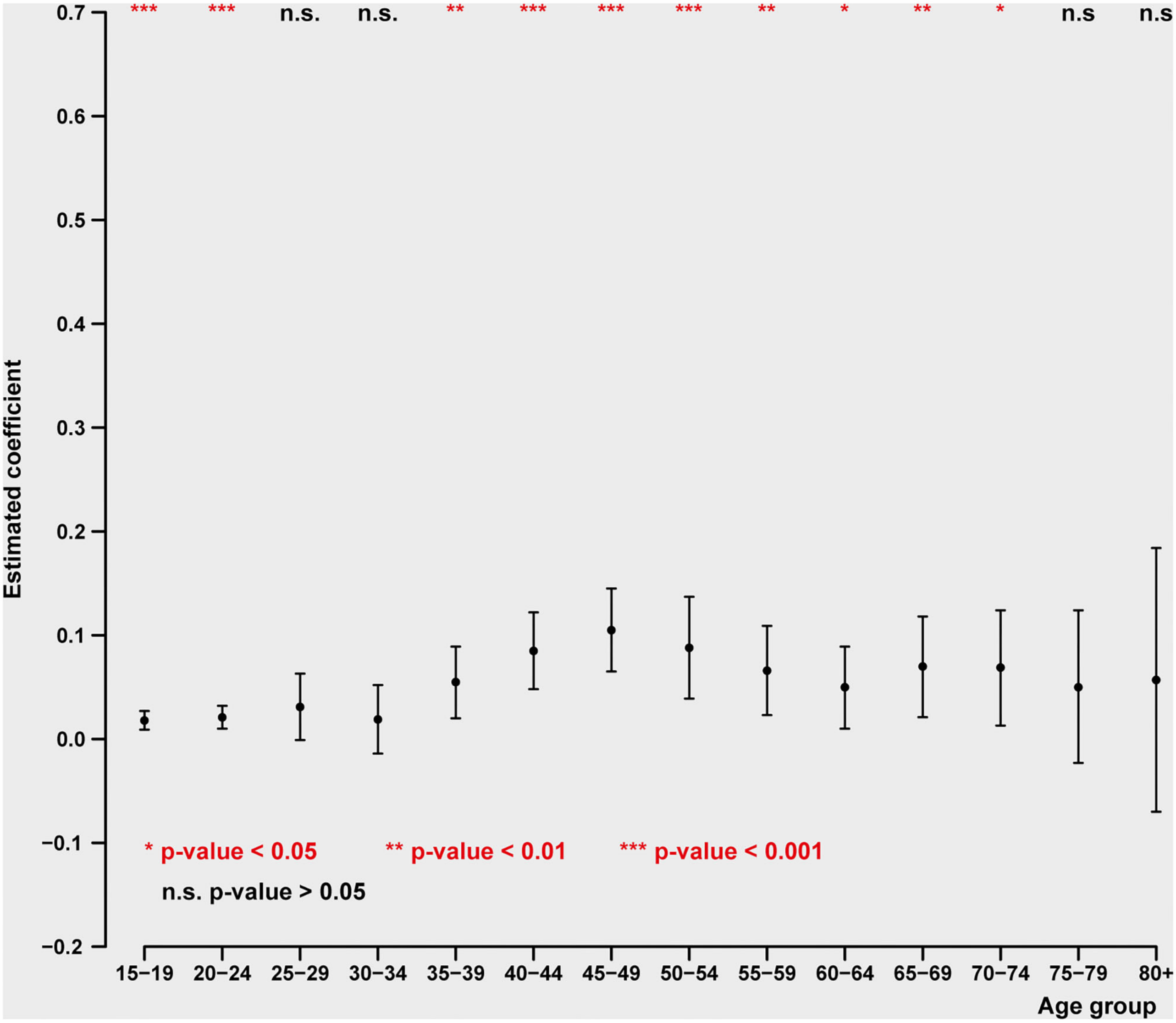

FIGURE 4 | Impact of unemployment rate on age-specific female intentional self-harm (ICD-10 X60-X84) death rate (pooled cross-sectional time series regression, 38 OECD states, years 2000–2017). Estimated coefficients with 95% confidence intervals. Adjustment variables: GDP pc, mental, and behavioral disorders due to psychoactive substance use (ICD-10 F10-F19), adverse effects of medical treatment death rate (ICD-10 T36-T50, T80-T88), regional dummies. ICD-10 causes of death: (1) intentional self-harm (ICD-10 X60-X84); (2) mental and behavioral disorders due to psychoactive substance use (ICD-10 F10-F19); (3) road injuries (ICD-10 V01-V89); (4) exposure to fire, heat, and hot substances (ICD-10 X00-X19); (5) accidental poisoning by and exposure to noxious substances (ICD-10 X40-X49); (6) adverse effects of medical treatment (ICD-10 T36-T50, T80-T88).

greater concern with physiologic illnesses ranging from infection to cardiovascular disease, becoming especially prominent in the 1970s (70). In fact, however, in the British and other European demographic literatures, we can see that the nearly iron-clad findings of the impact of "social class" on mortality have been observed since at least the 1940s. In those older, heavily physiologic, investigations of mortality, especially in the British Registrar General's Reports, the original observation of what is now called the "social gradient" or "health gradient" has been observed (44). There was little controversy among statisticians and demographic historians over the meaning of the social class-mortality gradient, in which higher occupational skill level of workers correlated very closely with decreasing levels of mortality. The clear interpretation seems to be that the physical stresses of work, environmental exposure, exhaustion and other manifestations of a stressful environment were the likely sources of this relationship.

The general understanding, even thought to be commonsense in the present era, is that a lower level of human resources, including nutrition, an egalitarian and stable public health structure, higher levels of education, render the population more highly adaptable to environmental threats. But the place of income has been more widely recognized in the later twentieth and twenty-first centuries. Within predominantly capitalist cultures, money, and income is seen correctly as the source of ability to purchase virtually every sort of physical commodity and knowledge-based output, health care, intellectual advice and political engagement. Thus, where significant environmental stresses, including those of unemployment and a damaged economy were rampant, clearly the importance of income as a means of escaping from the ravages of deprivation were fairly obvious. Much of the epidemiology—especially in the British case—of social class and illness has been responsible for the more robust development of the European welfare states and the force of the intellectual expression of labor unions.

Similar themes to this emerged as well in the psychiatric epidemiology of the 1950s. However, it was not until a decade or two later that psychiatric epidemiology began to focus on the macro-, or national-level significance of economic changes, especially economic development and unemployment. Moving from the individual level analyses to the macro understanding of economic changes on mental health, the beginnings of econometric analyses using techniques originally developed within the field of economics began to be used (71). The macro findings for the importance of economic events at the national level, but inserted into people's individual lives, have been more recently observed in alcohol and drug abuse.

Unemployment-Based Approach

Beginning in the 1980s, much less visible but significant long-term economic decline has occurred as a result of the shifting of manufacturing away from the industrialized countries and toward Asia—especially China. This is a phenomenon described very thoroughly by Autor in "The China shock" (72). The resulting economic devastation of manufacturing firms, societies and cultures have given rise to what has been described as "deaths of despair" (73) in this work. The emergence of mortality in younger populations related to alcohol, drugs, the opioid crisis and suicide have not been attributed to spectacular events like recessions, but rather the longer-term destruction of manufacturing employment in the industrial Western world and the emergence of the "gig" economy. Nevertheless, it is clear, from authors such as Autor, Krugmann, Rogoff, and others (74–76) that the clear evidence of many varieties of mental health disturbance have arisen out of an "economic shock" which has turned into a long-term trend, from which no immediate end is envisioned.

Life Events Approaches

Since the 1950s, one of the more sustained approaches in psychiatric epidemiology has been in the construction of scales identifying distinctive key events in the life cycle that tend to represent major changes (77, 78). The theory here is that significant changes in social role or social position, involving family, work role, friendship patterns, adverse health events sufficiently alter the circumstances of adaptation to the individual environment so that they should be considered stressful, i.e., requiring individual effort or resource expenditure in order to minimize circumstances to which the individual has difficulty adapting and thus could permanently change the person's health status. In this perspective even "good" or positive life changes such as marriage or taking on a new job or promotion with greater responsibilities, constitute a challenge to adaptation in that the person must significantly alter his/her pattern of living to cope with the requirements of the changed life circumstances. Considerable research over multiple generations have used the SSRS, and its many alternate versions, to assess the extent of stress in people's lives and thus attempt to predict heightened illness rates, especially mental health disturbances, emanating from a sum of such life alterations (77, 79). Subsequent researchers have tended to focus more exclusively on negative life events, such has major illnesses or economic losses, with somewhat greater success particularly in predicting negative mental health outcomes (80, 81).

Quantitative Impact of Great Recession on Mental Health

At the macro level, a substantial number of studies have continued to demonstrate the damaging impact of economic disturbances, especially recessions, involving high levels of unemployment in the United States, Europe and other parts of the industrialized world (43, 82–84).

The question now arises as to whether relatively recent disturbances to the national economy have shown the effects of unemployment and income loss on stress-related chronic disease and mental health disturbances. Findings have demonstrated the effects of losses of wealth on mortality (85) and the effects of both GDP losses and higher unemployment in Europe on increased cardiovascular mortality and self-reported health (86, 87). Additionally, the effects of downsizing on disturbed mental health and alcoholism have been found in national European and US studies (88, 89). These studies of downsizing have been more widely reported, with the additionally interesting finding that during downsizing even workers who maintained their employment showed evidence of disturbed mental health. Potentially most telling, in this respect, is that the most carefully designed Scandinavian studies have demonstrated a circular relationship between unemployment and disturbed mental health, in which, persons with lower mental health scores were more prone to recession-based job loss, and the job loss in turn was related to subsequent increases in mental disorders (29). This type of study appears to have put to rest the question of whether the relationship between poor economic status and poor mental health is causally related to the influence of mental health on later inability to find work or job loss, as distinguished from the situation of job loss making mental health problems more likely. The answer now appears to be that both sequences have a causal place in the relationship between job loss and deteriorated mental health.

The review by Brenner referred to earlier (44), also included studies on suicide which focused on the effects of unemployment. The outstanding methodological problem uncovered in the latter review showed that nearly always the metric used to identify the recessional impact consisted of the unemployment rate. Surprisingly, the recessional factor with the greater potential for damaging health, namely income loss through GDP and median income decline, was not to be found among these studies. The problem here is that while unemployment has been the most journalistically popular reference for the effect of recession, that measure clearly affects a minority of the population, generally <10%, whereas losses of income and wealth affect far greater proportions of the population over a longer period in the life cycle.

Effects of Economic Loss vs. Those of Unemployment on National Suicide Rates

Since our primary goal in this paper has been to ascertain the importance of changes in the economy, particularly recessions, on suicide, two outstanding observations must be noted. First, the prior literature provides robust indications that increased unemployment is a prime national predictor of suicide rates, and this is reproduced herein for industrialized countries in the Great Recession. But it is clear, that unemployment is not the most important economic predictor of national suicide rates, even though, both journalistically and in academic papers, it is the most frequently researched macroeconomic topic in relation to mental health, going back to original observations in the 1970s. This is true even though in analyses in this article, the oldest populations over 70—in the case of females and over 75 for males—do not show a relationship between national employment and suicide rates. The effects of economic loss during recessions must be seen, primarily, in terms of income loss to families over the short- and long term. Of course, such losses coincide, temporally, with recessions, during which unemployment is also high. But it is clear from these analyses that income losses, even among populations that do not lose employment are the more salient predictors of suicide rates for all age groups. In fact, the most powerful effects of income loss on suicide for both sexes are observed over the age of 70 and are outstanding over the age over 75. Therefore, it is necessary to consider the recessional effects on suicide to include a combination of GDP decline and unemployment increases.

Relation Between Recession and Suicide Is Underestimated

Secondly, it appears clear from these analyses that national levels of diagnostically identified suicide, in national data, probably represent a considerable underestimate of the actual suicide rate. This can be inferred from multiple literatures dealing with the effects of alcohol addiction and abuse, drug addiction and abuse, as well as poisoning-related mortality, accident-related mortality, as well as fire, heat and hot substances-related mortality (see **Table 5**). The separate literatures on these topics make clear that a sizable proportion of these "other" deaths can be understood to involve initial suicide intent at some stage in the process leading to mortality. Future analyses may benefit from these considerations of the national underestimate of suicide by taking into account a compendium of sources of mortality related to anxiety and depression as intrinsic motivation. A step in this direction has been taken by Case and Deaton in their designation of depression-related mortality as "deaths of despair," including such mortality as related to liver cirrhosis (90). Indeed, other literatures go even farther in their investigations of the relationship between economic stress, clinical depression, and cardiovascular illness (91). There is indeed evidence that in the case of alcohol-related mortality and alcohol-related cardiovascular mortality, that GDP declines and unemployment increases are significant predictors (92–94).

Short-Term vs. Sustained Effects

The major question now is how the experience of the Great Recession for suicide can be forecast (be repeated) as a result of COVID-19 pandemic. The first effect that other journalistic accounts and non-statistical academic papers have strongly suggested is that the immediate effects of losses (fear, deaths) have also materialized in the current COVID-19 limited period.

However, the major effect on mental health and suicide of COVID-19 may well be a fundamentally and indirect corollary—namely, the consequent effect of economic losses due to shutdowns worldwide. Whether suicide and related mental health effects will emanate from the current COVID-19 related recession depends greatly on the length of that recession, as well as efforts to ameliorate the economic situation of people and businesses by governments. Most important will be the duration and intensity of the COVID-19 recession, but this will of course depend on the duration and intensity of COVID-19 itself as its potential secondary and subsequent waves induce an international transmission from countries in the developing world influencing, in a circulatory manner, subsequent effects on industrialized countries.

Economic and Mental Health Policy Implications

The joint mortality outcomes of the COVID-19 pandemic and its corollary impact on the economic recession-induced mental health impact will depend on specific policies undertaken by individual country governments. The United States, for example, has experienced one of the most severe direct COVID-19-related mortality rates, as well as extremely large increases in unemployment rates, will likely suffer long-term economic declines (via weak economic recovery) and substantial permanent losses of jobs, life time income and wealth (95–97). This will be especially the case if an additional series of government support to maintain jobs, lengthen unemployment insurance, and payments and greatly extend business loans are not granted.

However, current economic policy considerations, taking COVID-19 health outcomes into consideration, still does not consider the indirect corollary implications of the COVID-19 recession in terms of major mental health outcomes and chronic disease mortality. Bearing such corollary health outcomes in mind, policy makers would be wise to include the total health gains to an expansive economic policy along the lines put forward by the International Monetary Fund (IMF), the World Bank and OECD (98–100).

Nevertheless, even under relatively generous economic support of individuals and businesses, it is quite likely that there will be permanent job losses, especially in the industrialized countries, as a result of economic restructuring under conditions of reduced demand. We have begun to see this occur in many of the service industries, such as restaurants and bars, tourism, travel, transportation, entertainment and shopping, and even healthcare (101, 102). Under these circumstances, it would be prudent for governments to be especially alert to expansion of mental health services. The evidence is clear that damage to a population's mental health can have further long-term consequences for reduction of national income and productivity.

Clearly, the most urgent policy effect must be to contain, and perhaps, eliminate COVID-19, but secondarily, and in order to facilitate public health measures, government financial sources of relief need simultaneously to be implemented.

Limitations

The present analysis is an estimation of the potential secondary effects of the economic recession due to the pandemic on mental health. The study is confined to the entire industrialized country populations of the OECD. Therefore, some of the special risks to suicide which are specific to each country and their sub-regions (e.g., seasonality, built and ambient environment, social integration, religion, ethnic cultures) could not be extracted and tested as control variables at this point. Similarly, since this is an epidemiological study based on aggregated, rather than individual, data, one cannot separately identify genetic differences or specific psychiatric syndromes that could represent individual proneness to suicide, especially in interaction with major economic variables such as national income (GDP per capita) or the unemployment rate.

From this point of view, it is only attributes of national populations that could be entered into the predictive models—more commonly known in the economic, epidemiological, and social science literatures as macro-level analyses. This approach is very much within the theme of the classical Durkheimian view that suicide rates are, to a large extent, attributes of societal, rather than individual, characteristics. Finally, this statistical correlative analysis only permits us to make inferences as to risk factors at the national level, that relate to the magnitude and fluctuations of population suicide rates, rather than enabling inferences as to aspects of causal relations attributed to characteristics of individuals.

Perhaps most important, the statistical analysis has shown that several causes of death are highly predictive of officially designated suicide deaths (see **Table 5**). These include deaths from poisoning, drug overdoses and unintentional accidents. These relations of differently diagnosed mortality, but potentially harboring an insidious mental state of anxiety, depression or anomie, lead to the conclusion that our suicide models underestimate the degree to which national economic loss and unemployment are risk factors to suicide. The ancillary diagnoses, in which suicidal intent could be a major underlying component were not taken into account as potential suicides. Thus, many "true" suicides, that were labeled differently in the ICD code—due to stigma, religion, unfamiliarity with psychiatric basis of mortality diagnosis or "error"—are likely, according to our findings, to have been substantially underreported. Therefore, the impact of these macroeconomic phenomena on officially designated suicide—even taken as a proxy marker of anxiety and depression—do not fully indicate the magnitude of mental distress brought about by recession in the short and long term.

The Way Forward

The governments and policymakers have a moral and ethical obligation to ensure the physical health and well-being of their populations. While setting in place preventive measures to avoid infections and then subsequent mortality, the focus on economic recovery has to be taken seriously. What is worrying is that 193 countries appear to be fighting the virus and the pandemic in 193 ways as if the virus requires visa permits which can be denied and the walls can stop the virus. A global pandemic requires a global response with a clear inter-linked strategy for health (5, 17, 103) as well as economic solutions. The vulnerable individuals and economies need to be protected in careful well thought-out ways to support under-privileged groups and communities.

DATA AVAILABILITY STATEMENT

Publicly available datasets were analyzed in this study. These data can be found here:

GDP per capita: World Bank, International Comparison Program database (https://databank.worldbank.org/source/jobs/Series/NY.GDP.PCAP.PP.KD).

Unemployment rate: ILO (https://www.ilo.org/shinyapps/bulkexplorer46/?lang=en&segment=indicator&id=UNE_2EAP_SEX_AGE_RT_A).

IHME. Global Health Data Exchange (http://ghdx.healthdata.org/gbd-results-tool?params=gbd-api-2019-permalink/9e08d79f2a6f48a4d42fc81f0db67eae').

AUTHOR CONTRIBUTIONS

MB developed the conceptualization and statistical analysis, and wrote the main findings in relation to the literature. DB wrote portions of the introduction, relation to psychiatry and mental health services, policies focused on underprivileged populations and The Way Forward, and wrote the abstract and edited the full manuscript. All authors contributed to the article and approved the submitted version.

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Erratum: Acceleration of Anxiety, Depression, and Suicide: Secondary Effects of Economic Disruption Related to COVID-19

*Frontiers Production Office**

Frontiers Media SA, Lausanne, Switzerland

Keywords: COVID-19, economy, suicide, depression, national income loss, unemployment, recession, Great Recession

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Due to a production error, there was an error in the affiliations. The affiliations for M. Harvey Brenner should read: 1. Johns Hopkins University Bloomberg School of Public Health, Health Policy and Management, Baltimore, MD, United States. 2. University of North Texas Health Science Center, Fort Worth, TX, United States. 3. Medizinische Hochschule Hannover, Hanover, Germany. The affiliation for Dinesh Bhugra should read: 4. King's College London, London, United Kingdom. The publisher apologizes for this mistake.

The original article has been updated.

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#Everything Will Be Fine. Duration of Home Confinement and "All-or-Nothing" Cognitive Thinking Style as Predictors of Traumatic Distress in Young University Students on a Digital Platform During the COVID-19 Italian Lockdown

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On March 10, 2020, Italy announced its lockdown caused by the novel coronavirus (COVID-19) pandemic, and home confinement exposed individuals to a stressful situation of unknown duration. Our study aimed to analyze the emotional and cognitive experiences and the psychopathological symptoms of young Italian University students seeking help from our University student Counseling and Consultation Service during the COVID-19 lockdown. Also, our study aimed to identify the predictors of traumatic psychological distress, investigating variables that could influence the students' well-being, related to their socio-demographic and clinical condition, to the "exposition" to the social distancing, and related to their cognitive thinking style. One-hundred and three University students were included in our study. The traumatic impact was assessed by the Impact of Event Scale-Revised (IES-R). A digital platform was used in our study, focused on narrative dimensions analyses. Our results showed that 21.4% of our help-seeking students experienced lockdown as a traumatic experience. The main stressful factors reported by students were: adjustment to the new academic activities (23.3 %), lack of autonomy (19.4%), and conflicts with family members (6.8%). The three main areas impaired were: changes in the sleeping pattern (68%), difficulty in concentration (67%), and loss of energy (58.6%). Furthermore, 36% of our student sample reported being suffering from anxiety symptoms, whereas 26% showed depressive symptomatology. Students having previous psychological and psychiatric contacts with mental health services (23%) showed a more severe traumatic and depressive symptomatology. The problematic thinking style "all or nothing" was predominantly associated with psychological distress, anxiety, depression, and posttraumatic symptoms.

"Everything Will Be Fine" could be identified by the "optimistic style" (27.2%), inversely correlated with the psychopathological measures and concentration problems. The results of the logistic regression analysis indicated that the length of home confinement (second month) seemed to increase by over 3 times the likelihood of experience posttraumatic symptomatology, and a thinking style "all or nothing" was the final strongest predictor increasing the risk by over 5 times. The implementation of psychological interventions to improve the mental health of vulnerable young subgroups to contain the structuring of psychopathological profiles represent a fundamental challenge.

Keywords: COVID-19 outbreak, narrative psychiatry, online psychological intervention, digital platform, traumatic impact, thinking styles, university students, predictors

INTRODUCTION

At the beginning of 2020, originating from Wuhan city, coronavirus disease (COVID-19) started to spread throughout China. On January 31, two Chinese tourists in Rome, Italy, tested positive for COVID-19. In the beginning, most Italians thought that the problem could be limited to a few cases and looked suspiciously at Chinese people in our country, considering COVID-19 as a "slightly more severe form of normal flu."

On February 18, 2020, the first case of SARS-CoV-2 pneumonia was diagnosed in Italy in an Italian man at the Codogno Hospital (Lodi) (1).

Based on the Italian government ordinance "I stay at home," since March 10 (decree issued on March 9, 2020, by the Italian Government, identifying the so-called "Phase one"), an isolation strategy was implemented to limit the spread of the virus in Italy.

The gradual easing of Italy's lockdown began on May 4, with the reopening of manufacturing activities taking around 4.4 million workers back out of their homes, and the "Phase two" of the Italian measures to contain the spread of COVID-19 began.

Italy became one of the significant COVID-19 hotspots, and, as of May 28, a total of 231,732 people tested positive for COVID-19; furthermore, 33,142 people died (including 165 physicians), out of a population of about 60 million.

Since Italy's COVID-19 lockdown, a range of containment measures was urgently adopted, including closure of all schools and Universities and home confinement. On the one hand, it was a useful strategy for defending and protecting lives; on the other hand, the resulting distress could cause significant emotional problems of still unknown duration (2).

The risks and fear of getting infected, being worried about one's family members in other areas contracting COVID-19, cognitions, and preventive behaviors regarding COVID-19 add to other psychological pressures. Being forced to stay at home; smart working; study at home for teenagers, children, and University students using remote learning methods to drastically reduce outings and social interactions; and the uncertainty of the future were all potential stressful conditions. COVID-19 is a complex emergency that requires a dynamic interpretation of the psychological impact. This emergency has led to restrictions on physical spaces, loneliness, family problems and conflicts in restricted private areas, and a sense of vulnerability and precariousness that changes the set of priorities in both family lives and the macro-system.

Two weeks after the World Health Organization announced the emergence of a new coronavirus (2019-nCoV) as a public health emergency, Liang et al. (3) reported that nearly 40.4% of their sampled youths were found to be prone to psychological problems, and 14.4% showed post-traumatic symptoms.

Women, students, and poor self-rated health status were significantly associated with a more significant psychological impact of the outbreak and higher levels of stress, anxiety, and depression; women reported significant higher post-traumatic symptoms, in the domains of re-experiencing, negative alterations in cognition or mood, and hyperarousal (4).

A recent study on the psychological impact of the COVID-19 pandemic on college students in China reported that around 25% of their sample showed anxiety with different severity levels significantly correlated with negative effects on daily life and delays in academic activities. The authors identified "living in urban areas," "family income stability," and "living with parents" as protective factors and "having relatives or acquaintances infected with COVID-19" as a risk factor (5).

Home confinement or quarantine reduces the availability of timely psychological intervention and implies the interruption of traditional "face-to-face" psychological counseling. Psychological emergency, in response to health emergency, requires urgent need for new types of psychological and mental problem intervention strategies potentially feasible and accessible (6).

In the last decade, the use of digital platforms and digital health interventions has increased rapidly. The growing rate of technology access highlights the potential for treatment and engagement with services to be taken from the clinic into the context of an individual's everyday life, unconstrained by location and time (7). Furthermore, researchers have been incorporating cognitive behavioral therapy (CBT) within apps and websites to help people self-manage their difficulties and provide help and psychoeducation about anxiety or depressive symptoms (8). In the public health emergency context, digital tools offering CBT intervention can also help build resilience (2).

Narrative research has significant implications for practice in recovery-oriented mental health care (9). Sharing individual stories of psychological distress has become a central practice within recovery-based healthcare, allowing to reorganize what is confusing to individuals and reinforcing empowerment and self-determination (10).

Remote written counseling by using a "structured letter therapeutic approach" as a potentially effective strategy was proposed in the actual global health emergency context (6).

An interesting model hypothesized that narrative elements integrated in CBT practices could not only help ameliorate distress but also promote resilience, happiness, courage, and other positive qualities (11).

We hypothesize that young University students could feel severely distressed about the social isolation imposed due to COVID-19, in a phase of their life in which their peer group and interpersonal relationships have a significant impact on their emotional development and in establishing intimate relationships. Our study aimed to analyze the emotional and cognitive experiences and the psychopathological symptoms of young Italian University students seeking help, during the COVID-19 lockdown. Also, our study aimed to identify the predictors of traumatic psychological distress, investigating variables that could influence the students' well-being, related to their socio-demographic and clinical condition, to the "exposition" to the social distancing, and to their cognitive thinking style.

MATERIALS AND METHODS

Study Design

This study was conducted through the digital platform of the Counseling and Consultation Service for Students, SACS, of the University of L'Aquila (Italy) (12).

Located in Central Italy in the town administrative center of the Abruzzo Region, the University of L'Aquila is a public teaching and research institution offering a full range of academic programs including biotechnologies, sciences, economics, engineering, education, humanities, medicine, psychology, and sport sciences. With seven departments, the University of L'Aquila offers its over 19,000 enrolled students 69 degree courses (divided between first and second level degrees), nine research doctorate programs, specialization schools, specializing master courses, and vocational courses. The faculty includes about 600 professors and researchers.

On April 6, 2009, the devastating earthquake that hit L'Aquila brought death and destruction to the University of L'Aquila, with 55 students killed (13, 14). Part of the University staff restarted their activities 3 days after the earthquake, but the process of reconstruction of some damaged University buildings is still going on.

Since March 16, due to the difficulty of conducting face-to-face interventions during lockdown, the service was provided via a digital platform to students and young people (https://www.univaq.it/section.php?id=530; http://sacsunivaq.altervista.org/index.html).

The project proposed a free online emotional support service and was promoted through various channels (e-mail, WhatsApp, Facebook, and university institutional site).

Students seeking help could send an e-mail to the SACS and register in the protected digital space "#IoRestoaCasa" ("#istayathome") after receiving a personal confirmation e-mail.

In the first step, the students were required to fill a short form about the main socio-demographic and clinical information, including age, gender, place of residence, off-site student condition (students were attending university in a different location, often very distant, from their residence) at the time of the lockdown, and previous mental health services contact, including prescription of psychopharmacological treatment. Furthermore, the students were asked to complete an assessment battery.

The second step included a narrative diary. The students were asked to write down the difficulties they were experiencing by responding to the following narrative stimuli, adapted from the narrative-based medicine questions and prompts (15, 16):

1. What are your main worries?
2. How is this situation affecting your life?
3. What kinds of unpleasant emotions are you feeling?
4. What kinds of unpleasant thoughts go through your mind?
5. How can we help you?

Once the responses were filled in, the person had a clinical virtual "room" with the professionals and through a protected messaging and video-chat system to communicate, according to a shared calendar. Students could use their own digital diary whenever they wanted it.

The study included 103 students consecutively referred in the almost 2-month period of the Italian lockdown (from March 16, 2020 to May 4, 2020).

All the 103 students included in the study entered the platform, filled their socio-demographic and clinical form, completed the assessment battery (first step), and answered the narrative stimuli entering their virtual room with the therapist (second step). The video sessions included counseling, problem solving, stress management strategies, and lifestyle suggestions. For each student, a weekly session lasting 60 min was planned.

After the considered period (March 16–May 4, 2020), eight (7.7%) of them did not enter the third "step" of the intervention, that is, the proposed CBT intervention for anxiety and/or the weekly planned video consultations with professionals. These students dropped the third step, not considered in our current paper, and preferred to have only the professional's video consultations.

If students showed high levels of anxiety or depression, they were invited to access the structured online CBT intervention for anxiety or to plan video sessions with the professionals.

Assessment Battery

The following measures were administered to all participants at the entry in the platform.

Traumatic Distress

The Impact of Event Scale-Revised (IES-R) is one of the most widely used self-report measures in the field of traumatic stress (17). The IES-R consists of 22 items with a 5-point Likert-type scale ranging from 0 (not at all) to 4 (often). Three subscale scores can be obtained by summing the relevant item scores: intrusion, avoidance, and hyperarousal. The total IES-R score was divided into 0–23 (normal), 24–32 (mild psychological impact), 33–36 (moderate psychological impact), and >37 (severe psychological impact) (17).

Anxiety and Depressive Symptomatology

The 12-item General Health Questionnaire (GHQ-12) (18–20) is the most extensively used screening instrument for common mental disorders, in addition to being a more general measure of psychiatric well-being. The GHQ-12 consists of 12 items, each one assessing the severity of a mental problem over the past few weeks using a 4-point Likert-type scale (from 0 to 3). The score was used to generate a total score ranging from 0 to 36. High scores indicated poor health. The scores fell into three categories: 0–14 = normal range, 15–19 = moderate psychological distress, and 20–36 = severe psychological distress. Graetz (21) proposed a GHQ-12 three-dimensional model that included three factors: anxiety and depression (including items 2, 5, 6, and 9), social dysfunction (including items 1, 3, 4, 7, 8, and 12), and loss of confidence (including items 10 and 11).

The Self-Rating Anxiety Scale (SAS) (22) comprises 20 items that investigates anxiety symptomatology, including five items that investigate well-being (the latter require reversed scores). The items are evaluated on a 4-point Likert scale (ranging from 1 = "nothing or only for a short time" to 4 = "continuously or most of the time"). The total raw scores range from 20 to 80. Higher scores are associated with greater severity of symptoms. The clinical interpretation of the level of anxiety is as follows: 20–44 = normal range, 45–59 = mild to moderate anxiety level, 60–74 = marked to severe anxiety level, and 75–80 = extreme anxiety level.

The Beck Depression Inventory-II (BDI-II) (23) is a 21-item inventory that measures the severity of self-reported depression over the prior 2 weeks; its item content corresponds to criteria for the diagnosis of depressive disorders as specified in the Diagnostic and Statistical Manual of Mental Disorders IV, DSM-IV. Items are structured on a 4-point scale, ranging from zero points (symptom not present) to three points (symptom strongly present). Thus, a BDI-II total score from 0 to 13 points represents normal to minimal depression, from 14 to 19 points indicate mild depression, from 20 to 28 points indicate moderate depression, and from 29 to 63 points indicate severe depression.

A Concentration Impairment Index, CII, was calculated using the sum of item 1 of the GHQ-12 and item 19 of the BDI-II (range 0–6). At the beginning of the study, the evaluation of attention and concentration abilities were not considered. Based on the students' recurring reports during the clinical consultations, we found it useful to deepen these data by referring to the available quantitative measures, thus calculating a Concentration Impairment Index.

Internet-Guided Intervention *via* a Protected Digital Platform

The platform PSYDIT.COM is a protected digital environment that brings together all the tools necessary for psychotherapy, ensuring total confidentiality of the health data as also provided by the European General Data Protection Regulation n. 2016/679. The PSYDIT.COM platform is an IT-telematic system that allows professionals and users to follow a treatment in the context of clinical practice.

PSYDIT.COM enhances the ease of digital communication, transferring it from a random, unprotected, and unmanaged context, such as emails or WhatsApp, to a communication and listening path structured and protected from the point of view of privacy.

Our intervention was administered via the PSYDIT.COM platform involving combined modalities of online therapy (synchronous and asynchronous, automatic and interpersonal, narrative, and cognitive behavioral strategies suggestions). The platform also included the following: (1) digital narrative diary available to the user to tell his/her story, through a guided tour of narrative stimuli about cognitive, emotional, and behavioral states; (2) messaging and video-counseling sessions, based on a shared calendar; and (3) a structured cognitive behavioral therapy program for anxiety (CBT). In this study, we focused on narrative dimensions analyses, using the first two functions of the platform, and on psychological distress.

The platform allows the professionals of the research team, with the involvement of all of them, to have access to the user's history and data, use a system of shared notes not visible to the users, and have a video chat for discussion or for teleconsultation.

Messages, video chats, and diary are included in an environment designed for interaction and aimed at clear and shared clinical and care objectives, which not only protect the professionals but also the user. The professionals were committed to answer within 24 h (except for weekends). The narration was used for personalization of the diagnostic-therapeutic path and was part of the user journey, in the most suitable phases and for which it is more important to enhance the user's narration. Due to its nature, such an intervention cannot be used in health emergency situations. The users were informed that they could not use the PSYDIT.COM platform to report situations of malaise or a condition that required rapid help. In these cases, the users were required to use the usual first aid and emergency medical channels.

Data Analysis

Quantitative Data

Parametric and non-parametric statistics were utilized in data analysis. Chi-square test and one-way analysis of variance (ANOVA) were conducted to examine the differences in socio-demographic variables and psychopathological variables, as measured by the IES-R, GHQ-12, SAS, BDI-II, and CII, based on gender differences. Spearman correlation was performed to measure the strength and direction of the association between standardized quantitative measures (scores of GHQ, BDI-II, SAS, IES-R, and CII), qualitative variables (emotion/feeling and thinking styles), as assessed though the digital narrative diaries, and the duration of the COVID-19 home confinement.

Regression analyses were conducted for identifying potential predictors of the traumatic impact of COVID-19 lockdown.

Logistic regression was used to test one predictive model. We included three blocks of variables. In step 1, socio-demographic and clinical data (women gender, age group, father and mother years of education, previous contacts with mental health services (MHS), and taking an antidepressant treatment) were included as potential predictors. Age was coded into two categories (19–21 years and 22 years and above). This categorization was based on the assumption that women and younger people might be more at risk for developing traumatic consequences. Education of relatives, indirect indicator of socio-economic status, was coded into two categories (8 years or less and more than 8 years of education). Previous contact with MHS and taking an antidepressant treatment were coded into two categories (no/yes). In step 2, distressful lockdown conditions, such as having been "locked" far from the family, were coded into two categories (no/yes), and months of the home confinement (coded into two categories first month and second month) were included as potential predictors. In step 3, we included data related to the subjects' personal cognitive thinking styles coded into two categories (yes/no).

We conducted odds ratios with 95% confidence intervals for the logistic regression analysis. Statistical analyses were performed using SPSS 26.0 (SPSS Inc., Chicago, IL, USA).

Qualitative Data

Narrative data analysis of qualitative components of the study was performed to identify, through significant keywords and phrases, psychological and psychosocial contents (stressful events, common affective, and cognitive patterns) experienced during the COVID-19 lockdown, reported on the digital diary of each student. In the research team meetings, the clinical psychologists (LG, SM, and DB) read and re-read several times the digital diaries. They identified and organized themes into emotional and cognitive thinking style pre-defined clusters according to the cognitive behavioral paradigm, which describes how people's perceptions of or spontaneous thoughts about situations influence their emotional, behavioral (and often physiological) reactions (24, 25). Findings were then compared and discussed by the team until consensus on coding was reached. For each student, a scoring sheet was filled in with related examples (0 = absent; 1 = present).

RESULTS

Participants

The main socio-demographical, living, and clinical conditions of our University student sample are reported in **Table 1**.

More than 80% of the sample included women, statistically younger than male students (22.06 SD 3.11 vs. 24.37 SD 3.67; $F = 6.952$; $p = 0.006$).

In this study, almost 80% were off-site students, and in this subgroup, 18 (22%, 14 women and 4 men) were "blocked" in L'Aquila, far from their families for the entire duration of the lockdown.

More than three-quarter students were enrolled in the health professions degree courses. More than 20% of students had previous psychological and psychiatric contacts with mental health services (MHS), and around 8% of them were taking a psychopharmacological antidepressant treatment.

TABLE 1 | Description of the main socio-demographical, living, and clinical conditions of our university students sample.

Variables	
Sex, *n* (%)	
Women	84 (81.6)
Males	19 (18.4)
Age (SD)	22.5 (3.33)
Relatives' education, years (%)	
Father	
<8 years	29 (28.2)
>8 years	62 (60.1)
Missing	12 (11.7)
Mother	
<8 years	22 (21.3)
>8 years	69 (67.0)
Missing	12 (11.7)
University degree courses, *n* (%)	
Health professions	78 (75.6)
Medical school	5 (4.9)
Economics	5 (4.9)
Humanistic courses	5 (4.9)
Scientific courses	4 (3.9)
Psychological courses	3 (2.9)
Engineering courses	3 (2.9)
Living situation, *n* (%)	
Living with family	21 (20.4)
Off-site students (students attending university in a different location, often very distant, from their residence)	82 (79.6)
Off-site students "blocked" far from families during the lockdown period	18 (17.5)
Previous psychological and psychiatric contacts with mental health services, *n* (%)	23 (22.3)
Students taking antidepressant treatments, *n* (%)	8 (7.8)

Impact of Event Scale-Revised

Statistics related to the Impact of Event Scale-Revised (IES-R) are presented in **Table 2**. Around 20% of students experienced this lockdown as a traumatic experience. The more distressing symptoms (mean scores higher than 1.5) reported were hyperarousal (13.6%), intrusion (13.6%), and avoidance (9.7%).

IES-R scores of female students were higher than those of the male students but did not reach a statistically significant difference by gender. We found a statistically significant difference between the students with previous psychological/psychiatric contacts reporting higher IES-R scores compared to students at their first contact with our service (ANOVA: 19.08 SD 15.97 vs. 11.91 SD 11.93; $F = 5.506$; $p = 0.021$). We found no statistically significant difference between the off-site students blocked in L'Aquila and the students who lived/returned to their family.

TABLE 2 | Statistics of traumatic, anxiety, and depressive symptomatology measures, assessed through the Impact of Event Scale-Revised 22 items (IES-R2), 12-item general health questionnaire (GHQ-12), self-rating anxiety scale (SAS), and beck depression inventory-II (BDI-II).

Measures	Total sample	Men	Women	
Impact of Event Scale-Revised (IES-R), total score mean (SD)	13.5 (13.2)	8.8 (7.69)	14.5 (13.9)	$F = 2.973$; $p = 0.088$
IES-R score 0–23, normal profile (%)	81 (78.6)	18 (94.7)	63 (75)	
IES-R score 24–32, mild psychological impact (%)	8 (7.8)	1 (12.5)	7 (8.3)	
IES-R score 33–36, moderate psychological impact (%)	4 (3.9)	0	4 (4.8)	
IES-R score >37, severe psychological impact (%)	10 (9.7)	0	10 (11.9)	chi-square = 4.122; $p = 0.249$
12-item General Health Questionnaire (GHQ-12), total score mean (SD)	14.33 (6.58)	12.2 (6.4)	14.8 (6.5)	$F = 2.325$; $p = 0.130$
GHQ-12 score 0–14, normal profile (%)	66 (64.1)	14 (73.6)	52 (61.9)	
GHQ-12 score 15–19, moderate distress (%)	13 (12.6)	1 (5.3)	12 (14.3)	
GHQ-12 score 20–26, severe distress (%)	24 (23.3)	4 (21.1)	20 (23.8)	chi-square = 1.386; $p = 0.500$
The Self-Rating Anxiety Scale, (SAS) total score mean (SD)	42.7 (9.8)	40.6 (8.5)	43.2 (10.1)	$F = 1.053$; $p = 0.307$
SAS score 0–44, normal profile (%)	66 (64)	15 (78.9)	51 (60.7)	
SAS score 45–59, mild–moderate anxiety (%)	29 (28.2)	3 (15.8)	26 (31)	
SAS score 60–74, marked–severe anxiety (%)	8 (7.8)	1 (5.3)	7 (8.3)	chi-square = 2.257; $p = 0.323$
Beck Depression Inventory-II (BDI) total score mean (SD)	10.8 (10.9)	6.42 (5.3)	11.86 (10.9)*	$F = 4.427$; $p = 0.038$
§ Item 1. Sadness	0.41 (0.66)	0.11 (0.31)	0.48 (0.70)*	$F = 5.038$; $p = 0.027$
Item 5. Feelings of guilt	0.55 (0.77)	0.21 (0.41)	0.63 (0.81)*	$F = 4.771$; $p = 0.032$
Item 7. Self-dislike	0.39 (0.74)	0.05 (0.29)	0.46 (0.79)*	$F = 4.926$; $p = 0.029$
Item 11. Agitation	0.62 (0.65)	0.05 (0.29)	0.69 (0.65)*	$F = 5.224$; $p = 0.022$
Item 20. Tiredness	0.50 (0.64)	0.21 (0.41)	0.56 (0.66)*	$F = 4.782$; $p = 0.031$
BDI-II score 0–13, absence of depressive symptoms (%)	76 (73.8)	17 (89.5)	59 (70.3)	
BDI-II score 14–19, mild depression (%)	10 (9.7)	2 (10.5)	8 (9.5)	
BDI-II score 20–29, moderate depression (%)	9 (8.7)	0	9 (10.7)	
BDI-II score >30 severe depression (%)	8 (7.8)	0	8 (9.5)	chi-square = 4.683; $p = 0.200$

*§Reported only statistically significant items. *p < 0.05.*

The 12-Item General Health Questionnaire

Table 2 summarizes the results of the GHQ-12 scores. No statistically significant difference was found between gender and lockdown housing placement, respectively. In the student subgroup scoring higher than 14, based on the model of Graetz, the highest scoring dimension was anxiety and depression (mean score 1.98, SD = 0.47), followed by social dysfunction (mean score 1.77, SD = 0.45) and loss of confidence (mean score 0.50, SD = 0.29). We found a statistically significant difference between the students with previous psychological/psychiatric contacts reporting higher GH-12 total scores compared to students at their first contact with our service (ANOVA: 17.65 SD 6.32 vs. 13.38 SD 6.37; $F = 8.059$; $p = 0.005$).

The Self-Rating Anxiety Scale

The mean overall SAS of the sample was 42.7 (SD = 9.8). Furthermore, 36% of the student sample reported a SAS score equal to or higher than 45, without a statistically significant difference by gender and lockdown housing placement (**Table 2**). We found no statistically significant difference between the students with previous psychological/psychiatric contacts and the students at their first contact with our service.

Beck Depression Inventory II

The BDI-II showed three main areas impaired in our sample: changes in sleeping pattern (reported by 68% of the total sample), lack of concentration (67%), and loss of energy (58.6%).

Further, almost 30% of students reported the presence of depressive symptomatology (**Table 2**).

A statistically significant difference was found in regard to gender; female students showed higher scores compared to those of male students, with respect to the total score of BDI-II, sadness, feelings of guilt, self-dislike, agitation, and tiredness. Students with previous psychological/psychiatric contacts showed higher BDI-II total scores compared to the students at their first contact with our service (ANOVA: 15.22 SD 10.28 vs. 9.61 SD 10.09; $F = 5.464$; $p = 0.021$).

We found no statistically significant difference between the off-site students blocked in L'Aquila and the students who lived/returned to their family.

The Concentration Impairment Index

The Concentration Impairment Index showed a mean score of 2.56 DS = 1.49. No statistically significant difference in gender and lockdown housing placement was found. We found a statistically significant difference between the students with previous psychological/psychiatric contacts scores complaining a worse functioning and reporting a higher CCI score compared to

TABLE 3 | Emotions/feelings reported by students in their digital narrative diaries during the lockdown.

Emotions/feelings	Student sample ($N = 103$)	Some examples from narrative diaries
Sadness	63 (61.2%)	*"Sometimes I struggle to get out of bed. I don't even want to play video games, to sit down to watch a movie or TV series, also if it seems interesting and I say that I would like to do it."* (User 2) *"The anguish and sadness assail me when I think I am about to finish the exams, and I do not have a degree thesis. At present, because of this emergency, I don't know if I will be able to carry out my internship. I don't know if I will be able to graduate or if I will remain enrolled in university because I am unable to do anything except study."* (User 62)
Fear/anxiety	54 (52.4%)	"*I am currently anxious and worried about my mother as she works in the hospital and is in contact with potentially infected people every day.*" (User 7) "*The situation is impacting the impossibility of using hospital services. I am apprehensive and anxious about my health, since my medical visits, which I had to undergo, have been postponed to a later date. Furthermore, I am currently distant from my family who do not have easy access to the internet, thus being able to interact very little and rarely with them.*" (User 47)
Loneliness	32 (31.1%)	"*I am afraid of being totally alone, of being excluded, replaced and unable to maintain solid ties with the significant persons around me. Some days I really think that I am destined to remain alone and to have only circumstantial people around, without ever creating deep and lasting relationships."* User (User 46). *"I feel really alone! I really miss my sister and my boyfriend who are away because of work! In 10 years of relationship, it is the first time that he happens to stay away for so long.... !!!" (User 6)*
Anger	18 (17.5%)	*"These days, I am tormented by the ghosts of the past, I think back on my failures and I am taken by growing anger." (User 3)* *"How can I not think negative? Not to be pessimistic? Can you explain it to me? But if every time I am fine then something negative must happen..., forget it. I can't take it anymore... what the f............... !!!." (User 100)*
Boredom	13 (12.6%)	*"Living days as if they were all the same starts to get tired and being away from home and my family is more difficult than usual."* (User 72) *"Some days are heavier than others and I can't do anything other than stay on the bed and think about filling myself with questions that will never be answered."* (User 46)
Guilty	8 (7.8%)	*"Following the health emergency, I decided to return home by ending the Erasmus experience that I did so much to achieve. I feel guilty because I have not been brave, making a decision that will have significant consequences for my academic future."* (User 52) *"I feel guilty because I know I could be a better person, but I can't forget this sadness, I feel selfish because I wish I could help instead of feeling I need help in this situation."* Stressful factors -family problems (User 99)
Happiness	5 (4.9%)	*"I have radically changed my daily habits; I had to reorganize my days trying to make them as productive as possible. I am happy because I am learning to know myself and my family better, since we had never spent so much time together." (User 60)* *"I'm an offsite student and I haven't been home since January. Now, I'm at home and I'm happy to be able to spend some time with my family, but I'm sorry I can't go out and see all my friends again."* (User 28)

students at their first contact with our service (ANOVA: 3.26 SD 1.32 vs. 2.36 SD 1.48; $F = 6.839$; $p = 0.010$).

Qualitative Analysis

Narrative data analysis of qualitative components of the study identified, through significant key words and phrases, common affective and cognitive patterns experienced after a traumatic event. Three main psychosocial areas emerged from narrative diaries:

- Stressful factors affecting student's mood (adjustment to the new academic activities, conflicts with family members, and lack of autonomy related the COVID-19 lockdown);
- The emotions/feelings experienced by students during lockdown (fear/anxiety, sadness, anger, boredom, guilt, loneliness, and happiness);
- The cognitive responses shown by students in the evaluation of the health emergency and related factors (thinking styles as "All-or-nothing—Global negative evaluations of themselves or others," "Catastrophizing—overestimation of risk," "Intolerance of uncertainty," and "Structured Positive Style").

The main stressful factors reported by students were the following: adjustment to the new academic activities (24, 23.3%), lack of autonomy relating the COVID-19 lockdown (20, 19.4%), and conflicts with family members (7, 6.8%).

The emotions/feelings and the cognitive styles that emerged from the participants' digital diaries about outbreak experiences, according to our model, were registered and analyzed.

The emotion identified from the digital diaries were sadness, fear/anxiety, anger, guilt, boredom, loneliness, and happiness.

Table 3 shows the expressed emotions/feelings in the digital diaries, accurately identified by the therapists, their distribution percentage, and some written examples. The three main emotions/feelings more frequently reported were sadness, fear/anxiety, and loneliness.

Table 4 shows the main thinking styles (as described below) of our student sample, their distribution percentage, and some participants' verbatim accounts.

TABLE 4 | Thinking styles reported by students in their lockdown digital narrative diaries.

Thinking styles	Student sample ($N = 103$)	Some examples from narrative diaries
Intolerance of uncertainty	47 (45.6 %)	*"The frequent unpleasant thought is that of not being able to achieve my goals, because I have the feeling that my life is in stand-by right now, it does not go forward or backward."* (User 88) *"I am worried about uncertainty, having to always be careful and fear even when going out respecting the rules that something can happen or become infected. I am also worried that according to experts the "peak" has still arrived and therefore the situation has yet to get worse."* (User 54)
Optimistic style	27 (26.2%)	*"This situation is allowing me to spend a lot of time on myself and on my well-being, something that I haven't been able to do for a long time".* (User 88) *"I try to get strength every day with my family, helping each other and not letting ourselves be discouraged. There is a bit of concern, but for now nothing that I can't manage easily. I think we need to be confident, and everything will be fine."* (User 15)
All or nothing/devaluation of self or others	25 (24.3%)	"*In my days, there is no margin of error although apparently I may seem relaxed and available for recreational activities (walks, sports, lunch with my girlfriend), whenever a break lasts too long or that I wake up late in the morning or that I take the phone for whatever reason the whole day in my mind has been lost and there is no possibility of correction, it is all lost now.*" (User 62) *"In this difficult situation, I am not doing anything to help people! I'm a useless person!!!"* (User 13)
Catastrophizing/ overestimation of risk	10 (9.7 %)	*"All the sacrifices I made to be a better person, the person I wanted to be, all the good intentions and progress that I made in the last year, after years of dissatisfaction and sadness, vanished. Now there is nothing left, I feel failed and oppressed. I don't know if I will ever be able to get my life back in hand as I was able to do after so many efforts. Chest pain will probably not stop with the end of the quarantine."* (User 52) *"I am concerned about not returning to a "normal" situation, the fact that they do not give us back our freedoms, it makes me feel bad not to be able to do this or that. I have a feeling that this situation will never change and that torments me."* (User 89) *"I am currently concerned about the situation that the whole nation is experiencing. In particular, I am afraid that some family member or loved one (myself included) could be infected without the possibility of being treated and in the worst case, of dying in total solitude. Often, I happen to imagine the consequences that may occur in the future, especially in a situation in which even the basic needs will start to fail and we will be reduced to living in conditions of pure subsistence. Or sometimes I think that if they were to reopen every national structure and everything were to return to normal, there could be contagions and relapses again especially for us students who will have to attend public and crowded places like the university."* (User 26)

All-or-Nothing/Global Negative Evaluations of Themselves

This distortion (also known as "black-and-white thinking") manifests as an inability or unwillingness to see shades of gray. In other words, you see things in terms of extremes—something is either fantastic or awful; you believe you are either perfect or a total failure.

Catastrophizing/Overestimation of Risk

This occurs when the person thinks about worst-case scenarios as if they are likely-case scenarios, and they self-induce a great deal of distress over anticipated hardships and losses that may be unlikely.

Intolerance of Uncertainty

Intolerance of uncertainty is defined as the cognitive style related to the dispositional fear underlying emotional difficulties and resulting in anxiety in cases where the unknown is perceived intensely (26).

Optimistic Style

Optimism is a cognitive attitude reflecting a belief or hope that the outcome of some specific endeavor, or outcomes in general, will be positive, favorable, and desirable.

Correlation Between Quantitative and Qualitative Variables

Table 5 shows the correlations of all investigated quantitative, emotional, and cognitive variables and the duration of home confinement.

Positive and statistically significant correlations of the problematic thinking style "all or nothing" were found between psychological distress, measured by the GHQ total score; anxiety symptoms, as measured by the SAS total score; and post-traumatic symptoms, measured by the IES total score. Hence, it was concluded that this negative cognitive pattern could promote negative emotional responses. Correlations analyses showed positive and significant correlations of "all or nothing" and "catastrophism" thinking styles with depressive symptoms and severity, as measured by BDI total scores and their severity levels, suggesting that both these cognitive styles could contribute to the maintenance or reinforcement of low mood.

Furthermore, a high level of psychological distress (GHQ total score) correlated positively and significantly with fear/anxiety and anger, showing that these negative feelings contributed to a condition of daily suffering. Anger also correlated with depression symptoms, as measured by the BDI total score.

TABLE 5 | Correlation analyses and qualitative and quantitative measures.

	GHQ total score	BDI-II Total score	BDII-livelli di gravità	SAS total score	IES-R total score	IES-R avoidance	IES-R intrusion	IES-R hyperarousal
All_or_nothing	0.404**	0.381**	0.423**	0.341**	0.231*	0.1	0.143	0.350**
P-value	<0.001	<0.001	<0.001	<0.001	0.019	0.313	0.149	<0.001
Catastrophic_thought	0.184	0.213*	0.280**	0.144	0.098	0.07	0.049	0.143
P-value	0.069	0.031	0.004	0.148	0.324	0.481	0.624	0.15
Intolerance_uncertainty	0.067	0.066	−0.007	0.069	0.147	0.157	0.144	0.071
P-value	0.501	0.508	0.942	0.487	0.139	0.113	0.147	0.475
Optimistic_style	−0.338**	−0.256**	−0.259**	−0.248*	−0.051	0.081	0.083	−0.233**
P-value	<0.001	0.009	0.008	0.011	0.609	0.418	0.405	0.018
Sadness	0.024	0.048	0.114	−0.035	−0.016	−0.021	−0.045	0.024
P-value	0.811	0.63	0.251	0.724	0.869	0.831	0.65	0.813
Fear_anxiety	0.202*	0.145	0.118	0.151	−0.054	−0.094	−0.111	0.07
P-value	0.041	0.144	0.235	0.128	0.588	0.343	0.266	0.483
Anger	0.228*	0.231*	0.126	0.167	0.127	0.062	0.05	0.168
P-value	0.021	0.019	0.205	0.092	0.2	0.532	0.613	0.089
Happiness	−0.133	−0.16	−0.133	−0.196*	−0.045	0.065	0.121	−0.174
P-value	0.18	0.107	0.181	0.047	0.653	0.512	0.222	0.079
Guilty	0.135	0.158	0.158	0.174	0.012	−0.114	−0.061	0.063
P-value	0.174	0.11	0.111	0.079	0.907	0.252	0.538	0.526
Boredom	−0.075	−0.028	0.020	−0.123	−0.125	−0.148	−0.182	−0.018
P-value	0.452	0.782	0.843	0.215	0.208	0.136	0.066	0.859
Loneliness	0.176	0.053	0.096	−0.044	−0.011	−0.047	−0.04	0.038
P-value	0.075	0.595	0.333	0.66	0.91	0.64	0.687	0.706
Quarantine_day	0.204*	0.182	0.213*	0.147	0.340**	0.330**	0.298**	0.306**
P-value	0.039	0.066	0.031	0.139	<0.001	0.001	0.002	0.002
Concentration impairment index	0.685**	0.715**	0.624**	0.527**	0.420**	0.07	0.105	0.737**
P-value	<0.001	<0.001	<0.001	<0.001	<0.001	0.482	0.29	<0.001

*The table reports correlation coefficients (Spearman's ρ) and statistical significance (*p < 0.05; **p < 0.01). GHQ, General Health Questionnaire; BDI-II, Beck Depression Inventory-II; SAS, Self-Rating Anxiety Scale; IES-R, Impact of Event Scale-Revised.*

Negative and statistically significant correlation of the optimistic thinking style with psychological distress, anxiety symptoms, depressive symptoms and their relative severity levels, and with the post-traumatic dimension of hyperarousal was found. A negative and statistically significant correlation between the positive feeling "happiness" and anxiety symptoms was found.

If any statistically significant difference was found in thinking styles by gender, a higher statistically significant proportion of off-site students (55.6%) blocked in L'Aquila expressed feelings of loneliness in their digital diaries compared to the students who spent the lockdown with their family (25.9%) (chi-square $=$ 6.107; DF $= 1$; $p = 0.013$).

Concentration impairment, as measured using CII, positively and significantly correlated with psychological distress, anxiety symptoms, depressive symptoms, and post-traumatic symptoms, especially in the hyperarousal dimension, depicting relevant impact of psychopathology on cognitive functioning. No statistically significant difference between gender and lockdown housing placement was found. Students showing an optimistic style showed statistically significant lower concentration impairment scores compared to their colleagues (ANOVA: 1.88 SD $= 1.25$ vs. 2.80 SD $= 1.50$; $F = 7.973$, $p = 0.006$).

Based on the correlation analyses, the level of psychological distress (GHQ total score), depressive and severity symptoms (BDI total and its severity level), and the post-traumatic symptomatology tended to increase with the progression of the days of lockdown (home quarantine).

Predictors of Traumatic Symptomatology

The predictive model shown in **Table 6** is the result of the logistic regression analysis for predicting the traumatic impact of COVID-19 lockdown from the IES-R scale (total score > 23).

Within the first step, among the socio-demographical, living, and clinical variables, none of the variables entered in the model showing a statistically significant predictive power. In step 2, including variables related to the trauma "exposition," the likelihood of a positive estimate of traumatic symptomatology increased around four times during the second month of home confinement (**Table 6**). The duration of the confinement seemed to have significant predictive power in our model since we did not enter the personal cognitive thinking styles. In the third

TABLE 6 | Logistic regression analysis for predicting the traumatic impact of COVID-19 lockdown from the IES-R scale (total score >23).

	Step 1					Step 2					Step 3				
	B	***p***	**Exp(B)**	**CI 95% *L***	**CI 95% *U***	***B***	***p***	**Exp(B)**	**CI 95% *L***	**CI 95% *U***	***B***	***p***	**Exp(B)**	**CI 95% *L***	**CI 95% *U***
Sex															
Men/women	1.796	0.101	6.028	0.703	51.677	2.095	0.061	8.127	0.906	72.9	1.975	0.137	7.21	0.535	97.177
Age ≤21 years															
No/yes	0.013	0.879	1.013	0.86	1.193	0.01	0.917	1.01	0.843	1.209	0.059	0.556	1.06	0.872	1.289
Father's years of education															
<8 years/>8 years	−0.011	0.987	0.989	0.268	3.654	0.11	0.874	1.117	0.285	4.375	0.262	0.741	1.3	0.275	6.152
Mother's years of education															
<8 years/>8 years	−0.704	0.364	0.495	0.108	2.259	−1.217	0.147	0.296	0.057	1.536	−1.268	0.157	0.282	0.049	1.627
Previous contact with MHS															
No/yes	0.398	0.23	1.489	0.778	2.851	0.346	0.323	1.414	0.711	2.813	0.644	0.08	1.904	0.926	3.912
Taking antidepressant treatment															
No/yes	−1.006	0.451	0.366	0.027	4.992	−1.058	0.442	0.347	0.023	5.148	−2.535	0.117	0.079	0.003	1.884
Locked student															
No/yes						0.42	0.565	1.521	0.364	6.359	0.894	0.271	2.445	0.498	12.017
Quarantine month															
First month/second month						1.313	**0.025**	**3.716**	1.179	11.705	0.888	0.177	2.429	0.669	8.82
All-or-nothing thinking style															
No/yes											1.704	**0.03**	**5.495**	1.179	25.598
Catastrophic thinking style															
No/yes											1.097	0.155	2.995	0.66	13.596
Intolerance-uncertainty															
No/yes											0.44	0.507	1.552	0.423	5.694
Optimistic style															
No/yes											1.55	0.049	4.713	1.008	22.048

In bold significant values are reported.

step, only the "all-or-nothing" cognitive style showed a significant predictive power, and the likelihood of a positive estimate of traumatic reaction increased to more than five times.

The values of Nagelkerke's r^2 for the three blocks within the model in **Table 6** are 0.12 for step 1, 0.206 for step 2, and 0.335 for step 3.

DISCUSSION

To the best of our knowledge, this study is a first in investigating quantitative emotional and cognitive aspects and qualitative psychopathological data on a digital platform during the lockdown following the Italian outbreak of COVID-19. Until now, narrative medicine worked on interviews, written reports, and storytelling. Also, the study contributed to the identification of potential predictors of post-traumatic distress in a sample of university students seeking help to the counseling and consultation service.

First, we analyzed the emotional and cognitive experiences and the psychopathological symptomatology of youths during the occurrence of the Italian lockdown due to COVID-19. A little more than 20% of our students experienced this lockdown as a traumatic experience. Furthermore, 36% of the students reported to be psychologically distressed and suffering from anxiety symptoms, whereas 26% showed depressive symptomatology.

In this study, more than 80% of the female students were more likely to ask for help, but we did not report a higher proportion of female students affected. About one-fifth of the students that had previous psychological and psychiatric contacts with MHS showed a more severe traumatic and depressive symptomatology. The three main areas impaired were changes in the sleeping pattern (68%), lack of concentration (67%), and loss of energy (58.6%).

Our study confirms the effect of COVID-19 on young people, showing a high, similar proportion of youth suffering from psychological problems, nearly 40%, as seen in a Chinese study (41.4%) (3), and a higher proportion suffering from post-traumatic symptoms as compared to the Chinese population (14.4%). In the scientific literature, women seem more likely to show symptoms of PTSD related to traumas, and Mazza et al. (27) confirmed this data during the Italian COVID-19 outbreak; surprisingly, our study did not show such evidence. Furthermore, Liang et al. (3) found that during the COVID-19 outbreak, in their sample of youths, men scored significantly higher on psychological distress, PTSD, and negative coping scales as compared to women.

The high level of depression, anxiety, and stress symptomatology could be the basis for sleep difficulties, reported by almost 70% of our student sample, in line with the Italian survey data of 52.4% of poor sleepers registered by Cellini et al. (28). Moreover, sensation of time elongation, increased hours of information exposure, increased use of social media and websites, frequent inversion of circadian rhythms (sleeping in the morning and the afternoon), impossibility to articulate daily life in different activities, and spaces could be hypothesized to be co-responsible for sleep disturbances. Difficulties in concentration and loss of energy were most reported by a large part of our student sample in their digital diaries, with a reduced progression in studies. Psychological distress was positively and significantly correlated with concentration and attentive difficulties, showing that psychological distress could impact our ability to function correctly.

According to the correlation analyses, the level of post-traumatic, anxiety, and depressive symptoms tended to increase with the progression of the days of the lockdown period (home confinement). As if, after an initial phase of optimism, the challenges, efforts, and changes related to the event and the relative adaptation difficulties, such as difficulty in studying, family conflicts, and increased annoyance toward social restrictions, begin to emerge predominantly. Our findings confirmed the impact of the duration of quarantine on post-traumatic distress symptoms (29, 30).

The analysis of narrative digital diaries allowed to detect the "optimistic style" in around a quarter of the students of our sample (26.2%). At the time of COVID-19 pandemic, the popular expression repeated all over the world, "Everything Will Be Fine," could be identified in such a cognitive style, inversely correlated with psychopathological distress and concentration problems.

As expected, a negative and statistically significant correlation was observed between "optimistic" thinking style and psychological distress, anxiety, depressive, and post-traumatic symptoms, showing that this positive cognition was correlated with a sense of well-being and could represent an important resilient resource for a better adjustment to stressful situations (31). According to these results, a negative and statistically significant correlation was found between anxiety and happiness, which together with the optimistic style represented an adaptive and positive response to adversity. Both optimistic style and the feeling of happiness depict the resilient strength of "Everything-Will-Be-Fine" students, who better survived the lockdown period. Feelings of loneliness were experienced by a higher proportion of off-site students "blocked" in their university town compared to the students who were able to go back home to their families.

More than 50% of our sample showed an "intolerance-of-uncertainty" style of thinking, variable recently studied during the pandemic COVID-19 outbreak (32). The authors reported the relationship of intolerance of uncertainty and mental well-being, mediated by rumination and fear of COVID-19 (32). Our data do not confirm the relationship between "intolerance of uncertainty," which certainly has pervaded most, and the distress of our students.

The "intolerance of uncertainty" was the most represented cognitive style in our student sample, but the "all or nothing" one influenced students' well-being more negatively, directly correlated with the psychopathological distress and post-traumatic symptoms. The thinking style "all or nothing" represents a negative cognitive pattern that identifies an inability to see the alternatives in a situation or solutions to a problem and may represent an obstacle to well-being, characterizing around 25% of the sample.

Second, we investigated the variables that could predict the traumatic impact of the COVID-19 home confinement. The "all-or-nothing" thinking style was the final strongest predictor increasing by over five times the likelihood of experience post-traumatic symptomatology, confirming that maladaptive appraisals can predict severity of stress reactions after a traumatic event and mediate adaptive functioning to environmental stressors (33).

None of the socio-demographic (gender, age, and relatives' educational level) or clinical (previous contact with MHS and antidepressant treatment) variables were predictive of a potential presentation of post-traumatic symptomatology. The results of the logistic regression analysis on our selected variables also indicated that the duration of home confinement, the second month, seemed to increase of 3.7 times the risk of post-traumatic manifestations since the cognitive thinking styles were not entered in the model. The insertion of these variables modifies the "risk model" concerning such usually unexplored factors. The condition of being "locked," home confined far from family in the university town, considered as another potential peritraumatic factor, did not enter our model.

We cannot compare our results with the results of the Chinese study of Cao et al. (5), the only study investigating predictors of the psychological impact of the COVID-19 epidemic on college students. They identified factors not investigated in our study, such as risk factors "living in urban areas," "family income stability," and "living with parents" and protective factors, such as "having relatives or acquaintances infected with COVID-19."

A Spanish study investigating on university students and workers in a sample of 2,530 participants found moderate to extremely severe scores of anxiety, depression, and stress reported by 21.34%, 34.19%, and 28.14% of the respondents, respectively (34). Evaluating the psychological impact level, half of the sample obtained a score related to the psychological impact of outbreak and lockdown as moderate or severe (IES $\leq$ 26). The university staff presented lower scores in all measures compared to students, who have been specially impacted by the COVID-19 confinement during the first weeks of the lockdown. The authors hypothesized that students could be more concerned about their perception of the future and alarmed by their way of consuming information media, etc.

A recent Italian study investigated on psychological distress among general population during the COVID-19 pandemic and examined the potential predictive value of sociodemographic variables and personality traits. Among selected predictors of their constructed model, the student condition did not seem to represent a predictive significant variable of stress, anxiety, and depression symptoms (27), whereas significant predictors were female gender, negative affect, and detachment. Having an acquaintance infected, a history of stressful situations and medical problems, a family member infected, and young person who had to work outside their domicile presented higher levels of psychopathological symptoms.

This study has some strengths and limitations. Among the strengths, firstly, this is an early study that investigates not only psychopathological variables but also the cognitive and emotional experiences of a sample of university students. Secondly, the current study uses a protected digital platform that allowed the collection of personal experiences from "innovative" narrative diaries. Thirdly, the identification of predictors as dysfunctional cognitive styles can address targeted interventions on subgroups of a vulnerable population.

Regarding the limitations, the main limitation of this study is the sample size. The study was not presented as one out of the several Internet anonymous surveys on psychological conditions during the COVID-19 home confinement. It was addressed to students in need of help for their psychological and/or academic difficulties. Then, we can hypothesize that the access could be limited because of the need for the registration on a digital platform after sending an e-mail, the absence of anonymity, and the conduction of video consultations, implying more than a single action and an overt request of help. Moreover, the results of our study are not generalizable concerning the qualitative findings due to the difficulty of conducting a rigorous reliable qualitative narrative analysis. Although our research study on qualitative data followed the criteria for SRQR (Standard for Reporting Qualitative Research) (35), the presence of possible bias in the data analysis has to be considered, while respecting a paradigm like the cognitive behavioral one.

CONCLUSION

Imposed home confinement or isolation is an unfamiliar and unpleasant experience that involves separation from friends and family and a departure from usual, everyday routines (36). Social isolation associated with home confinement can be the catalyst for many mental health sequelae, even in people who were previously well (37).

At the time of COVID-19, services are providing psychological counseling using electronic digital devices and applications (such as smartphones and chat) for help seekers, for persons affected by mental disorders, as well as their families (38), and this can represent an opportunity to improve the accessibility to psychological and mental health services, beyond the virus spreading.

Our study was based on the utilization of a digital platform that integrated quantitative and qualitative, narrative data and investigated not only psychopathological profiles in young people but also their emotional and cognitive experiences at the time of an exceptional event of forced social isolation, the COVID-19 outbreak.

If happiness and optimistic style, shown by a quarter of our students, give content to the "resilience" model, underlying the "#everythingwillbefine" message of hope, our preliminary data suggests the need of monitoring the rest of the students who showed significant difficulties instead during the COVID-19 pandemic.

The identification of the "all-or-nothing" dysfunctional cognitive style, as a robust predictor of post-traumatic symptoms, can address intervention on such a modifiable risk factor.

The implementation of psychological interventions to improve the mental health of vulnerable young subgroups during a global health emergency and to contain, as far as possible, the evolution and structuring of psychopathological profiles represents a fundamental challenge.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by University of L'Aquila, Internal Review Board. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

LG, MC, and RR designed the study and wrote the protocol. AS developed and oversaw the maintenance of the digital platform. LG, DB, SM, AS, and DU followed the clinical cases and conducted clinical video-chat interviews. LG, DB, and SM analyzed the narrative data. LG and RR conducted the statistical analyses. LG, MC, and RR conducted literature research and wrote the publication. All authors contributed to the article and approved the submitted version.

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MINI REVIEW
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Alcohol Use and COVID-19: Can we Predict the Impact of the Pandemic on Alcohol Use Based on the Previous Crises in the 21st Century? A Brief Review

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The enormous health and economic challenges precipitated by the 2019 coronavirus disease (COVID-19) pandemic are comparable or even greater than those associated with previous historical world crises. Alcohol use, especially drinking to cope with stress, is a concern, as an increase in its sales has been reported in some countries during the quarantine. This study aims to provide a better understanding of what to expect in terms of alcohol consumption, risk factors for excessive use, and its potential consequences during this pandemic based on previous experiences. We investigated how traumatic events related to alcohol consumption. Studies on mass traumatic events (i.e., terrorism as 9/11), epidemic outbreaks (i.e., severe acute respiratory syndrome [SARS] in 2003), economic crises (such as 2008's Great Recession), and COVID-19 were selected. The main keywords used to select the studies were alcohol use, drinking patterns, alcohol use disorders, and alcohol-related consequences. Previous studies reported increases in alcohol use associated with those events mediated, at least partially, by anxiety and depressive symptoms, and posttraumatic stress disorder (PTSD). Being male, young, and single also seems to be associated with a higher vulnerability to develop risky drinking behavior after those tragic events. The discussion of previous risk and protective factors can contribute to elaborate more specific public health policies to mitigate the impact of the current pandemic on people's mental health, especially alcohol-related problems.

Keywords: alcohol, terrorism, economic crises, COVID-19, pandemic

INTRODUCTION

The 2019 coronavirus disease (COVID-19) pandemic is an unprecedented situation in the 21st century. Since its outbreak, the entire world is facing health and economic challenges. The consequences of this pandemic on people's mental health are still unknown, but the available data suggest that the situation can be considered a "disaster" (1). Disasters like pandemics are collective experiences, also called mass traumas, and quarantine restrictions pose an additional threat to individuals' mental integrity (2).

Anxiety symptoms, mood disturbances, hypochondriac beliefs, poor sleep, and worries are the most common mental health manifestations in the COVID-19 outbreak (3–7). Fear of contamination, personal afflictions (grieving, lack of routine, and isolation), and financial insecurity (i.e., uncertainty and unemployment) are some of the current stressors.

A review of psychological stressful experiences and alcohol intake concluded that stress is associated with increased risk for excessive alcohol use, alcohol-related problems, and alcohol use disorders (AUD) (8). Some recent data showed that alcohol sales and delivery increased during the COVID-19 outbreak (9, 10).

The scientific community has expressed its concern on alcohol misuse during and after the COVID-19 pandemic (10–12) as preliminary studies have been detecting some alcohol-related problems. There are reports of an increased number of emergency room (ER) visits related to alcohol use (including severe alcohol withdrawal syndromes) (13–15) and suicide attempts related to fear of contamination in individuals with severe AUD (16). Additionally, moderate levels of alcohol intake were seen in 28.6% of individuals hospitalized for COVID-19 in England (17).

This narrative review aims to examine the data about the impact of three critical previous disasters on alcohol use. The information extracted from this review will be analyzed as a potential tool to preview the effect of the current crisis on alcohol consumption. We considered the following three previous events: the World Trade Center attack (terrorism), SARS (respiratory epidemic), and 2008's Great Recession. Recent studies on COVID-19 and alcohol use were also reviewed. We run four different searches on PubMed with "alcohol use," "alcohol-related problems," or "Alcohol Use Disorder," and/or "stress," and/or "PTSD" with the following events separately: 1 World Trade Center or 9/11 attack (terrorism); 2 economic recessions; 3 SARS (respiratory epidemic), and 4 COVID-19 in Title/Abstract. We present the most relevant studies gathered for this review in **Table 1**, which has been divided accordingly to the following sections: 1 terrorism, 2 economic adversity, 3 SARS, and 4 COVID-19.

Terrorism

In the last 20 years, many studies have been conducted on the effects of terrorism on mental health and alcohol use. A meta-analysis that included investigations on 9/11 twin towers attack, Oklahoma City bombing, and terrorist events in Israel and England showed an increase in alcohol consumption up to 2 years after the traumatic episode. The authors estimated that 7.3% of the population exposed to the event present alcohol misuse after a terrorist attack. The methods used in the researches grouped in this meta-analysis included prospective studies using random digit dial telephone surveys to contact participants, analyses focused on specific groups (i.e., rescue workers, veterans), and longitudinal cohorts, among others (19).

After the publication of this meta-analysis, a community study revealed that drinking motives (i.e., drinking to cope with negative affect and for enjoyment) assessed 10 years earlier could predict greater risk for alcohol use after 9/11 attack (2001) regardless of exposure level to the fateful event and lifetime AUD diagnosis (18).

A unique dataset on the impact of terrorism in society is the World Trade Center (WTC) Health Registry, a cohort of individuals directly exposed to the event. Individuals were assessed at four different time points: Wave 1 (2003–2004), Wave 2 (2006–2007), Wave 3 (2011–2012), and Wave 4 (2015–2016) (51, 52). For this review, two recent studies published by Welch et al. (21, 22) were selected, which investigated the long-term impact of this tragic episode on alcohol use. The authors observed that 7.8% of participants reported frequent binge drinking 5–6 years after 9/11. In addition, frequent binge drinking (5+ drinks per occasion, 5+ times in the last 30 days) was associated with high exposure of the event (4+ experiences such as witnessing terror, being close to someone who died in the event, and others). Higher odds of frequent binge drinking were found in young males (18–29 years old), current and former smokers, with 12–16 years of formal education (high school/college), higher exposure of the event, and participants with posttraumatic stress disorders (PTSD) symptoms. On the other hand, factors related to lower rates of frequent binge were 65 years old or older and being Asian (21).

The second study aimed to investigate the intensity of binge drinking in the previous 30 days, 10 years after the terrorist attack (Wave 3). Their findings revealed that 24.6% of participants reported binge drinking, about one-third of them with high intensity (8+ drinks for men, 7+ drinks, women). Higher odds of excessive alcohol use were observed in young males (18–34 years old), Caucasian, with higher exposure of the event, and with symptoms of PTSD (22).

A more recent study investigated hospitalizations for alcohol- or drug-related diagnosis during a period of up to nine years after 9/11 combining two datasets: the WTC Health Registry and New York State Administrative Hospitalization Data. Six hundred and five individuals (1.5% from a sample of 41,176 subjects) were hospitalized at least once for alcohol- or drug-related diagnosis. Males and individuals with PTSD related to the event were four times more likely to have an alcohol-related hospitalization (20).

Summarizing, risk factors for more frequent and excessive alcohol use were being male and meeting criteria for PTSD. Also, long-term drinking habits related to 9/11 were more likely to occur in younger individuals, with higher exposure (20–22).

Economic Adversity

Economic crises, *per se,* or as a consequence of other disasters, may affect alcohol use in different ways. At the individual level (micro), alcohol consumption may increase as a way to cope with negative affect. On the other hand, it can decrease due to the loss of economic resources. At the societal/country level (macro), alcohol use may be influenced by public policies (such as social support or preventive strategies for alcohol-related problems), price and availability of alcoholic beverages, and access to treatment (24, 27, 53).

The Great Recession of 2008 was characterized by increased unemployment rates, reduced wages, higher individual debts, and loss of purchasing power. Worldwide countries were impacted and responded differently according to social support (24, 29, 53),

TABLE 1 | Findings of the main studies included in the present narrative review.

Author	Year	Type	Section	Main findings	Limitations
Beseler et al. (18)	2011	Prospective	1	Drinking motives accessed a decade early predicted greater alcohol use 1 and 16 weeks after 9 /11 in individuals from New Jersey county aged 18–65 years Drinking to cope with negative affect and drinking for enjoyment were the significant variables and no interactions with proximity to the fateful event and history alcohol dependence were noted	Alcohol use was not evaluated right before 9/11
DiMaggio et al. (19)	2009	Meta-analysis	1	An increase in alcohol consumption 2 years after the traumatic event was observed in this meta-analysis that included 31 population-based studies (the majority [24] of studies was from 9/11). These results suggest the need for public health interventions on alcohol use after massive trauma	Heterogeneity of the studies, and a small number of data points inserted in the meta-regression
Hirst et al. (20)	2018	Prospective	1	Findings showed that 1.5% was hospitalized for alcohol- (0.8%) or drug-related diagnosis Participants with PTSD were more likely to have been hospitalized for an alcohol- or drug-related condition than those without PTSD during a period of up to 9 years after 9/11	The study did not include data from federal, psychiatry hospitals out of NY, and emergency department visits
Welch et al. (21)	2014	Longitudinal	1	5–6 years after 9/11, 7.8% of participants reported frequent Binge Drinking (BD) (5+ drinks per occasion, 5+ times in the last 30 days) Higher odds of frequent BD were seen in individuals who were male, young (18–29 years old), never married, smokers, with high school diploma, an income of > 50 K, high exposure of the event and PTSD	The response rate of 68% on wave 2 Self-reported alcohol use and PTSD diagnosis were performed using a self-reported instrument
Welch et al. (22)	2017	Longitudinal	1	10 years after 9/11, 24.6% of the sample reported 1+ episode of Binge Drinking (BD) in the 30 days prior, to those ∼37 with high intensity of BD (8+ drinks for men, 7+, women) Higher odds of BD were found in males, younger (18–34 years old), Caucasian, with an income <75 K, higher exposure of the event, and PTSD	Self-reported alcohol use and PTSD diagnosis were performed using a self-reported instrument
Alonso et al. (23)	2017	Longitudinal	2	Data from the National Institute of Statistics (INE, n = 21.9 million; 25–64 years) evaluated Deaths Directly Attributable to Alcohol (DDA) and employment status from 2002 to 2011 After the crisis, DDA increased among the employed and decreased among the unemployed, except for men, non-married, and medium/high-wealth people	Only a few DDA were analyzed Alcohol use variables were not available and it some individuals could have history of AUD before the crisis
Ásgeirsdóttir et al. (24)	2014	Longitudinal	2	A random sample of 9,028 individuals from the national survey Health and Well-being, conducted in 2007 and 2009 Reduction (−0.027) in drinking (5+ alcoholic drinks in 1 day at least 1 time/month [past year]) after the crisis among working age population (25–64 y.o.) even after including individual factors as covariates (hours of work, real income, financial assets, mortgage debt, or mental health)	Self-report alcohol use Working age population included a wide age range (25–64 y.o.)
Ásgeirsdóttir et al. (25)	2016	Longitudinal	2	Follow up of the above-mentioned study, conducted in 2012 Reduction of 5% a year in drinking (i.e., 5+ alcoholic drinks in 1 day at least 1 time/month in the past year) during the crisis and at a slower rate (2–3% a year) during recovery among the working-age population, controlling for individual factors (i.e., hours of work, real income, financial assets, mortgage debt, and mental health).	Self-report alcohol use Working age population included a wide age range (25–64 y.o.)
Bor et al. (26)	2013	Longitudinal	2	National survey with >2 million individuals conducted from 2006 to 2010 Frequent binge drinking (4+ episodes in the past 30 days) had a 7% increase, and was associated with young men (< 30 y.o.), not married, non-Black, higher household income, unemployed for <1 year, and without a college degree	Self-report alcohol use
de Goeij (27)	2015	Realistic review	2	Self-medication mechanism could explain a rise in heavy drinking in the US and Spain after the crisis, and that association was stronger in men. Budgetary shortfall could explain the fall in heavy drinking in Iceland	Less evidence for microeconomic (individual) factors
de Goeij (28)	2016	Longitudinal	2	Dutch Health Interview Survey conducted between 2004 and 2013 (n = 20, 140 men and 22,394 women aged 25–64) evaluated month-to-month trends in alcohol consumption over several years (episodic [6+ glasses on 1 day 1+ day/week] and chronic drinking [>14 glasses/week for women and >21 for men]) Downward trends showed a ceasing of decline among women in general and among 35–64 and high-income men. A start of decline was observed among younger men (25–34 y.o.)	Self-report alcohol use Harmful drinking was not measured longitudinally (repeated cross-sectional data), and causal relationship cannot be inferred

(Continued)

TABLE 1 | Continued

Author	Year	Type	Section	Main findings	Limitations
de Goeij et al. (29)	2017	Longitudinal	2	Data from Dutch Health Interview Survey (N = 26,355 aged 30–64 years) collected from 2004 to 2013 Job loss duration (>6 months) was related to both episodic [OR 1.40 (95% CI 1.01–1.94)] and chronic drinking (OR 1.42 [95% CI 1.05–1.91]). Current job loss was associated with chronic drinking (OR 1.43 [95% CI 1.03–1.98]) during the post 2008 economic crisis, but not before. These associations were most clear in men and different between pre-crisis and crisis period (p interaction = 0.023 and 0.035, respectively)	Self-report alcohol use Harmful drinking was not measured longitudinally (repeated cross-sectional data), and causal relationship cannot be inferred
Gili et al. (30)	2013	Longitudinal	2	Primary care patients (N = 7,940 in 2006–07 and N = 5,876 in 2010–11) were evaluated for mental health disorders AUD diagnosis increased 4.6% (dependence) and 2.4% (abuse) after the crisis. Relative increase, in comparison to other psychiatric disorders, were greater for alcohol dependence and abuse (OR= 12.2 and 4.6, respectively)	Individuals were not evaluated longitudinally
Global Burden of Disease (31)	2016	Longitudinal	2	Between 2000 and 2016 there was a 2% increase in YLD Alcohol was the second behavioral risk factor for YLD and	Inconsistencies in registry data
Kalousova et al. (32)	2014	Longitudinal	2	Data from Michigan Recession and Recovery Study (N = 840, followed from 2009–10 to 2011) using Alcohol Use Disorder Identification Test (AUDIT) Harmful drinking was associated with perceived loss of economic resources (HR: 2.75 [95% CI 1.2–6.27] $p < 0.05$), whereas objective measures did not predict this outcome	Data is not nationally representative Objective measures of economic resources were self-reported
Kaplan (33)	2016	Retrospective	2	Data from the U.S. National Violent Death Reporting System (NVDRS) was used to compare heavy drinking among men who committed suicide and living men (Blood alcohol levels [BAC] $\geq$ 0.08 g/dl for suicide decedents; at least one binge drinking in the last 30 days for the control group) Men who committed suicide had a greater increase (8%) in heavy drinking at the onset of the recession in comparison to living men. For men, adjusted odds ratio was higher after the crisis (adOR =1.15 [95% CI 1.10–1.20; $p < 0.001$]) relative to the prerecession period (adOR = 0.93 [95% CI 0.90–0.97]). The same pattern was not observed in women	BAC measures do not indicate a diagnosis of AUD or harmful drinking Postmortem toxicology testing rates varied across states
Mateo-Urdiales (34)	2020	Longitudinal	2	Data from Spanish Longitudinal Mortality Study (Census) collected from 2004 to 2011 evaluated DDA in a sample of 22.2 million people Largest increase in DDA in men and women with tertiary studies (+ 25.3% and +113.8%, respectively) and smallest in those with primary studies (+6.2% and +1.5%), decreasing relative educational inequalities	Only a few DDA were analyzed Causal relationship cannot be inferred (repetitive cross-sectional data)
Yang (35)	2018	Longitudinal	2	Data from The National Survey on Drug Use and Health (N = 307,935) from 2007 to 2016 Millennials were at significantly increased risk of past month binge alcohol (AOR = 1.51; 95% CI = 1.46 $\pm$ 1.56) than Gen X, while Baby Boomers were at significantly reduced risk of all substances (AOR = 0.56; 95% CI = 0.54 $\pm$ 0.58)	Self-report alcohol use Causal relationship cannot be inferred (repetitive cross-sectional data)
Lancee (36)	2008	Retrospective	3	It was not reported any increase in alcohol intake since the SARS outbreak in Hospital Workers in Canada	Self-report alcohol use
Mak et al. (37)	2009	Retrospective	3	One-third of the sample had psychiatric disorders 30 months after SARS, the most prevalent disorders in this sample were depressive and anxiety disorders, including PTSD. However, the new incidence of AUD was not observed in this infected and hospitalized patients who survived	Small sample size Self-reported questionnaires
Phua et al. (38)	2005	Cross-sectional	3	The use of alcohol and drugs was not observed as a coping mechanism in Healthcare Workers (HCW) in Singapore. Authors stated that cultural e religious factors could contribute to that finding	Small sample size
Wu et al. (39)	2008	Cross-sectional	3	Increased AUD symptoms in hospital employees were related to being male, in quarantining, having a higher household income, working at high-risk locations, high PTS symptoms and depression, hyper-arousal, and drinking to cope, 3 years after the SARS outbreak in China.	It is not possible to determine whether AUD symptoms started before or after the SARS outbreak
Ammar (40)	2020	Cross-sectional	4	An online survey performed in different regions (Europe, Africa, Asia, and Americas) involving 35 institutions showed a decrease in binge drinking during quarantine ($p < 0.001$, d = 0.58) comparing data from 2019 and 2020	Lack of inclusion and exclusion criteria Data from a convenience sample recruited online

(Continued)

TABLE 1 | Continued

Author	Year	Type	Section	Main findings	Limitations
Ahmed et al. (41)	2020	Cross-sectional	4	In the overall sample, about one third affirmed the occurrence of anxiety symptoms and 37.1% of depressive symptoms Additionally, 29.1% of the participants reported hazardous drinking, 9.5% harmful drinking, and 1.6% alcohol dependency. Individuals ages 21–40 were more vulnerable to alcohol use Hubei had significantly higher proportions of hazardous drinking (33.5% in Hubei and 21.5% in others); harmful drinking (11.1 vs. 1.9%) and alcohol dependence (6.8% vs. 1.0%).	Self-report scales More than 50% of the sample was from Wuhan province
Fiocruz (42)	2020	Cross-sectional	4	In Brazil, participants were selected using a Respondent-Driven Sampling (RDS) method from April 24th and May 8th. There was a subject perception of increased use of alcoholic beverages by 18% of the respondents, individuals from 30 to 39 years old showed a higher increase. Alcohol intake was associated with feeling sad/depressed (reaching 46.9% of the participants who reported feeling sometimes [22.5%] or always [24.4%] sad/depressed during the pandemic)	Self-report alcohol use Subjective perception of an increase in consumption Data from a convenience sample recruited online
Lee et al. (43)	2020	Cross-sectional	4	Examining the validation of the Obsession COVID-19 Scale (OCS) in the U.S. population, proposing a cutoff point of 7. Findings also showed that higher scores of OCS were correlated with alcohol and drug use to cope	Does not quantify alcohol use
Liang et al. (44)	2020	Cross-sectional	4	Two weeks after the outbreak of the COVID-19 in China, 40.4% of the sample was prone to psychological problems, and 14.4% PTSD symptoms. Among these young adults (age 14–35), those with more negative coping strategies (including alcohol use) had a higher chance of having psychological problems	Self-report Snowball sampling approach
Nanos Research (45)	2020	Cross-sectional	4	Participants were selected using a Random Digit Dialed in April and May. In this Canadian study, among individuals who affirmed staying home more due to COVID-19 (90% of the sample), 20% of those reported increased alcohol, and 21% said they were drinking more often as well. The main reasons for drinking more: lack of a regular schedule, boredom, and stress	Non-standard questionnaire Descriptive analysis
Newby et al. (46)	2020	Cross-sectional	4	Participants filled out an online questionnaire through (March 27th and April 7th), respondents were mostly females (86%). About three-quarters of the subjects said that their mental health was worse. Levels of distress, anxiety, and fears were higher in the respondents with a mental health diagnosis 52.7% declared a hazardous pattern of alcohol use in the prior month (scores $\leq$ 3/women; $\leq$ 4 men in AUDIT-C)	Self-report
Stanton et al. (47)	2020	Cross-sectional	4	An online survey carried out between April 9–19, participants were on average 50 years old (SD 14.9) and 67% were women. 22.3% of the respondents affirmed using alcohol 4+ occasions/week, and 26.6% said there was an increase in alcohol use Higher anxiety, depression, and stress levels were noted in individuals aged 18–45 and were related to more elevated alcohol use	Self-report
Sidor and Rzymski (48)	2020	Cross-sectional	4	An online study conducted between 17 April and 1 May (period of national quarantine) in Poland observed an increase of 14.6% in alcohol use. Additionally, individuals who recognized themselves with an AUD reported more frequent alcohol use	Self-report
Sun et al. (49)	2020	Cross-sectional	4	An online survey carried out from March 24–31 observed relapses and an increase in alcohol use during COVID-19 in China. Respondents were on average 28 years old (SD 9) and the distribution of males and females was similar. Results revealed that 32.1% of regular drinkers increased alcohol intake, 18.7% ex-drinkers relapsed, and 1.7% non-drinkers initiated the use of alcohol	Data from a convenience sample recruited online Self-report
Zhang et al. (50)	2020	Cross-sectional	4	The study was conducted between February 28 and March 02 in Wuhan. Participants were submitted to the Perceived Stress Scale (PSS), daily routine, and habits. Results showed that more than 80% reported elevated perceived stress levels. Also, females who were regular alcohol drinkers had more elevated perceived stress levels	Self-report

1: Terrorist attacks; 2: Economic crises; 3: SARS; 4 Covid-19.

alcohol prices (25, 27, 29), and the availability of healthcare services (53, 54), There were some differences also related to regional drinking patterns and cultural and demographic specificities (53).

American studies showed a decline in alcohol consumption during 2008's Great Recession. However, an increase in binge drinking was observed in specific populations, i.e., youngsters, men, unemployed, individuals with fewer years of education, non-Black, and higher income (26, 27, 33, 35, 55). Moreover, subjective perception of economic loss and higher economic adversity in the context of social prejudice were related to problematic drinking in Black Americans and Hispanics (32, 55).

Economic stressors were also relevant to drinking outcomes, and this association was stronger in men (27). A study examined the relation among alcohol use, economic adversity, and suicide. Men who committed suicide had a more significant increase in heavy drinking at the onset of the recession than the male general population. This finding was not observed in female (33).

When comparing alcohol use across generations (Millennials, Generation X, and Baby Boomers), and the impact of the socioeconomic vulnerability, 30) observed that Millennials had an increased risk of binge drinking compared to Generation X, while Baby Boomers had reduced risk. Social vulnerability rates were also higher among Millennials and lower among the oldest cohort, although it was not associated with binge drinking (35).

The Great Recession affected European countries differently. In Spain, higher rates of alcohol-related problems were observed in men, in the working-age population, and those with higher income, whereas results for employment status were mixed. Gili et al. (30) found a significant increase (4.6%) in alcohol abuse and dependence in primary care settings during the recession. A cohort study evaluated Deaths Directly Attributable to Alcohol (DDA) and employment status. Overall, results showed subgroups as unemployed non-married men with substantial material wealth had more unfavorable changes in DDA. At the same time, more favorable outcomes were seen in employed individuals, including unskilled workers (23). A large prospective population study found an increase in DDA after the crisis among men and women in all educational groups. However, this increase was highest in highly educated individuals (+ 25.3% in men and +113.8% in women) and smallest in those with lower education (+6.2% and +1.5%, respectively) (34).

After the Great Recession, economic plans imposed by the European Union, the European Central Bank, and the International Monetary Fund lead Greece to an austerity era. At that time, The Global Burden of Disease Initiative (2018) evaluated years living with a disability (YLD) in the pre- and post-austerity era. From 2000 to 2016, Greece had a 2% increase in YLD, whereas other European countries showed the opposite trend. Alcohol was the second behavioral risk factor for YLD among people aged 15–49 years (31).

In the Netherlands, an epidemiological survey investigated temporal trends for episodic and chronic drinking from 2004 to 2013. Diverted patterns after the crisis suggested that income effect could explain changes in drinking in the lower socioeconomic groups. In contrast, for women and middle-aged high-income men, the self-medication mechanism related to alcohol use was more evident (28). This survey also showed that unemployment was associated with increased alcohol use, especially among men with more extended periods of unemployment (>months). Interestingly, these associations were not found before the crisis (29).

In Iceland, there was a reduction of 5% per year in drinking among the working-age population during the crisis. The devaluation of Icelandic krona (36%) and inflation increased alcohol prices by 48.7% (24). By 2012, Iceland had already recovered from the economic crisis but drinking patterns did not return to its pre-crisis levels and continued to decline at a slower rate (2–3% a year) (25). Therefore, although macroeconomic factors played an important role in reducing drinking, elevated prices could not fully explain this effect. Other variables, such as increased community participation, could have contributed (25).

In conclusion, most studies about economic adversity and alcohol use indicated an increased vulnerability for harmful drinking among unemployed working-age men. Other factors such as marital status, educational background, economic status, psychological distress, ethnic prejudice, and generation also interact with drinking outcomes.

Severe Acute Respiratory Syndrome (SARS)

The majority of the studies concerning the SARS outbreak assessed healthcare workers' (HCW) risk factors, coping strategies, and the occurrence of mental health problems. One study in emergency department (ED) HCW who assisted patients with SARS in Singapore (38) showed that the main coping strategies were social bonds such as religion and not alcohol/drug use.

Moreover, depressive and anxiety disorders, including PTSD, and not AUD, were the most prevalent disorders in hospitalized patients who survived 30 months after SARS epidemics (37). The authors suggested that the knowledge that alcohol was a risk for Post-SARS avascular necrosis may have been a deterrence to alcohol consumption. Lancee et al. (36) also did not note an elevation in AUD in a Canadian sample affected by SARS.

Contrary to what was observed in the studies above, Wu et al. (39) studied the number of AUD symptoms among hospital employees in Beijing, China, three years after the SARS outbreak. Increased number of AUD symptoms was positively associated with being male, having a higher household income, being quarantined, or working at high-risk locations, as well as drinking to cope, posttraumatic symptoms (PTS), and depression. The relationship between outbreak exposure and AUD symptoms was not affected by sociodemographic factors. Besides, the inclusion of PTS clusters into the model revealed that higher hyper-arousal scores were associated with AUD symptoms.

Three out of four SARS studies examined HCW responses to the epidemic. Increases in alcohol-related problems number of symptoms were significantly associated with higher hyper-arousal scores. Cultural and patient concerns about alcohol-related impacts on SARS could prevent alcohol abuse.

Coronavirus Disease (COVID-19)

After one semester of the COVID-19 pandemic, several studies reported some increase in alcohol use. In Canada, 20% of the participants who stayed at home increased alcohol consumption. Comparing alcohol use before the pandemic, 21% of the Canadians who stay at home reported drinking more often. The reasons for such behavior were lack of a routine, boredom, and stress (45). A Brazilian study found that 18% of the sample drank more during the pandemic. Participants from ages 30–39 showed the highest increase (25.6%). Alcohol use was associated with feeling sad/depressed (42). In Poland, an increase in alcohol use was seen in 14.6% of the studied sample during quarantine (48). In Belgium, there was a 30.3% increase in alcohol consumption, which was associated with having more children at home, unemployment, and younger age (56). Conviviality was the top motive reported, followed by reward, lack of social contacts, loss of daily structure, and increased tension (56).

In Australia, an online survey administered during the peak of the outbreak (03/27–04/07) revealed that 52.7% of the sample had a hazardous pattern of alcohol use, according to AUDIT-C (46). Another survey conducted between April 9 and 19 showed that ∼25% of the adults increased their alcohol consumption mainly due to higher levels of stress, anxiety, and depression symptoms (47). Furthermore, a later online survey, conducted from 4/16 to 5/11, showed that higher levels of stress were associated with harmful alcohol use as well; however, authors reported a decrease in harmful drinking (measured by AUDIT) especially in individuals aged 18–25 (57). Also, Bade et al. (58) observed lower levels of alcohol detection in wastewater analysis in Australia during quarantine in comparison to previous years, suggesting a reduction in drinking among the general population (58). These findings are possibly the result of restrictions to social events associated with drinking behavior (58).

In China, a study in Hubei (the main focus in the beginning of the pandemic) detected higher proportions of harmful/hazardous alcohol use and AUD compared to other provinces (41). In Wuhan (the epicenter of COVID-19), an exploratory study about the living circumstances of those quarantined showed that more than 80% reported elevated perceived stress levels. In this case, women who drink regularly had a two times higher probability of higher perception of stress than abstainers (50) indicating that alcohol and stress could work both ways. Also, in China, individuals reporting more negative coping strategies (including alcohol use) were more likely to have psychological disorders (44). In another study, more persistent thinking of COVID-19 was related to alcohol/drug use as a coping strategy (43). Almost two out of ten ex-drinkers relapsed in youth, and 1.7% started to drink (49).

Despite all studies above reporting an increase of alcohol use during COVID-19, preliminary results of an online international survey (Europe, North Africa, Western Asia, and the Americas) showed that binge drinking decreased in 2020 compared with 2019. One of the possible explanations for this finding was lack of peer pressure in the youth (40).

Most COVID-19 studies show increases in quantity/frequency of alcohol consumption and harmful and hazardous drinking. Boredom, being at home/quarantined, lack of a routine, symptoms of mental disorders, and negative coping styles were associated with those increases. When bored, people want to engage with an activity, but not with whatever is currently available. This conflict is exacerbated when external factors impose restrictions on the range of behaviors they can engage in, which is precisely the current scenario, at a global level, during the period of social isolation in response to the COVID-19 pandemic (59). Struk et al. (60) study suggests that feelings of boredom may contribute to rule-breaking behavior and some negative outcomes, including higher levels of depression and anxiety and problems with alcohol in youth and older adults (61, 62). In that sense, a strong association with drinking and social contact during quarantine was observed in the US (63). This non-adherence to social distancing norms was found among young adults (18–25 y.o) with previous hazardous drinking (63).

The COVID-19 pandemic has also changed alcohol use in adolescents. A Canadian study showed that while there was a decrease in binge drinking, frequency of alcohol use has increased (64). Although alcohol use in adolescence typically occurs in the context of peers, during this pandemic 67% reported solitary drinking. Surprisingly, 93.3% were drinking with their parents, which was also associated with less binge drinking and less use of cannabis or vaping, suggesting a switch to a more "acceptable" behavior when consuming substance at home (64).

However, peer context was still relevant for adolescents and 77.6% reported drinking with friends via technology. More worrisome, 67% reported drinking with friends face-to-face. Concerns of how social distancing would affect their reputation was predictive of face-to-face drinking among those with self-reported low popularity, whereas it was a significant predictor of solitary drinking among those with self-reported high popularity. Depression and fear of infection also predicted solitary drinking (64).

Being home/quarantined requires more organization, self-monitoring, and discipline to accomplish and manage all daily life demands. In this context, some individuals face challenges in setting their routine, having difficulties in discriminating which periods and days are designed exclusively for working, leisure, and household tasks, which can contribute to the increase in their alcohol use as they do not have social restrictions and other immediate negative consequences/reasons related to its use, such as being late to work and underperforming on a meeting among others. Other factors that contribute to alcohol use are social isolation, stress, and negative coping styles, such as drinking to cope with stress and emotion coping. Drinking alcoholic beverages as a mechanism or strategy to tolerate the burden of negative emotions is not recommended and can be unsafe due to its associate with increase in alcohol use and negative alcohol-related outcomes in longitudinal studies (12, 65, 66).

On the other hand, non-adherence to social distancing norms and in-person contacts were also associated with drinking, especially among youth with lifetime hazardous drinking and those with self-perceived low popularity. Therefore, having a structured routine, performing favorable activities, and improving coping skills are considered protective elements to harmful alcohol use and are commonly targeted in alcohol use disorders treatment as well (67). Adolescents may also benefit from interventions aiming to improve self-stem and parents should be advised against the harms of underage drinking.

DISCUSSION

Individuals respond to traumatic events in different manners, as observed in prior mass trauma situations. Increase in alcohol drinking, especially in specific subgroups, is one of the possible responses (19, 27). Preliminary studies conducted from March to May 2020 indicated an increase in alcohol use, drinking to cope with negative emotions, and depressive and anxiety symptoms (41, 42, 45, 46, 48).

After stressful experiences of terrorist attacks, economic adversity, and epidemics, some sociodemographic characteristics—male gender, unmarried, and young people—seem to predict a higher risk of developing adverse drinking outcomes (higher frequency/quantity, alcohol related-problems). High proximity/exposure to the event is another risk factor (21, 26, 35). These data can help to tailor our preventive strategies to avoid alcohol use problems among the above sociodemographic profile.

On the other hand, in Asia, studies regarding alcohol use and SARS did not show changes in alcohol use patterns. These results could be associated with the use of more adaptive coping strategies (i.e., religion) and less tolerance to alcohol seen in Asian individuals (36, 38, 68, 69).

Various limitations in the current data regarding alcohol use and stressful events should be considered as the lack of standard measures to access alcohol use in those studies. Due to the urgency of the matter, data on alcohol use during the COVID pandemic has been assessed mainly by subjective self-perception of alcohol intake (42, 45, 48). Another frequent limitation in those studies was the lack of quantification of the use of alcohol (43, 44, 70). Concluding, all these variables should be taken into consideration when interpreting the previous study's results and formulating hypotheses for the impact of economic adversities caused by the COVID-19 pandemic.

The full extension of the impact of COVID-19 on mental health is yet to be established. Individuals and regional variables should be considered when developing strategies to mitigate alcohol use problems.

AUTHOR CONTRIBUTIONS

PG designed the study, reviewed the literature, edited and critically reviewed the manuscript, and approved the final version of the manuscript. HM reviewed the literature, edited and critically reviewed the manuscript, and approved the final version of the manuscript. RA reviewed the literature, edited and critically reviewed the manuscript, and approved the final version of the manuscript. JC-M edited and critically reviewed the manuscript and approved the final version of the manuscript. AM designed the study, edited and critically reviewed the manuscript, and approved the final version of the manuscript. All authors contributed to the article and approved the submitted version.

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Occupational Stress and Mental Health: A Comparison Between Frontline Medical Staff and Non-frontline Medical Staff During the 2019 Novel Coronavirus Disease Outbreak

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Background: During an epidemic, both frontline and non-frontline medical staff endure stressful work circumstances that render their mental health a major public health concern. This study aims at investigating and comparing the prevalence and severity of mental health symptoms (i.e., anxiety, depression and insomnia) between frontline medical staff and non-frontline medical staff during the coronavirus disease 2019 (COVID-19) outbreak. It also seeks to evaluate the association of their mental health with occupational stress.

Methods: A cross-sectional study was conducted in Wenzhou, China from 2020 February 16th to 2020 March 2th. A total of 524 medical staff responded to the Generalized Anxiety Disorder Scale, the Patient Health Questionnaire, the Insomnia Severity Index, the Occupational stress Questionnaire, and a demographic data form. Data were principally analyzed with logistic regression.

Results: Of the 524 participants, 31.3% reported depression, 41.2% reported anxiety, and 39.3% reported insomnia. Compared with the citizens during the COVID-19 epidemic, medical staff experienced higher level of anxiety, depression and insomnia, especially the frontline medical staff. Furthermore, male, married medical staff with poorer physical health reported lower mental health. Frontline medical staff endorsed higher self-reported occupational stress, especially higher occupational hazards, than non-frontline medical staff. In addition, four indicators on occupational stress (working intensity, working time, working difficulty and working risk) were correlated positively with mental health symptoms. Regression analyses found a significant association between occupational stress and mental health symptoms in both frontline and non-frontline medical staff during COVID-19 outbreak.

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Conclusion: The results indicated that during the COVID-19 epidemic, medical staff experienced higher levels of anxiety, depression and insomnia than citizens, and their occupational stress had positive effects on their psychological distress. These findings emphasize the importance of occupational stress management interventions to decrease the risk of developing mental health problems among the medical staff during a biological disaster.

Keywords: occupational stress, COVID-19, medical staff, depression, anxiety, insomnia

INTRODUCTION

The World Health Organization has declared the coronavirus disease 2019 (COVID-19) outbreak a worldwide pandemic. By the end of April 2020, COVID-19 has spread in more than 140 countries and has infected more than two million people. An infectious disease outbreak, such as Middle East respiratory syndrome (MERS) and severe acute respiratory syndrome (SARS), is a biological disaster that causes profound fear, anxiety, and panic in individuals subjected to the real or perceived threat of the virus (1, 2). Compared to previous epidemics, COVID-19 is capable of human-to-human transmission, asymptomatic carrier transmission and high transmission efficiency, which makes it challenging and highly stressful for medical staff to treat. Such an occupational environment is likely to impede frontline workers' mental health (3).

Medical practice is known to be stressful (4). Medical staff members, including physicians and nurses, usually experience heavy workloads, extended working hours and high levels of time pressure in routine work (4, 5). Epidemic outbreak could exacerbate occupational stress and even burnout in the medical staff. For example, David Koh and his colleagues found that more than half of clinical staff reported increased work stress (56%) during the SARS epidemic in Singapore (6). In addition, medical workers, especially nurses, were vulnerable to many occupational risks and experienced a great deal of emotional stress related to their work in MERS outbreak (7). During the COVID-19 outbreak, medical staff are inevitably exposed to an extremely stressful work environment with the ever-increasing number of confirmed and suspected patients, overwhelming workload, depletion of personal protection equipment, and severe shortage of manpower (8, 9). Numerous studies indicate that acute and chronic stressful occupational experiences significantly contribute to mental health concerns (10, 11). These studies not only have significantly advanced current knowledge concerning the mental health of frontline medical staff but also have motivated new important research questions. For example, what is the mental health profile of essential medical staff during the COVID-19 outbreak? Do medical staff who are under severe or constant occupational stress during the COVID-19 outbreak experience more mental health problems? Compared with non-frontline medical staff, is it possible for frontline medical staff who are directly involved in the diagnosis, treatment, and care of patients with COVID-19 to be at higher risk of developing psychological distress due to higher occupational hazards and greater work burden?

Therefore, the present study seeks to expand existing studies by (1) investigating and comparing the prevalence of and severity of mental health symptoms between frontline medical staff and non-frontline medical staff during the COVID-19 outbreak, (2) identifying the characteristics of medical staff with the mental health symptoms, and (3) evaluating the association of their mental health with occupational stress.

METHODS

Participants and Procedure

Medical Staff

Due to the COVID-19 epidemic, face-to-face investigations were restricted (12). Therefore, online questionnaire was constructed via a WeChat applet. Data were collected from both the non-frontline medical staff and frontline medical staff during the COVID-19 pandemic from February 16 to March 2, 2020. The online questionnaire for medical staff (doctors, nurses, and medical technician) was publicized through posters in one isolation hospital designated for COVID-19 patients (The First Affiliated Hospital of Wenzhou Medical University) and two common hospitals (Yuying Children's Hospital of Wenzhou Medical University and Wenzhou People's Hospital) in Wenzhou, which is one of the most affected cities in terms of the number of COVID-19 cases apart from those in the hardest-hit Hubei Province in China (13). The participants included frontline medical staff and non-frontline medical staff. Frontline medical staff were defined as the medical workers who directly participated in the fight against COVID-19 by contacting confirmed COVID-19 cases or their specimens in the isolation hospitals. Non-frontline medical staff were defined as the medical workers who deal with non-COVID-19 patients in the common hospitals. All the participants were recruited through purposive sampling by means of Wen Juan Xing (www.wjx.cn), which is a widely used web-based survey platform in China. Participants were assured of data confidentiality and it was explained that only the authorized researchers could access the data. This study was conducted in compliance with the Helsinki Declaration, and was reviewed and approved by the Ethics Committee of Wenzhou Medical University. Hence, 536 medical staff were eligible for the study and consent with the study procedures, and then 524 made valid replies, yielding a response rate of 97.76%.

Citizens

In order to compare the level of mental health between the medical staff and citizens, we used the data of mental health of citizens in one study conducted by Mu (14) ("Knowledge, and attitudes toward COVID-19 among Chinese citizens and their mental health during the period of the COVID-19 outbreak"). In this study, a cross-sectional study was conducted by the online questionnaire constructed via a WeChat applet from 10th February 2020 to 20th February 2020 in China. The online questionnaire for citizens was publicized through posters by the community staff in three communities in Beijing, and all subjects voluntarily participated and signed informed consent in this survey and identified by the method of random number. Hence, 217 Chinese citizens were eligible for the study and consent with the study procedures. The prevalence of anxiety and depression was estimated by the Generalized Anxiety Disorder Scale and the Patient Health Questionnaire.

Measurements

Demographic Data

A demographic questionnaire elicited basic background information, including gender, age, education level, marital status, health status, and length of service.

Occupational Stress

For the purpose of this study, occupational stress is defined as the stressful aspects of work that a medical staff experienced in their workplace. Four items assessed medical staff occupational stress during the COVID-19 outbreak: (1) work hours, (2) work intensity, (3) work difficulty, and (4) occupational hazards during the COVID-19 epidemic. Responses were recorded on a 5-point scale ranging from "Strongly Disagree" to" Strongly Agree." Example items include "I have very long working hours during the epidemic" and "I have too much work allotted to me during the epidemic." Higher scores indicate a higher degree of occupational stress. The items demonstrated acceptable internal consistency in this sample ($\alpha = 0.74$).

Self-Reported Symptoms of Mental Health

Anxiety

The Generalized Anxiety Disorder Scale-7 (GAD-7) was used to determine the level of anxiety of participants. The seven items of the GAD-7 measure the frequency by which participants experience within the last 2 weeks the seven core symptoms of GAD (15). Items are rated from 0 (not at all) to 3 (almost every day), such that the total score ranges from 0 to 21. The score is interpreted as indicating either no anxiety (0–4), mild (5–9), moderate (10–14), or severe anxiety (15–21). Previous studies have shown that the GAD-7 is a well-validated screening instrument (16), and it has demonstrated excellent internal consistency (Cronbach's alpha = 0.94) in the present study.

Depression

The Patient Health Questionnaire-9 (PHQ-9) (17) is a nine-item assessment tool designed to measure depression based on the nine diagnostic criteria for major depressive disorder covered in the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-V). Items are rated from 0 (not at all) to 3 (almost every day) according to increased frequency of experiencing difficulties in each area covered within the last 2 weeks. Total score ranges from 0 to 27 and indicates either no depression (0–4), mild (5–9), moderate (10–14), moderately severe (15–19), or severe depression (20–27). The PHQ-9 is a well-validated screening instrument (18) that has yielded strong internal consistency (Cronbach's alpha = 0.87) in the present study.

Insomnia

The Insomnia Severity Index (ISI) (19) consists of seven items which corresponds in part to DSM-IV criteria for insomnia. Items are rated from 1 (not at all) to 5 (almost every day), higher scores indicate more severe insomnia. Scores are summed and can range from 0 to 28. The total score signifies either absence of insomnia (0–7), mild (8–14), moderate (15–21), or severe insomnia (22–28). Previous studies have shown that the ISI is a well-validated screening instrument (20), and it has demonstrated excellent internal consistency (Cronbach's alpha = 0.94) in the present study.

Statistical Analysis

Categorical variables were presented as numbers (percentages) and analyzed using chi squared test. Continuous variables with normal distribution were expressed as mean ± standard deviation and analyzed using independent samples t-test, while those with skewed distribution were analyzed using MannWhitney U-test. Hierarchical multiple regression models were established to identify factors that contributed to mental health symptoms (i.e., anxiety, depression, and insomnia) in frontline medical staff or non-frontline medical staff. All statistical analyses were performed with SPSS statistics package (version 18.0) and all reported P-values are two-tailed with statistical significance set at 0.05.

RESULTS

Demographic Characteristics in Frontline Medical Staff and Non-frontline Medical Staff

A total of 524 medical staff from hospitals in Wenzhou completed this survey. Of these participants, 150 (28.6%) are frontline medical staff in direct contact with confirmed COVID-19 patients, and 374 (71.4%) are non-frontline medical staff in direct contact with non-COVID-19 patients. Participants' demographics are shown in **Table 1**. It is noted that younger (33.65 ± 6.71), more educated (college or above) (96.7%) or unmarried (32%) medical staff were found in frontline medical staff compared with non-frontline medical staff correspondingly (36.10 ± 7.11; 78.9% or 15.2%).

Self-Reported Symptoms of Mental Health in Frontline Medical Staff and Non-frontline Medical Staff

Out of 524 participants, 164 (31.3%) subjects endorsed symptoms of depression on the PHQ-9, 216 (41.2%) subjects reported symptoms of anxiety on the GAD-7, and 206 (39.3%) subjects had symptoms of insomnia on the ISI. Prevalence of insomnia,

TABLE 1 | Demographic characteristics of the respondents ($N = 524$).

Variables	Frontline medical staff ($n = 150$)	Non-frontline medical staff ($n = 374$)	Statistics	p
Gender			14.79	<0.001
Male ($n = 134$, 25.6%)	21 (14.0%)	113 (30.2%)		
Female ($n = 390$, 74.4%)	129 (86.0%)	261 (69.8%)		
Age (mean ± SD)	33.63 ± 6.72	36.10 ± 7.11	3.02	<0.001
Education level			25.17	<0.001
High school or below (84, 16.0%)	5 (3.3%)	79 (21.1%)		
College or above (440, 84.0%)	145 (96.7%)	295 (78.9%)		
Professional			19.78	<0.001
Nurse (292, 55.7%)	120 (80%)	172 (45.9%)		
Doctor (196, 37.2%)	22 (14.7%)	174 (46.5%)		
Medical technician (36, 7.1%)	8 (5.3%)	28 (7.6%)		
Marital status			18.79	<0.001
Unmarried (105, 20.0%)	48 (32.0%)	57 (15.2%)		
Married (419, 80.0%)	102 (68.0%)	317 (84.8%)		
Health status			2.91	0.08
Good (429, 81.9%)	116 (77.3%)	313 (83.7%)		
Fair or poor (95, 18.1%)	34 (22.7%)	61 (16.3%)		
Length of service (mean ± SD)	10.67 ± 7.49	13.19 ± 9.05	3.65	0.003

Chi-square analysis was used to test for differences in the categorical variables, and t-test was used to test for differences in the continuous variables between frontline medical staff and non-frontline medical staff.

TABLE 2 | Comparison of proportion of different levels of insomnia, anxiety and depression between non-frontline medical staff and frontline medical staff.

		Non-frontline medical staff	Frontline medical staff	χ^2	p
Depression	Symptom absent	280 (74.9%)	80 (53.3%)	26.78	< 0.001
	Mild symptom	79 (21.1%)	51 (34.0%)		
	Moderate symptom	14 (3.7%)	18 (12.0%)		
	Severe symptom	1 (0.3%)	1 (0.7%)		
Anxiety	Symptom absent	220 (58.8%)	88 (58.7%)	9.89	0.02
	Mild symptom	122 (32.6%)	37 (24.7%)		
	Moderate symptom	22 (5.9%)	14 (9.3%)		
	Severe symptom	10 (2.7%)	11 (7.3%)		
Insomnia	Symptom absent	245 (65.5%)	73 (48.7%)	32.68	<0.001
	Mild symptom	105 (28.1%)	48 (32.0%)		
	Moderate symptom	24 (6.4%)	21 (14.0%)		
	Severe symptom	0 (0.0%)	8 (5.3%)		

anxiety and depression was also higher in frontline staff than in non-frontline workers, as shown in **Table 2**.

Moreover, scores on insomnia, anxiety and depression in all participants were 6.74 ± 5.64 in ISI, 4.50 ± 4.40 in GAD-7 and 3.55 ± 3.89 in PHQ-9 scales respectively, which were above the cutoff score for mental health concern in each questionnaire. Medical staff (frontline or non-frontline) scored higher on anxiety (frontline, non-frontline, mean ± standard deviation; GAD-7: 5.10 ± 5.09, 4.26 ± 4.08) and depression (PHQ-9: 4.99 ± 4.45, 2.98 ± 3.49) than citizens (14) during the COVID-19 epidemic (GAD-7: 1.15 ± 2.13, $p < 0.001$, PHQ-9: 0.70 ± 1.89, $ps < 0.001$). Furthermore, compared with non-frontline peers, frontline staff scored significantly higher on insomnia (non-frontline, frontline, mean ± standard deviation; ISI: 5.86 ± 5.05, 8.95 ± 6.39, $p < 0.001$), anxiety (GAD-7: 4.26 ± 4.08, 5.10 ± 5.09, $p < 0.05$) and depression (PHQ-9: 2.98 ± 3.49, 4.99 ± 4.45, $p < 0.05$).

In order to recognize the characteristics of frontline staff susceptible to these mental health problems, multiple comparisons were performed. It was found that among the frontline medical workers, male staff members scored higher on GAD-7 and on PHQ-9. However, this difference was not discovered between male and female non-frontline staff (**Figure 1A**). In addition, compared with unmarried workers, married medical staff showed similar pattern on insomnia, anxiety and depression scales (**Figure 1B**). Also, poor physical health had a strong impact on mental health as reflected by the ISI, GAD-7 or PHQ-9 scores, regardless of non-frontline or frontline responsibilities (**Figure 1C**).

Characteristics of Occupational Stress in Frontline Medical Staff and Non-frontline Medical Staff

As mentioned above, several characteristics of medical staff had effects on the occurrence of mental health problems during the COVID-19 epidemics, however, the influence of occupational stress on mental health should also be concerned. Occupational stress was characteristic with four indicators including working intensity, working time, working difficulty, and working risk. The mean score of occupational stress in the medical staff was 14.52 ± 2.06. As showed in **Table 3**, compared with non-frontline staff, frontline staff scored significantly higher in work difficulty and in occupational hazards.

Hierarchal Multiple Regression Analysis of Factors Contribution to Mental Health Problems in Frontline or Non-frontline Medical Staff

Results from frontline staff multiple linear regression analysis were summarized in **Table 4**. The ISI ($\beta = -3.69$, $p = 0.002$), GAD-7 ($\beta = -3.61$, $p < 0.001$) and PHQ-9 ($\beta = -3.90$, $p < 0.001$) scores were inversely and strongly associated with physical health status. With regard to occupational stress, only ISI scores were correlated with working risk ($\beta = 2.16$, $p < 0.001$). Both GAD-7 ($\beta = 1.35$, $p < 0.001$) and PHQ-9 ($\beta = 1.11$, $p < 0.001$) scores were related to work difficulty.

The same regression model was performed on the non-frontline group with results summarized in **Table 5**. Physical health status was significantly correlated with GAD-7 ($\beta = -3.22$, $p < 0.001$), ISI ($\beta = -4.97$, $p < 0.001$) and PHQ-9

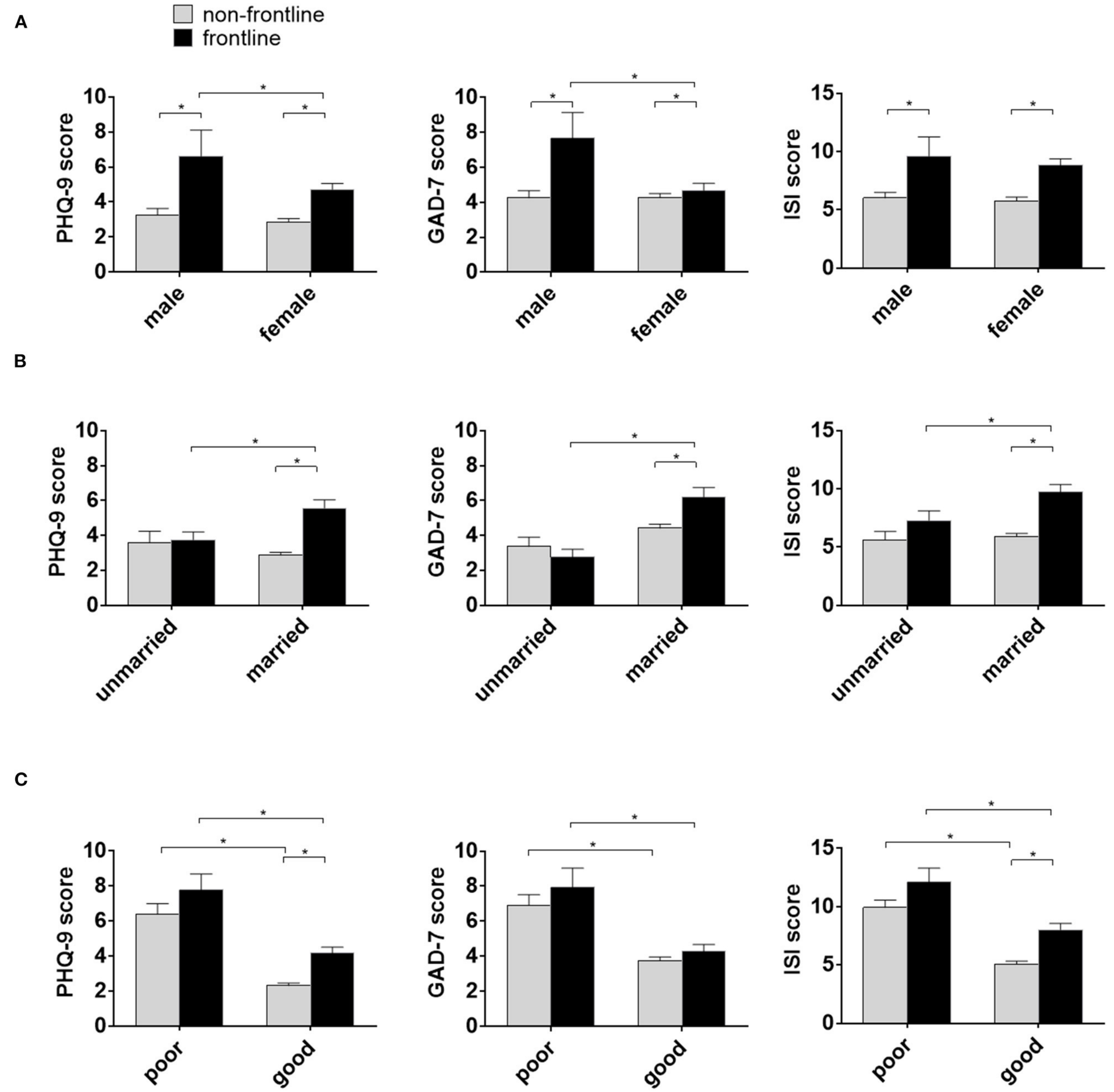

FIGURE 1 | The characteristics of medical staff susceptible for mental health problems during the COVID-19. **(A)** Self-reported depression and anxiety scores higher in male frontline staff compared with female frontline staff. Scores reported in mean ± standard error of the mean(SEM). * $=p < 0.01$. PHQ-0 = Patient Health Questionnaire; GAPD-7 = Generalized Anxiety Disorder 7-item; ISI=Insomnia Severity Index. **(B)** Self-reported depression and anxiety scores higher in married frontline staff compared with unmarried frontline staff. **(C)** Self-reported depression and anxiety scores higher in poor physical health medical staff compared with good physical health staff.

($\beta = -4.01$, $p < 0.001$) scores. Interestingly, the regression analysis showed that work difficulty was also related to GAD-7 ($\beta = 1.25$, $p < 0.001$), which is consistent with the analysis result from frontline staff. In addition, working intensity was related to insomnia in ISI scores ($\beta = 0.72$, $p < 0.05$), and working hour was related to depression in PHQ-9 scores ($\beta = 0.70, p < 0.01$).

DISCUSSION

Extending previous research on mental health among medical staff in China, this study investigated and compared the prevalence and severity of mental health symptoms between frontline medical staff and non-frontline medical staff. It also examined whether mental health is associated with four

TABLE 3 | Comparison of occupational stress between non-frontline medical staff and frontline medical staff.

Variables	Frontline medical staff (n = 150)	Non-frontline medical staff (n = 374)	Mann-Whitney U	p
Occupational stress				
Working intensity	3.56 ± 0.76	3.53 ± 0.68	28367.00	0.824
Working hours	3.33 ± 0.92	3.59 ± 0.63	23318.00	0.001
Working difficulty	3.67 ± 0.73	3.37 ± 0.62	34445.00	<0.001
Working risk	4.27 ± 0.62	3.90 ± 0.58	36377.00	<0.001

TABLE 4 | Hierarchical multiple regression analysis of insomnia, depression and anxiety in frontline medical staff.

	Model	Variable	B	SE	P	Δ*Model* R^2	P
Insomnia	1	Health status	−3.69	1.19	0.002	0.07	0.001
	2	Working risk	2.16	0.81	0.008	0.11	<0.001
Anxiety	1	Marital status	2.60	0.80	0.004	0.09	<0.001
	2	Health status	−3.61	0.87	<0.001	0.16	<0.001
	3	Gender	3.46	1.05	0.003	0.21	<0.001
	4	Working difficulty	1.35	0.51	0.008	0.24	<0.001
Depression	1	Health status	−3.90	0.79	<0.001	0.11	<0.001
	2	Education level	3.75	1.84	0.043	0.14	<0.001
	3	Gender	2.32	0.95	0.016	0.16	<0.001
	4	Working difficulty	1.11	0.45	0.014	0.19	<0.001

TABLE 5 | Hierarchical multiple regression analysis of insomnia, depression and anxiety in non-frontline medical staff.

	Model	Variable	B	SE	P	Δ*Model* R^2	P
Insomnia	1	Health status	−4.97	0.65	<0.001	0.13	<0.001
	2	Education level	1.67	0.59	0.006	0.14	<0.001
	3	Working intensity	−0.72	0.35	0.039	0.15	<0.001
Anxiety	1	Health status	−3.22	0.53	<0.001	0.08	<0.001
	2	Working difficulty	1.25	0.33	<0.001	0.14	<0.001
Depression	1	Health status	−4.01	0.43	<0.001	0.18	<0.001
	2	Working hours	0.70	0.25	0.006	0.19	<0.001

indicators of occupational stress among medical staff in the region with high prevalence of COVID-19 epidemic in China.

To our knowledge, this is the first study to compare the level of mental health between frontline medical staff and non-frontline medical staff during the COVID-19 outbreak. The first finding of the study is that medical staff exhibited much poorer mental health than citizens during the COVID-19 epidemic. Similarly, compared with the non-frontline staff, the frontline medical staff, who had direct and frequent contact with COVID-19 patients, suffered higher level of anxiety, depression, and insomnia. This is consistent with previous reports during severe epidemics outbreak (21–23). For instance, in one study conducted in the SARS outbreak, health care professionals showed higher levels of emotional distress than that of the general public (22). Another study reported that the medical staff in the hospital for SARS infected patients felt extreme vulnerability, uncertainty and threat to life; they also exhibited significantly high psychiatric morbidity of acute stress syndrome (21). The high level of contagion, the unfamiliarity with the characteristics of the virus, the elevated transmission rate, and the experience of isolation increase the psychological burden of medical staff and subsequently, their propensity for mental health problems during COVID-19 outbreak. The present study, along with prior studies, indicates that mental health problem is common among medical staff, especially frontline medical staff.

The second important finding of the study is that male, married medical staff with poorer physical health exhibited much poorer mental health. Firstly, poorer physical health showed strong association with worse mental health of medical staff, no matter whether working in non-frontline or frontline. Literature suggests that excessive stress can trigger the sympathetic adrenal medulla system and hypothalamus-pituitary adrenal axis, which cause physical and mental health problems (24). This interplay of physical and mental health leads to medical staff with poorer physical health to be more susceptible to mental health problems in response to stress compared to healthy medical staff. Secondly, we also found more anxiety and depression in male than female frontline medical staff, which is inconsistent with findings of other studies during the epidemic period (25–27). For example, Du et al. (25) surveyed 134 frontline medical workers during COVID-19 outbreak in Wuhan and found that anxiety and depression symptoms were more common among female medical staff than male medical staff, which is different from the present study. This discrepancy could be related to various assessment scales used, different samples selected and different data analyses used in these studies. In addition, due to convenient sampling in this study, a relatively small sample size of male frontline medical staff might lead to cases of bias. Thirdly, we found that married medical staff reported more mental health symptoms than those who were unmarried or divorced. This finding indicates perhaps that greater family responsibilities amplifies the level of perceived stress of medical staff, which in turn results in worse mental health. This finding is consistent with the existing literature, which suggests health care workers living with children were more concerned about their own health and that of their families (23).

The third important finding of the study is that frontline medical staff faced higher occupational stress during COVID-19 outbreak than non-frontline staff, specifically in terms of work hours, work difficulty, and occupational hazards. Furthermore, occupational stress acted as a risk factor for mental health symptoms in medical staff. Specifically, occupational hazards contribute to mental health symptoms in frontline medical staff but not in non-frontline medical staff. This result is consistent with the findings in Wuhan, which reported that occupational hazard was identified as a significant risk factor of anxiety in frontline medical staff (28). It could suggest that the lack of sufficient information of COVID-19, the high propagation potential of asymptomatic carriers, and the depletion of personal protection equipment increased the psychological symptoms burden of frontline medical staff (29). Compared with the frontline medical staff, the risk of exposure to infection is much lower among the non-frontline medical staff. Thus, it may not be a significant contributor of poor mental health in non-frontline medical staff. Meanwhile, it is worth mentioning that work difficulty was significantly associated with the mental health symptoms of both frontline and non-frontline medical staff. A pandemic renders essential workers' tasks more complex and difficult to manage, which may require them to have more energy to accomplish their work responsibilities. Such responsibilities may result in medical staff burnout and ultimately lead to anxiety, depression and other adverse emotions. Frontline staff, for example, may feel psychologically burdened over the responsibility of medical failures that may directly lead to health deterioration or death of their patients.

In addition, the increase in work hour and work intensity leads to the poor mental health of medical staff (30). This result is consistent with a growing literature showing that working longer hours each day is associated with significantly greater stress-related symptoms of medical staff, such as headache, and gastrointestinal upset (5).

There are some limitations in our study. First, our study was based on cross sectional design, which does not permit determination of the cause-and-effect relation between occupational stress and mental health. To clarify the causality, we need longitudinal data or panel data for further research. Secondly, data were self-reported in nature and respondents might exaggerate or conceal mental health symptoms, which may be subject to reporting bias. Future studies should consider triangulating self-reports with clinical records, and health and social services records. Nevertheless, the findings in our study do provide valuable information for policy makers and mental health professionals regarding the psychological impact of an infectious disease outbreak and the potential crisis-preparedness factors to consider in future biological disasters.

Despite these limitations, we believe that there are at least two major advantages gained from our study. Firstly, we characterize the feature of frontline medical staff who are more susceptible to mental health problems during epidemic, which may prompt the authorities to establish more rigorous standard for the selection of frontline medical staff from volunteers. For instance, the higher percentage of single, and good perceived physical health medical staff may be taken into consideration. Secondly, our study shows a novel association between working difficulty and mental health symptoms of medical staff. This finding suggests that even medical staff, one group of higher educated population, may feel more stressful to manage the complex and difficult tasks. The hospital administration should take steps to optimize the division of labor, and frame hierarchical decision making strategy.

IMPLICATION AND CONCLUSION

The major empirical findings lead to three critical implications. First, based on the findings that medical staff experienced high level of anxiety, depression and insomnia during the COVID-19 epidemic, the Chinese government may attend more to the growing concern of mental health among them by establishing mental health assessment and efficient psychological interventions in hospitals. This may be of particular salience for male, married medical staff with poorer physical health as they may experience more anxiety and depression symptoms. Second, in consideration that there is a significant association between occupational stress and mental health symptoms among the medical staff during the COVID-19 epidemic, favorable social support and response strategies are essential for reducing occupational stressors provisionally as well as lowering risk of long-lasting effects. The response to ongoing high stress should aim to support coping, foster resilience, reduce burnout and reduce the risk of developing mental health difficulties. Third, crisis-preparedness training is also essential to improve the mental health of the medical staff during a biological disaster. Crisis-preparedness training program not only includes the clinical skills required to deal with health crisis, but also the skills required to deal with the potentially traumatic situations that medical staff might be exposed to. In addition, this program would develop skills to cope with these and awareness of potential mental health consequences (31).

In conclusion, this study provides empirical evidence for the prevalence and severity of medical staff during the COVID-19 period. The frontline medical staff reported higher level of depression, anxiety and insomnia than the non-frontline medical staff and citizens during the COVID-19 epidemic. Furthermore, male, married medical staff with poorer physical health exhibited lower mental health. Four indicators on occupational stress acted as risk factors for mental health symptoms in medical staff.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The study was approved by the Ethics Committee of the Wenzhou Medical University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

LC, XZ, KZ, GZ, YL, WW, and RF: participated in research design. LC, WW, GZ, RF, DX, XL, and HH: collected the data. LC, YL, WW, XZ, KZ, GZ, and DX: conducted the data analysis. LC, YL, WW, XZ, KZ, GZ, and AN-A: wrote and contributed to the writing of the manuscript. All authors contributed to the article and approved the submitted version.

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Death Associated With Coronavirus (COVID-19) Infection in Individuals With Severe Mental Disorders in Sweden During the Early Months of the Outbreak—An Exploratory Cross-Sectional Analysis of a Population-Based Register Study

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Background: Individuals with severe mental disorder (SMD) have a higher risk of somatic comorbidity and mortality than the rest of the population. We set up a population-based study to assess whether individuals with SMD had a higher risk of death associated with a COVID-19 infection (COVID-19 associated death) than individuals without SMD.

Methods: Exploratory analysis with a cross-sectional design in the framework of a population-based register study covering the entire Swedish population. The Swedish Board for Health and Welfare (Socialstyrelsen) provided anonymized tabulated summary data for further analysis. We compared numbers of COVID-19 associated death in individuals with SMD (cases) and without SMD (controls). We calculated the odds ratio (OR) for the whole sample and by age group and four comorbidities, namely diabetes, cardiovascular disease, hypertension, chronic lung disease.

Results: The sample comprised of 7,923,859 individuals, 103,999 with SMD and 7,819,860 controls. There were 130 (0.1%) COVID-19 associated deaths in the SMD group and 4,945 (0.06%) in the control group, corresponding to an OR of 1.98 (CI 1.66-2.35; $p < 0.001$). The odds were 4-fold for the age groups between 60 and 79 years and 1.5-fold for cardiovascular diseases. Individuals with SMD without any of the risk factors under study had 3-fold odds of COVID-19 associated death.

Conclusion: Our preliminary results identify individuals with SMD as a further group at increased risk of COVID-19 associated death. In regard to comorbidities, future studies should explore the potential confounding or mediation role in the relationship between SMD and COVID-19 associated deaths.

Keywords: coronavirus, COVID-19, severe mental disorder, death, risk factors, mortality, psychotic disorder, bipolar disorder

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INTRODUCTION

Severe mental disorders (SMD), such as bipolar or psychotic disorders are associated with premature mortality. SMD has a substantial impact on life expectancy, which may be shortened by 10 to 20 years (1–3). Somatic disorders account for at least 50% of this shortened life expectancy (3). Cardiovascular conditions are the main cause of premature death (3–5). Infectious diseases also seem to contribute to a shortened life expectancy in individuals with SMD (1, 2). It currently remains unclear whether individuals with severe SMD have an increased risk of death associated with coronavirus SARS-CoV-2 (COVID-19) infection. The question is important, since individuals with SMD may have an excess risk of factors linked to an adverse outcome of COVID-19 infection. Such include comorbidities such as cardiovascular conditions, diabetes, chronic respiratory disease, hypertension and obesity (6, 7). At the same time, individuals with SMD have less access to somatic health care (5, 8). Therefore, there are reasons to believe that individuals with SMDs experience a higher mortality associated with COVID-19 infection than the rest of the population. If this assumption held true, individuals with SMD would join the category of individuals at increased risk of an adverse clinical course of COVID-19 infection, along with people who are older, obese or who have pre-existing somatic conditions. We set up a national register study to examine this hypothesis. In order to be able to make health professionals aware of this potential risk group as soon as possible, we conducted a first exploratory analysis, which we report here.

Aim

To assess the risk of death associated with COVID-19 infection (COVID-19 associated death) in individuals with SMD. We tested the following hypothesis: Individuals with SMD have a higher risk of COVID-19 associated death than individuals without SMD (reference population).

METHODS

Study Design

The current study is part of a longitudinal population-based register study based on the Swedish National Patient Register, the Swedish National Death Register, and the Swedish Prescribed Drug Register. All registers are held by the Swedish Board for Health and Welfare (Socialstyrelsen). For this exploratory analysis, we chose a cross-sectional design, linking the Swedish National Patient Register and the Swedish National Death Register. The data manager at the Swedish Board for Health and Welfare linked the respective registers through the unique personal identification number (Swedish personal number). Anonymized tabulated summary data was made available to the research team for further analysis. We checked our whole method against the Strobe checklist (**Appendix 1**) (9).

Data Sources

The Swedish National Patient Register is based on diagnoses for both in and outpatient care in specialized medicine (secondary care). Diagnoses from general practitioners (primary care) are not included in this register. The Swedish National Death Register includes all Swedish persons that have died. The cause of death is established in either primary or secondary care, depending on where the death has occurred. The Swedish Prescribed Drug Register contains data on treatments that were dispensed at a pharmacy.

Sample

We included the whole Swedish population of at least 20 years of age by 31 Dec 2019. We defined individuals with a diagnosis of SMD as cases and all other individuals as controls. As the sample covered the whole adult Swedish population, all individuals fell either into the category "SMD" or the category "without SMD." Therefore, there were no other exclusion criteria other than age < 20 years. The cut-off of 20 years was chosen, because we used multiples of 10 years to stratify our data. Eighteen to twenty years was left out, because of the short age span and expected low risk of COVID-19 associated death in young people.

Variable Definitions

Outcomes

In Sweden, the first confirmed case of COVID-19 infection was reported on 31st January 2020 (10). The first COVID-19 related death was reported on 11th March 2020 (11). Our outcome was COVID-19 associated death, registered as such by the Swedish Board for Health and Welfare. We included all COVID-19 associated deaths occurring over a 3 month period, from 11 March 2020 until 15 June 2020.

We analyzed COVID-19 associated deaths as a dichotomous yes/no variable. The Swedish Board for Health and Welfare bases the criteria COVID-19 associated death on the underlying cause of death recorded on the death certificates. Two codes of the 10th version of the International Classification of Diseases (ICD-10) (12) are currently used, U07.1 or U07.2. Both codes fall into the ICD-10 chapter for provisional assignment of new diseases of uncertain etiology or emergency use (U00–U49). U07.1 is used when COVID-19 has been confirmed by laboratory testing irrespective of severity of clinical signs or symptoms. U07.2 is used when COVID-19 is diagnosed clinically or epidemiologically, but laboratory testing is inconclusive or not available (12). The World Health Organization (WHO) defines as "epidemiologically linked" "being linked to a cluster with at least one confirmed case" (13).

Exposures

The main exposure was SMD. Into the SMD variable, we included psychotic disorders with ICD-10 codes F20, F22, F25, and bipolar disorders/single manic episodes with ICD-10 codes F30, or F31. We combined these disorders into one category to increase the sample size for our relatively rare outcome, death. We focused on psychotic and bipolar disorders, since this allowed comparison with a previous Swedish register study reporting on somatic comorbidities, including lung diseases, and excess mortality in both conditions (1, 2). Individuals were included in the SMD category when there were at least two registered diagnoses between 1998 and 2019.

We also explored four somatic comorbidities, diabetes, cardiovascular diseases, hypertension and chronic respiratory diseases, which were available in the registers. In our choice of comorbidities, we were guided by the Swedish National Board of Health and Welfare, which defined groups deemed to have increased risk for severe course of Covid-19 infection in April 2020. This list was last updated 2 June 2020. Besides age over 70, this list includes cardiovascular disease, hypertension, diabetes, chronic renal disease, chronic respiratory disorders and other somatic disorders (14). From this list, we then chose our four comorbidities for two reasons, (a) being known to be associated with severe mental disorders, and (b) being of sufficient sample size to explore the relatively rare outcome of death. Comorbidities with lover prevalence would lead to only few individuals to be included, in which case the Swedish Board of Health and Social Welfare would withhold much of the information due to confidentiality reasons.

We introduced a fifth category "none of the above," which included all other individuals. As the use of the term risk factor is ambiguous, we have used the term comorbidities instead, as a personal attribute linked to the (binary) outcome death and assumed to be present at the same time as the outcome or potentially having a role in the aetiological mechanism (15). We checked these comorbidities for a time period from 2015 to 2019, based on diagnosis or pharmacological treatment received, using ICD and Anatomical Therapeutic Chemical Classification System (ATC) codes. We used the following ICD and ATC codes, (a) diabetes ICD E10-14, ATC A10, (b) cardiovascular diseases ICD I20-25, I48, I50, I61, I63, I64.9, I69.1, I69.3, I69.4, I69.8, I70, (c) hypertension ICD I10.9, I11–13, I15, ATC C02, C03, C07AB02, C08CA, C09, and (d) chronic respiratory diseases ICD J40–47, J60–67, J68.4, J70.1, J70.3, J96.1, J96.8, E 84.0. We stratified age into the following groups, 20–39, 40–59, 60–69, 70–79, and 80+ years.

Statistical Methods

The data was provided as summary data in anonymized form by the Swedish Board of Health and Welfare. Statistical analysis underlying this summary data was performed by a statistician at the National Board of Health and Welfare. The research group then analyzed this data further. The data included information stratified according to case and controls on number of individuals in each age group and number of individuals in each comorbidity category. From this data, we calculated the odds ratios (OR) for COVID-19 associated death for (a) the whole sample, (b) for each age group, and (c) for each risk factor category. For OR according to age-group, each death was only counted once. For OR according to comorbidity category, a death could be counted several times when it appeared in more than one comorbidity category. As for this preliminary report we only had access to summary data, we could therefore only stratify by one variable at the time, age or comorbidity but not age and comorbidity. We calculated confidence intervals (CI) using Woolf's formula for the standard error. Significance was tested with z-test. The significance level as a measure of random variability as a source of error (16) was set to 0.05 throughout, corresponding to a 95% CI. As we had to rely on summary data and had no access to individual level data, we constructed the respective formulae in Excel (**Figure 1**). We then confirmed our analysis using the internet based statistical software MedCalc (17). We also used MedCalc to derive our *p*-values. Where available, we compared the results of our z-test to the results of the Fisher exact test, provided by the National Board of Health and Welfare. Identification of significant relationships was 100% concordant.

Missing Data

The number of deaths was available for all age groups. However, for some comorbidity categories, the number of deaths had been withheld due to confidentiality reasons. For summary estimates of comorbidities in the whole age group, we set missing data to 0.

Ethics and Consent Procedures

The study was approved by the Swedish Ethical Review Authority (DNR 2020-02759) and conducted according to the declaration of Helsinki. The data originated from routine information collected by the Swedish Board of Health and Welfare, then made available as summary data in anonymized form for this first exploratory analysis. As only anonymized data was provided and potentially identifiable data was withheld, informed consent was not required.

RESULTS

Baseline Characteristics of the Samples

The sample comprised of 7,923,859 individuals, 103,999 (1.3%) with SMD and 7,819,860 (98.7%) controls. As to be expected with a sample of that size, all differences regarding age groups and comorbidities under study were significant with $p < 0.001$ (**Table 1**).

COVID-19 Associated Death

There were 130 (0.13%) deaths associated with COVID-19 infection in the SMD group and 4,945 (0.06%) in the control group. In the SMD group, 90.0% of COVID-19 diagnoses were ascertained by test (U07.1). In the reference group, 91.2% of COVID-19 diagnoses were ascertained by test (U07.1). There were no significant differences in the proportion of COVID-19 diagnoses ascertained by test (U07.1) in both groups ($p = 0.419$). The SMD group had double odds of COVID-19 associated death (OR 1.98, CI 1.66–2.35; $p < 0.001$). Regarding age, higher odds were found for individuals with SMD in the older age groups, about 4-fold in the age groups of 60–69 years and 70–79 years, and about 2-fold in the age group 80+ years (all $p < 0.001$). For the age group of 40–59 years the OR narrowly missed the pre-defined significance level ($p = 0.052$). For the age group 20–29 years, the OR could not be calculated since data were withheld due to confidentiality reasons. Regarding comorbid conditions in individuals with SMD, 1.5-fold odds were found for cardiovascular diseases ($p < 0.007$). The other three comorbidities, diabetes, hypertension and chronic lung disease did not reach significance in terms of the pre-defined significance level. Individuals with SMD who had none of the sampled comorbid conditions had about 3-fold increased odds of COVID-19 associated death ($p < 0.001$) (**Table 2**).

Demonstrated for the total sample

Exposure: Severe mental disorder (SMD)
Event: Death

		Event	
		Yes	**No**
Exposure	**Yes**	a	b
	No	c	d

$$Odds\ Ratio = \frac{odds\ of\ the\ event\ in\ exposed\ group}{odds\ of\ the\ event\ in\ non-exposed\ group}$$

$$Odds\ Ratio = \frac{a/b}{c/d} = \frac{ad}{bc}$$

$$Upper\ 95\%\ CI = e^{[\ln(OR)+1.96\sqrt{(1/a)+(1/b)+(1/c)+(1/d)}]}$$

$$Lower\ 95\%\ CI = e^{[\ln(OR)-1.96\sqrt{(1/a)+(1/b)+(1/c)+(1/d)}]}$$

FIGURE 1 | Method for calculation of odds ratios and 95% confidence interval.

DISCUSSION

Main Findings

This is one of the first population-based studies reporting on the risk of COVID-19 associated mortality in individuals with SMD during the early months of the coronavirus outbreak. We found that individuals with SMD had almost double odds of COVID-19 associated death compared to the reference population without SMD. Individuals with SMD aged between 60 and 79 years were particularly vulnerable with more than 4-fold odds of COVID-19 associated death. Of the four comorbidities available for study, cardiovascular disease increased the odds of COVID-19 associated death by 50%. Individuals without any of the four comorbidities under study, had 3-fold odds of COVID-19 associated death. Our findings are in line with other recently published population-based studies from the US and the UK. One US study covered health records of 61 million adult patients across the country until 29 July 2020. This study compared patients with a recent diagnosis of mental disorder, including ADHD, bipolar disorder, depression or schizophrenia with all other patients without mental disorder defined in this way. Patients with mental disorder and COVID-19 infection also had a nearly 2-fold increased death rate with 8.5% vs. 4.7% among COVID-19 patients without mental disorder (18). Another analysis from the same database until 15 June 2020 showed that patients with substance use disorder (SUD) and COVID-19 had an approximately 30% increased death rate with 9.6% vs. 6.6% among COVID-19 patients without SUD (19). A UK biobank study explored the association between death, COVID-19 infections with tests performed between 16 March 2020 and 26 April 2020, and pre-existing medical conditions as ascertained between 2006 and 2010. This study included 269,070 COVID-19 positive individuals aged between 65 and 86 years. There were

TABLE 1 | Age and risk factor distribution in patients with severe mental disorders vs. reference population.

	Population with severe mental disorder[a] $n = 103{,}999$		Reference population $n = 7{,}819{,}860$	
	n	**%**	***n***	**%**
Age groups				
20–39	31,246	30.0	2,662,638	34.0
40–59	40,899	39.3	2,555,319	32.7
60–69	17,163	16.5	1,091,275	14.0
70–79	10,986	10.6	978,027	12.5
80+	3,705	3.6	532,601	6.8
Comorbidities across all age groups[bc]				
Diabetes	8,012	7.7	327,738	4.2
Cardiovascular disease	7,308	7.0	573,187	7.3
Hypertension	10,993	10.6	779,557	10.0
Chronic lung disease	5,664	5.4	231,686	3.0
None of above	83,044	79.9	6,599,259	84.4

n, number.
[a]*Diagnoses of severe mental disorders (bipolar or psychotic disorder) recorded between 1998 and 2019.*
[b]*Diabetes, cardiovascular disease, hypertension, chronic lung disease, recorded between 2015 and 2019.*
[c]*Individuals could have more than one risk factor. Hence, the number of risk factors exceeded the number of individuals.*

TABLE 2 | COVID-19 associated death having occurred between 1 January 2020 and 15 June 2020 in patients with severe mental disorder vs. reference population according to age or risk factors.

	Population with severe mental disorder n = 103,999[a]		Reference population n = 7,819,860				
	n	%	*n*	%	OR	LCI	UCI
Total sample							
N deaths	130	0.13	4,945	0.06	1.98	1.66	2.35
According to age group [years]							
20–39	–	–	–	–	–[b]	–	–
40–59	6	0.01	167	0.01	2.24	0.99	5.07
60–69	21	0.12	296	0.03	4.52	2.90	7.03
70–79	51	0.46	1,094	0.11	4.16	3.14	5.52
80+	52	1.40	3,388	0.64	2.22	1.69	2.93
According to comorbidity[c]							
Diabetes	32	0.40	1,161	0.35	1.13	0.79	1.60
Cardiovascular disease	46	0.63	2,431	0.42	1.49	1.11	1.99
Hypertension	43	0.39	2,644	0.34	1.15	0.85	1.56
Chronic lung disease	13	0.23	633	0.27	0.84	0.48	1.46
None of above	48	0.06	1,328	0.02	2.87	2.15	3.83

n, number; OR, odds ratio; LCI, lower 95% confidence interval; UCI, upper 95% confidence interval.

[a]Diagnoses of severe mental disorders (bipolar or psychotic disorder) recorded between 1998 and 2019, risk factors recorded between 2015 and 2019.

[b]OR not calculated because data withheld due to confidentiality reasons.

[c]n Deaths counted for each risk factor. i.e., deaths associated with more than one risk factor will appear several times.

507 COVID-19 positive inpatients, 141 (27.8%) of whom died. Five pre-existing conditions significantly increased the odds of dying. Dementia increased the odds of dying 7.3-fold, diabetes 3.1-fold, chronic obstructive pulmonary disease (COPD) 1.9-fold, pneumonia 1.9-fold, and depression 1.8-fold (20).

Severe Mental Disorder and Risk of Death From Other Respiratory Infections

At the time of writing, evidence regarding the association between SMD and COVID-19 infection is only emerging. But our findings are also in line with studies exploring the association between SMD and other (non-COVID-19) respiratory infections. A Swedish register study showed a 3- to 4-fold increased risk of death due to influenza or pneumonia in individuals with bipolar disorder (1). In individuals with schizophrenia, the risk was increased 7-fold (2). An American study also found a 7-fold increased risk of death due to pneumonia or influenza in adults with schizophrenia (21). A Danish register study explored all individuals hospitalized for any infection between 1995 and 2011. Individuals with bipolar or psychotic disorder had 52% increased mortality risk within 30 days after their infection (22). We could not find any study that explicitly explored risk factors associated with death from respiratory infections in individuals with SMD.

Underlying Medical Conditions Associated With a Severe Outcome From COVID-19 Infection in the General Population

The evidence regarding risk factors for a severe outcome from COVID-19 infection is rapidly evolving. The US Centers for Disease Control and Prevention (CDC) have collated a list of underlying medical conditions that increase a person's risk of severe illness from COVID-19, defined as hospitalization, admission to the ICU, intubation or mechanical ventilation, or death. On this list, these conditions are rated into three categories according to quality of evidence, (a) strongest and most consistent evidence, (b) mixed evidence, and (c) limited evidence. Conditions with the strongest and most consistent evidence include cancer, chronic kidney disease, COPD, heart conditions such as heart failure, coronary artery disease, or cardiomyopathies, obesity with a body mass index (BMI) > 30 kg/m^2, severe obesity with a body mass index (BMI) > 40 kg/m^2, sickle cell disease, smoking, solid organ transplantation and type-2 diabetes mellitus. Conditions with mixed evidence include asthma, cerebrovascular disease, hypertension, pregnancy, use of corticosteroids and other immunosuppressive medications. Conditions with limited evidence include bone-marrow transplantation, HIV, immune deficiencies, inherited metabolic disorders, liver disease, neurological conditions specific to pediatric conditions, other chronic lung diseases, overweight with a BMI > 25 but < 30 kg/m^2, complex pediatric conditions, thalassaemia and type-1 diabetes mellitus (23). Notably, SMD is not mentioned in this list.

The CDC list identifies a large number of potentially underlying medical conditions. Most of these could increase mortality risk in their own right. Thus, COVID-19 associated death may not necessarily be caused by COVID-19 infection. CDC statistics show that in just 6% of deaths involving COVID-19 infection, COVID-19 was the only cause mentioned. For the 94% deaths with conditions or causes in addition to

COVID-19, there were on average 2.6 additional conditions or causes per death (24). An audit of 122 Covid-19 associated deaths from Östergötland County, Sweden, came to similar results. In only 15% of deaths, COVID-19 infection was given as the direct cause. In 70% COVID-19 infection was thought to be a contributory factor but not the main cause. In the remaining 15%, the death could not be related to COVID-19 infection (25).

Underlying Medical Conditions Associated With Death From COVID-19 Infection in Individuals With Severe Mental Disorder

In bipolar disorder and schizophrenia, comorbidity with at least one somatic condition is very common (26, 27). When acute physically ill, individuals with SMD may then be sicker. One insurance claims study from Taiwan compared the risk of death in an intensive care unit (ICU) between 203 patients with schizophrenia and 2,036 matched controls. In ICU, patients with schizophrenia were sicker, had a higher risk of acute organ dysfunction and death (28). Therefore, it is plausible that individuals with SMD may have a higher risk of COVID-19 associated death.

For our study, we chose four comorbidities thought to be more prevalent in individuals with SMD (21). We chose these comorbidities during the set-up of the study. At the time, evidence regarding comorbidities and other risk factors was only emerging. Therefore, we made an informed guess that these four risk factors could affect the risk of COVID-19 associated mortality. But only cardiovascular disease led to a significantly increased OR in individuals with SMD. Cardiovascular conditions belong to the CDC category of risk factors with the strongest and most consistent evidence (23). For hypertension and chronic lung disease, we did not find an increased risk of death. Hypertension belongs to the CDC category of risk factors with mixed evidence (23). Chronic lung disease includes conditions that fall in the CDC categories of either mixed or limited evidence (23). Surprisingly, diabetes did not significantly increase the risk of COVID-19 associated death in our study. However, our study is only exploratory, sampling the first 3 months of the outbreak. There is also a chance that diabetes was underestimated in individuals with SMD. Despite rising awareness, diabetes may be one of the comorbidities easily missed in individuals with SMD (29, 30).

Our current analysis is exploratory, covering the first 3 months of the COVID-19 outbreak in Sweden. Therefore, the comorbidity profile may change in future analyses. In our study, the OR was highest for the individuals with SMD who did not have any of our chosen four comorbidities. There is no plausible mechanism which could explain a direct role of SMD in the pathophysiology of COVID-19 infection, which would make SMD a risk factor in its own right. More likely, there were other factors and/or comorbidities, not captured by our study, that increased the mortality risk from COVID-19 infection in individuals with SMD. Yet, this clear excess mortality risk identified makes individuals with SMD a risk group of their own, even if SMD *per se* is not involved in the pathophysiology of COVID-19 infections or its clinical course. As already argued by Wang et al. based on their finding of excess mortality in patients with mental disorder (18), individuals with SMD should be added to the groups already known to be at risk of serious illness from COVID-19 infection, i.e., the elderly, the obese or those with somatic comorbidities. Ultimately, longitudinal studies are required to identify the factors and comorbidities that increase the risk of an adverse outcome from COVID-19 infection including death. This puts clinicians and policy makers at a moral dilemma. In view of the second wave of the pandemic and its threats to human health and lives clinicians and policy makers need to act according to the available evidence even if this evidence is currently incomplete.

Other Medical Factors and Conditions That May Specifically Associated With Severe Mental Disorder and/or Its Treatment

There may be other factors in individuals with SMD that can increase the risk for COVID-19 associated mortality. Such factors may either be associated with SMD itself, its pharmacological treatment or with a combination of both underlying SMD and its pharmacological treatment.

Factors associated with SMD include smoking and substance use disorder (SUD). Both remain highly prevalent in individuals with SMD (31–33). They increase the risk of pneumonia, cardiovascular disease, and compromised immunity. Increased risk for infection and subsequent worse outcomes may also result from difficulties to adhere to preventive measures (34).

Medical conditions associated with the pharmacological treatment include medication associated pneumonia, neutropenia and QT prolongation. Exposure to first-generation antipsychotics (FGA) or second-generation antipsychotics (SGA) may double the risk of pneumonia (35). Mortality from pneumonia may also increase (36). Mood stabilizers such as valproate and carbamazepine may be risk neutral. Lithium may be protective (37, 38), for reasons yet to be explained. Benzodiazepines and benzodiazepine related drugs (BZRD), taken by 30 to 60% of individuals with schizophrenia or bipolar disorder, are other concerns (39–42). Neutropenia and its extreme form agranulocytosis can occur with a variety of antipsychotics and mood-stabilizers, particularly with clozapine and carbamazepine (43). Some of the agents used to treat COVID-19 infection such as chloroquine, hydroxychloroquine, azithromycin, and lopinavir can also cause neutropenia (44). Hence, individuals with SMD taking such agents need careful monitoring (45). QT prolongation is a potentially dangerous adverse effect increasing the risk of torsade de pointes and current cardiac death. Many antipsychotics can prolong QT interval. Citalopram, escitalopram, tricyclic antidepressants and methadone can also prolong the QT interval. Intravenous administration, combination therapy or excess doses also increase the risk for QT prolongation (43). These psychotropic agents may become problematic in combination with somatic drugs also increasing QT interval, used for treating a COVID-19 infection. The latter group includes some antibiotics and antiarrhythmics, chloroquine, hydroxychloroquine and the antiviral and histamin-2 antagonist famotidine (44). It currently remains unclear how often such interactions with psychotropic drugs occur in the context of COVID-19 treatment.

Medical conditions associated with the underlying SMD and its treatment include obesity and venous thromboembolism (VTE). The likelihood of obesity is 2.8 to 4.4 times increased in individuals with schizophrenia and about 1.2 to 1.7 times increased in individuals with bipolar disorder or major depression (46). In part, this increased risk is associated with psychotropic medications. Antipsychotics are of particular concern. Of all antipsychotics, clozapine and olanzapine have the highest risk of weight gain (43, 46). Both schizophrenia and bipolar disorder are associated with an increased risk venous thromboembolism (VTE) in form of deep-vein thrombosis (DVT) or pulmonary embolism (PE). This increased risk of venous thromboembolism may be related to a higher risk of smoking and obesity in individuals with SMD. Immobilization, including lack of exercises, restraints and lower leg paralysis, and treatments with antipsychotics may constitute further risk factors for VTE (47, 48). Antipsychotics have also been implicated to increase the risk of VTE. Risk estimates range from 50% to 3-fold increased risk, depending on substance class (49, 50).

PSYCHOSOCIAL STRESS

Based on previous experience from accounts of the Spanish flu 1918–1919 and recent respiratory infection outbreaks such as the SARS outbreak in 2002–2003, there is reason for concern that psychiatric conditions and suicide rates may increase under the ongoing pandemic. Anxiety, depression and post-traumatic stress syndrome (PTSD) may all become more prevalent (51–53). A COVID-19 infection, or fear of it, or physical distancing and related income loss and unemployment would represent the types of stresses that could exacerbate severe mental illness (54–57). Added economic stress and particularly unemployment could then further elevate levels of severe mental illness and suicide (57–59). Individuals with SMD may be particularly vulnerable because SMD in itself and its co-morbidities are likely associated with lower socioeconomic status (57). This would be consistent with findings from the US that COVID-19 mortality is more frequent in lower socioeconomic ethnic minority groups (60, 61). The impact of socioeconomic status and ethnicity on the risk of COVID-19 infection and mortality in individuals with SMD requires further study. As demonstrated, individuals with SMD are more vulnerable to stress, and in turn, stress may make affected individuals more vulnerable to a COVID-19 infection. Susceptibility to respiratory infections has been shown to increase under stressful conditions (62, 63). Possibly, prolonged stressors result in glucocorticoid receptor resistance, which then alters the local pro-inflammatory cytokine response to an infectious agent (64). In summary, a circularity could ensue between SMD, comorbid conditions, economic disruption and COVID-19 infection, where all factors precipitate or amplify each other. Similar circularities have been observed previously, for instance during the Great Depression in the US in the 1930 (57).

Strengths

The major strength of this study is its large sample-size and representativeness with register data covering the entire Swedish population aged 20 years and older. Therefore, there is no scope for selection bias. Individuals fell into one group (SMD) or the other group (reference population); no further exclusion criteria were warranted. The summary data was prepared independently from the research group by a statistician at the Swedish Board of Health and Welfare. Hence, the scope for observation bias was minimized. A further strength lies in the accuracy of Swedish register data. For instance, the Swedish Cause of Death Register covers more than 99% of all deaths. Obviously, despite covering the whole Swedish population, our findings may not automatically generalizable to all population groups within Sweden, or as it matters to populations outside of Sweden. However, our findings are in line with other population-based studies from the US and the UK who found excess of COVID-19 associated mortality of similar magnitude.

Limitations

Our data covered the early months of the COVID-19 outbreak in Sweden. In these early months, numbers of deaths were much higher with an average of 54 deaths per day during our observation period. The numbers of deaths then substantially dropped off from the beginning of August and the mortality curve has flattened out to an average of 4 deaths per day in October. At the time of writing at the end of November, the numbers of death have risen again, but nowhere near to previous levels and not in keeping the number of infections (65). Equally it remains unclear how this would affect the odds of COVID-19 associated death in individuals with SMD. In this preliminary report based on register data, it was not possible to distinguish if any increased odds of death due to COVID-19 in individuals with SMD was due to an increased risk of contracting the SARS-CoV-2 virus, or due to an increased risk of a severe course of COVID-19 illness resulting in death.

Individuals were classified as having severe mental disorders if they were diagnosed twice between 1998 and 2019. Theoretically, an individual diagnosed early on, for instance in 1998, but then remained symptom-free could be entered in the SMD category. This could have led to misclassification. However, this would most likely have resulted in an underestimation rather than an overestimation of the odds of COVID-19 associated death in individuals with SMD. Such a misclassification would therefore not invalidate our results. The scope for misclassification was further reduced by the requirement of having two such diagnoses registered. Besides, bipolar disorder and schizophrenia are both chronic disorders, often of life-long duration. Symptomatic remission may not be equated with functional recovery and residual symptoms may persist (66, 67). We intend to extend our analysis, which is currently based on summary data, with individual level data as soon as possible.

In order to maximize power, we amalgamated bipolar and psychotic disorders into SMD as one exposure category. Several other examples of epidemiological studies exist, where mood and psychotic disorders are amalgamated in similar ways (3, 22, 48, 68–70). Here, we combined psychotic and bipolar disorders into one category because the prevalence for somatic comorbidities and excess mortality are similar for both conditions (1, 2). We did not include severe depression in our SMD variable, since severe depression is a more heterogeneous group. For this group, based on register data alone, it can be difficult to establish whether depression is the cause or consequence of somatic comorbidity. However, based on the available literature, we have reason to believe that including individuals with depression into our study would not have substantially altered the results.

The US study examining the association between mental disorder and death associated with COVID-19 infection did not only find a 2-fold death rate in patients with mental disorder as compared with patients without any mental disorder. The death rate was also approximately double for patients with depression only (8.2%) (18). The UK study exploring the association between pre-existing comorbidities, COVID-19 infection and death found 80% increased odds of dying with a pre-existing diagnosis of depression (20). As pointed out previously, these figures are very similar to our own. Including the ICD code F30, manic episode, could lead to an inclusion of individuals with one single hypomanic episode under the ICD sub-category of F30.0. However, as each individual required at least two registered diagnosis, the scope of including such individuals is virtually non-existent.

Another source of misclassification could arise if individuals with SMD were less likely to be tested for COVID-19 than the rest of the population. This again would lead to an underestimation rather than an overestimation of COVID-19 associated mortality in individuals with SMD. In the beginning of the pandemic, testing was not ubiquitously available. Thus, diagnoses were also made clinically. This is reflected by the provisional ICD code U07.2. Thus, there was scope for misclassification due to false positive COVID-19 diagnoses. In both groups, about 90% of diagnoses were confirmed by laboratory testing (U07.1). Hence, the scope for misclassification was comparably low in both groups. As acknowledged earlier in this discussion, not every death associated with COVID-19 infection may have been caused by COVID-19 infection (24, 25). Distinguishing between causation and association may have been particularly difficult in the early months of the COVID-19 outbreak. However, this would have affected cases and controls in the same way without any impact on the OR.

As pointed out previously, for this exploratory analysis, we had to rely on summary data. Summary data are much less detailed than individual level data. However, we decided to report our summary data at this point to alert clinicians to this new risk group. We intend to conduct further analyses with individual level data as soon as possible. With individual level data it will be possible to adjust for baseline variables, such as age and sex, specific mental disorder (psychotic vs. bipolar disorder), psychotropic drugs used, residence (urban vs. rural), and other variables of potential importance as outlined in our discussion. The association between COVID-19 associated mortality and SMD involves most likely a large quantity of biological and psychosocial factors. Some of these will be confounders, but others may actually lie as mediators on exposure-outcome causal pathways. Thus, even though our finding that SMD doubles the odds of COVID-19 associated death is crude and preliminary, it is nevertheless noteworthy. We intend to expand our analysis on individual data level and more detailed stratification and adjustment for confounders and mediators next year, when more longitudinal data is available. To further study the impact of SMD on the risk of COVID-19 infection or associated deaths, both register and clinical studies are needed. Register studies have the advantage of large sample sizes, but clinical information is limited. Clinical studies will be smaller, but risk factors can be explored in more detail.

It could be argued that it would be more informative to wait until more longitudinal data was available. However, our time frame is in keeping with the time frame chosen in the US studies reporting on mental disorders and SUD (18, 19). Our time frame is substantially longer than the time frame of the UK study reporting on depression (20). At the same time individuals with SMD may be particularly vulnerable at the beginning of a pandemic when health care resources are redirected toward acute somatic care. Finally, although a vaccine is not yet available, decisions about its allocation are made now. The Public Health Agency of Sweden states that those most in need of help to prevent serious illness from COVID-19 infection will be given top priority and which groups are given priority will be determined by the state of knowledge available when the vaccine arrives (71). Therefore, waiting for more longitudinal data would deprive individuals with SMD from the opportunity to be considered a risk group meriting priority (72).

CONCLUSIONS

Our preliminary results suggest that individuals with SMD may be a further group at increased risk of COVID-19 associated death. It is important that clinicians are alerted to this new risk group. This increased mortality can be associated with a higher prevalence of somatic morbidity and life-style related factors. In regard to comorbidities, future studies should explore the potential confounding or mediation role in the relationship between SMD and COVID-19 associated deaths. Such clarification will help to enabling clinicians to provide the best physical and mental health care tailored to special requirements of this risk group.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Swedish Ethical Review Authority (DNR 2020-02759). Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

MM, UW, MB, LÖ, and MW: conception and design of the work and revising and providing the final approval of the work. MM, UW, and LÖ: acquisition and analysis of data. UW, MM, and MB: drafting the work. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2020.609579/full#supplementary-material

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Demand Analysis of a Psychiatric Emergency Room and an Adolescent Acute Inpatient Unit in the Context of the COVID-19 Pandemic in Madrid, Spain

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Introduction: COVID-19 represents a serious threat to mental health worldwide. The aim of this study is to identify changes in adolescent psychiatry treatment demand in a tertiary hospital in Madrid during the first month (March 11 to April 11) after the pandemic declaration by the World Health Organization (WHO). We hypothesized that fear of contagion within COVID-19 may deter people from asking for psychiatric care.

Method: The current study is retrospective, observational, and transversal. We reviewed the clinical records of 89 adolescents who went to the Emergency Room (ER) or were hospitalized at the Acute Inpatient Unit (AIU) at the Puerta de Hierro University Hospital-Majadahonda (PHUH-M) between March 11 and April 11. Socio-demographic, clinical, and demand variables were included in the study. Chi-square or Fisher exact tests were performed to compare categorical variables. We used the U Mann-Whitney test to compare quantitative variables. The level of statistical significance was set at $p < 0.05$. Analyses were conducted using SPSS v11.0.

Results: The number of adolescents demanding psychiatric care at the ER dropped from 64 adolescents in 2019 to 25 in 2020. Similarly, psychiatric demand collapsed from 31 to 18 patients when comparing 2019 and 2020. Furthermore, the average hospital stay in 2020 trended toward a decrease when compared to 2019 (8.94 ± 4.87 vs. 14.32 ± 10.23, $p = 0.08$). Self-injurious thoughts and behaviors were the most predominant reasons for consultation at both ER and AIU.

Conclusion: The demand for adolescent psychiatric care decreased in the first month after the declaration of the pandemic. Our findings may be explained by (1) the fear of contagion, (2) the strict confinement measures, and (3) the initial shock as an adaptive reaction described in other disasters. Further studies are needed.

Keywords: COVID-19, adolescent, mental health, emergency room, acute inpatient unit

INTRODUCTION

COVID-19 represents a serious threat to health worldwide, potentially impacting global mental health (1). Since the first COVID-19 cases confirmed in Madrid (Spain) on February 24, 2020, Madrid has become the most affected region in Spain. On the same day as the declaration of the COVID-19 pandemic by the World Health Organization (WHO) (March 11), the Autonomous Government of Madrid declared school closures. Furthermore, the Spanish government declared a national state of emergency on March 14 (Royal Ordinance 463/2020, https://www.boe.es/eli/es/rd/2020/03/14/463) including strict social distancing policies for more than 47 million Spaniards: home confinement, school closure, workplace closure, and travel restrictions, among others.

For a myriad of reasons after the outbreak, the health care system was urged to make decisions to avoid the collapse of health resources. Spain has a public health care system that covers all population health needs. In the initial stage after the outbreak, hospitals reorganized their spaces, wards, and emergency rooms (ERs) to attend mostly COVID-19 patients. In Madrid, the number of beds in adolescent acute psychiatric inpatient units (AIUs) was reduced from 73 to 41 and located at two hospitals. Furthermore, most face-to-face interventions (mental health visits, group therapy, day hospital, etc.) were canceled and immediately converted into either online or telephone call interventions.

Immediate psychological impact on mental health among the general population in China was reported during the initial stage of the COVID-19 pandemic (2, 3). In addition, behavioral and emotional disorders have been described in children and adolescents affected by the pandemic (4, 5). In light of previous health disasters, mental health consequences are presumed to be significant and long-lasting (6). Some groups may be more vulnerable than others, in particular, the pediatric population with preexisting psychiatric disorders (3, 7, 8). Despite the potential major impact on adolescent mental health (9), there is comparatively less literature about the impact of COVID-19 on both the mental health and the demand for psychiatry services in adolescents. Furthermore, the scarce literature available has been devoted to means of preventive measures to protect children, particularly those more vulnerable, against the impact of pandemics (10–12). Thus, although there is an increasing number of studies regarding several adult psychiatric aspects about the COVID-19 pandemic (3, 13–17), there is virtually no literature addressing the impact of COVID-19 on mental health services demand and the delivery of mental health care in adolescents.

The aim of this study is to analyze the impact of the COVID-19 pandemic on mental health demand from patients aged 17 or less at the ER and AIU of a tertiary hospital in Madrid (Spain) during the first month (March 11 to April 11) after the pandemic declaration by the WHO. We hypothesize that the demand for psychiatric care at both ER and AIU will decrease due to fear of contagion.

MATERIALS AND METHODS

Sample and Procedure

The current study is a retrospective, observational, and transversal study. Eighty-nine children and adolescents aged 17 or less who went to the ER and/or the AIU at the Puerta de Hierro University Hospital (PHUH-M) between March 11 and April 11 were included. The PHUH-M is a tertiary, general hospital with 613 beds for hospitalization; it provides free, universal medical coverage to a catchment area of nearly 236,847 in the pediatric population (0–17 years old), of which 83,433 are adolescents (12–17 years old). The adolescent AIU has 10 beds for adolescents requiring psychiatric hospitalization.

ER records and psychiatric admissions in the AIU's daily record were reviewed to identify all patients. In order to ensure the objectivity of the data collected, clinical records were reviewed by two independent researchers, also by the clinicians working at the AIU during the time the data were reviewed. Whenever the information retrieved did not match, a consensus was reached with a third investigator.

The study was approved by the PHUH-M ethics committee.

Measures

The following sociodemographic variables were included in the study: age, sex, and mental health hospitalization referral area. At the ER, we also considered the following clinical variables: reason for consultation, the International Classification of Mental and Behavioral Disorders, version 10 (ICD-10) Axis I diagnosis, antecedents of previous mental health contact, whether the patient went to the ER voluntarily or not, and attitude to discharge. The following clinical variables were also recorded at the AIU: reason for consultation, main ICD-10 Axis I diagnosis, antecedents of previous mental health contact, previous psychopharmacological treatment, previous psychiatric hospitalization at the AIU (re-admission), and days of hospitalization. We also recorded the number of all psychiatric ER patients evaluated and the occupancy rate at the AIU. Furthermore, in 2020 we also recorded data regarding the COVID-19 situation: reason for demand at the ER, and COVID-19 testing at the AIU, if available. Fear of contagion and "initial shock" were identified within clinical records as reported by patients during anamnesis at ER and admission at AIU.

Statistical Analysis

We performed descriptive analyses using the relative and absolute frequencies for the categorical variables and the mean (± standard deviation, SD) or the median (25th and 75th percentiles), and the minimum and maximum values of the numerical variables. Chi-square or Fisher exact tests were performed to compare categorical variables. We used the U Mann-Whitney test to compare quantitative variables. The level of statistical significance was set at $p < 0.05$. Analyses were conducted using SPSS v11.0.

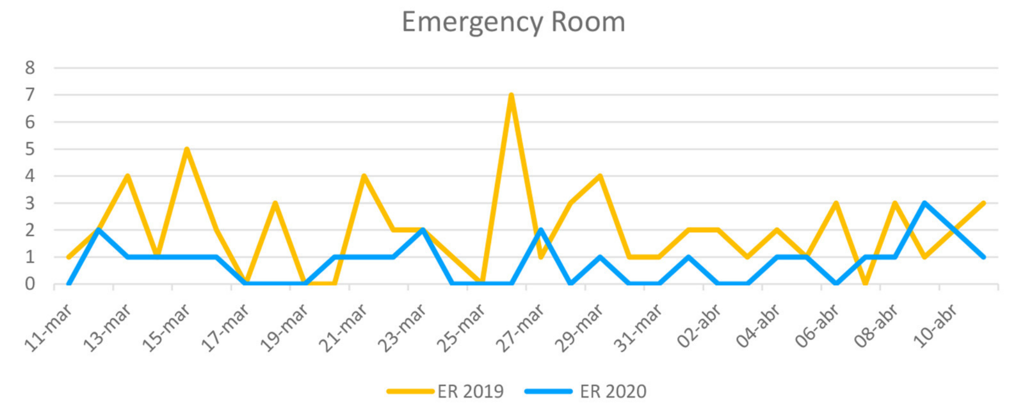

FIGURE 1 | Demand for psychiatric care at the ER March 11–April 11.

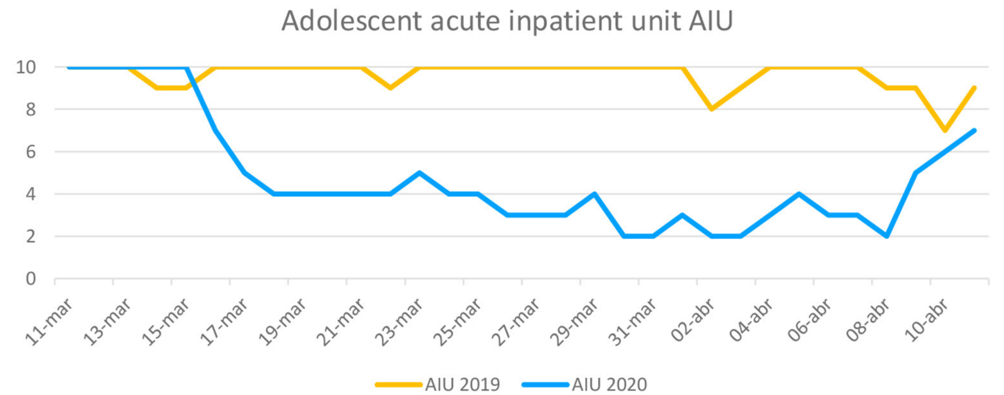

FIGURE 2 | Number of adolescents hospitalized at the AIU.

RESULTS

Figures 1, **2** display the demand for psychiatric ER care, and the AIU's bed occupancy rate, respectively, in 2019 and 2020. Sixty-four and 25 children or adolescents were evaluated at the psychiatric ER in 2019 and 2020, respectively.

Table 1 shows the characteristics of the children or adolescents psychiatrically evaluated at the ER in 2019 and 2020. Six patients (24%) of those who went to the ER referred to the COVID-19 pandemic as the reason for their consultation.

Regarding hospitalization, 31 and 18 adolescents were hospitalized at the AIU in 2019 and 2020, respectively. Among the 18 patients hospitalized at the AIU in 2020, we could screen for the COVID-19 virus in nine patients; one tested positive, developing pneumonia 3 days after admission that was treated in our ward (see **Table 2**). The patient with the COVID-19 diagnosis was admitted in week four in an isolated room. Prior admitted AIU patients and ER patients didn't know this fact.

Table 3 displays the reason for referral to the ER and hospitalization at the AIU in 2019 and 2020. **Table 4** shows Axis I ICD-10 diagnoses at the ER and AIU in 2019 and 2020.

TABLE 1 | Characteristics of the children or adolescents psychiatrically evaluated at the ER.

	2019 *n* = 64	**2020 *n* = 25**	**Significance**
Female gender	62.5%	72%	ns
Age	14.2 (±2.3)	15.36 (±1.8)	**0.09***
Area of referral	78.1%	64%	ns
Antecedents of mental health follow-up	90.6%	88%	ns
Voluntarily attending	78.1%	72%	ns
Hospitalization at the AIU as a result of ER consultation	28.1%	60%	**0.007**

Bold values represent significant p-values. Bold with asterisks (*) represent Marginally non-significant.

DISCUSSION

The COVID-19 outbreak represents a serious health issue with a potentially huge deleterious impact on adolescent mental health. Some have suggested that we will see a secondary mental health

TABLE 2 | Characteristics of adolescents hospitalized at the AIU.

	2019 *n* = 31	2020 *n* = 18	Significance
Female gender	64.5%	72.2%	ns
Age	15.55 (±1.23)	15.17 (±1.54)	ns
Hospitalization days at the AIU	14.32, 10.23	8.94, 4.87	**0.082***
Antecedents of mental health follow-up	87.1%	100%	ns
Previous psychopharmacological treatment	67%	94.4%	**0.038**
Previous AIU hospitalization	25.8%	61.1%	**0.032**
Area of referral	41.9%	83.3%	**0.007**

Bold values represent significant p-values. Bold with asterisks (*) represent Marginally non-significant.

TABLE 3 | Reason for referral at the ER and hospitalization at the AIU in 2019 and 2020.

	ER 2019 *n* = 64	ER 2020 *n* = 25	AIU 2019 *n* = 31	AIU 2020 *n* = 18
Anxiety	12.5%	12%	3.2%	0
Non-aggressive conduct disorder	9.4%	14%	0	0
Heteroaggression	26.6%	20%	16.1%	22.2%
Suicide attempt	12.5%	24%	22.6%	22.2%
Non-suicidal self-injury (NSSI)	12.5%	12%	0	0
Suicidal ideation	10.9%	24%	29%	44.4%
Depressive symptoms	3.1%	0	6.5%	5.6%
Psychotic symptoms	3.1%	0	9.7%	5.6%
Somatic symptoms	4.7%	0	0	0
Eating disorder	3.1%	0	12.9%	0
Other	1.6%	4%	0	0

pandemic due to either the direct COVID-19 impact or to the strict quarantine polices deployed by governments. In this context, we detected a significant decrease in the demand for adolescent psychiatric care both at the ER and the AIU during the first month in the immediate aftermath of the COVID-19 outbreak, as compared with the same period in 2019. The number of patients who demanded psychiatric care at the ER dropped from 64 (62% women) in 2019 to 25 (72% women) in 2020. At the AIU, the psychiatric demand collapsed from 31 (64.5% women) patients to 18 patients (72.2% women) when comparing 2019 and 2020. This sharp decrease coincides with the maximum increase in general hospital COVID-19 admissions in the Madrid community. Furthermore, the average hospitalization stay at the AIU decreased in 2020 when compared to 2019. Self-injurious thoughts and behaviors were the most predominant reasons for consultation at both ER and AIU during the COVID-19 outbreak.

TABLE 4 | ICD-10 diagnoses at the ER and the AIU in 2019 and 2020.

	ER 2019 *n* = 64	ER 2020 *n* = 25	AIU 2019 *n* = 31	AIU 2020 *n* = 18
F10–F19 Mental and behavioral disorders due to psychoactive substance use	1.6%	14%	3.2%	0
F20–F29 Schizophrenia, schizotypal and delusional disorders	4.7%	0	6.5%	0
F31 Bipolar affective disorder	3.1%	0	3.2%	0
F32 Depressive episode	12.5%	16%	6.5%	27.8%
F41 Other anxiety disorders	6.3%	0	3.2%	0
F43.1 Post-traumatic stress disorder	4.7%	4%	3.2%	16.7%
F43.2. Adjustment disorders	14.1%	0	9.7%	0
F40–F48 Neurotic, stress-related and somatoform disorders (F41, F43.1, and F43.2 excluded)	9.4%	0	0	0
F50 Eating disorders	4.7%	4%	12.9%	0
F84.0 Childhood autism	6.3%	0	16.1%	5.6%
F90 Hyperkinetic disorders	4.7%	4%	0	5.6%
F91 Conduct disorders	4.7%	4%	0	5.6%
F92 Mixed disorders of conduct and emotions	10.9%	24%	0	22.2%
F93 Emotional disorders with onset specific to childhood	0	0	29%	5.6%
F98 Other behavioral and emotional disorders	6.3%	28%	0	1.2%
F94.1 and F94.2 Attachment disorder	9.4%	12%	6.4%	0

Large-scale human disasters such as war conflicts, terrorism, natural disasters, or global pandemic diseases can cause a wide range of mental disorders (18). Accordingly, one might expect an increase in demand for psychiatric care in the immediate aftermath of these so-called catastrophes. For instance, Madrid's March 11, 2004, terrorist attacks produced a significant increase in demand for outpatient psychiatric care during the month after (19). However, in keeping with our hypothesis that fear of contagion to COVID-19 may deter people from asking for psychiatric care, we found that adolescent psychiatric demand collapsed in the first 3 weeks after the WHO COVID-19 Pandemic Declaration. A decrease in adult psychiatric admission rates during the lockdown period in Lombardy was also reported by Clerici et al. (15).

In the aftermath of a catastrophe, disbelief, fear, and shock are the initial responses of people (20). But compared to other human disasters, global pandemics are characterized by fear of contagion. Fear of contagion may modulate psychiatric demand as both patients and their relatives perceive hospitals as risky places for contagion. Indeed, COVID-19 fears probably kept people away from hospitals. Moreover, in this context, caregivers can be emotionally shocked and less sensitive to children and adolescent emotional needs, not taking their adolescents to the mental health services that they would use in normal circumstances (21). A second explanation for our finding of decreased adolescent psychiatric demand is that greater difficulty in accessing mental health resources (appointment cancellations, indirect telephone visiting with parents, etc.) and social services may have prevented adolescents suffering risky situations at home from asking for help (3, 22). A third explanation is that spending more time with caregivers may have had positive self-regulatory properties at home, resulting in a short-term decrease in psychopathology. Finally, school closures may have been a relief for the most vulnerable adolescents experiencing bullying, peer conflicts, or any other school-related anxiety situation, decreasing their needs for mental health care. In addition, new technologies promoting social connectedness may have also played a protective role (23).

After the initial phase, if prolonged, the quarantine may progressively increase family conflict, emotional discomfort, isolation from peers, and pessimistic thoughts, thus being a risk factor for psychiatric decompensation. Indeed, we observed a sharp increase in psychiatric demand both at the ER and AIU in the fourth week of the period studied. After the initial shock and fear due to the outbreak, quarantine and strict home confinement may have negatively impacted both adolescents and their relatives, and may have worsened pre-existing mental health disorders in children and adolescents (11, 24). Psychological impact on parents and youth associated with health emergencies has been reported (25), and parenting is challenging under these conditions. Indeed, violence and vulnerability rise during school closure periods (26). Furthermore, school closure represents a major source of stress given the drastic change in regular daily routines and the abrupt disruption of psychological support for children with special education needs usually delivered at school. For them, quarantine is particularly more stressful (10). Alongside with home confinement, children and adolescents may face their own illness or the illness or even loss of loved ones, and the economic impact of the crisis in their families (27).

Another finding is that the rate of adolescent re-admission was significantly higher during the COVID-19 crisis than in 2019. One possible explanation is that previous knowledge of the AIU together with a conflictive family dynamic at home during confinement may have facilitated asking for help at the hospital. Furthermore, it may also suggest that the most severely ill patients are those who demanded psychiatric care under these circumstances. Indeed, a significantly higher proportion of patients were hospitalized after ER consultation in 2020 when compared to 2019.

We also found that the average length of stay at the AIU decreased in 2020 when compared to 2019. This is in consonance with other reports that identified early discharge from adult psychiatry inpatient units during the pandemic (3) but in contrast with data reported by Clerici et al. (15), who reported a longer length of stay in Lombardy. This decreased AIU stay may be explained by the more restrictive conditions that governed AIU functioning following a strict COVID-19 preventive protocol, including (1) an isolation period of 48 h soon after hospitalization; (2) cancellation of family visiting and family-accompanied therapeutic outings, suspension of usual group activities (group psychotherapy, occupational therapy, community activities); and (3) the mandatory use of masks. These COVID-19 prevention measures undertaken in our unit were similar to those reported in adult inpatient settings by other authors (28). At discharge, we kept the usual protocol of community mental health care, despite existing difficulties in the context of the COVID-19 pandemic, also reported by other authors (3, 29).

Finally, self-injurious thoughts and behaviors were the most predominant reasons for consultation at both the ER and AIU. The first suicides in the COVID-19 era have already been reported in the adult population (30, 31). Indeed, some authors fear a suicide pandemic (32), particularly in the United States, given their firearm accessibility (33). Social connectedness and other preventive measures have been suggested to prevent suicides (23, 34, 35). We also found that major depression and mixed disorders of conduct and emotions were more frequently diagnosed both at the ER and AIU in 2020 than in 2019. This finding is in keeping with findings reported in China (36). These authors reported an elevated rate of affective disorders in children and adolescents during the COVID-19 outbreak.

The major strength of the current study is that our study is a "real world" observational study. Plus, the PHUH-M AIU is the only AIU in Madrid having data that allows us to review comparable situations in 2019 and 2020. To our knowledge, this is the first report of a demand analysis of an adolescent ER and AIU during the COVID-19 pandemic. However, our study has several limitations. The major limitation is the small sample size as we have only analyzed data from the first month since the COVID-19 pandemic was declared. This limitation prevented us from testing statistical differences in the prevalence of the different mental disorders between 2019 and 2020. In any case, further data will be recorded in the following months so we will be able to measure the pandemic's impact on demand once the outbreak is controlled and de-escalation of confinement is ongoing. The subjective striking observation by our team of a dramatic drop of adolescent demand for both ER and AIU services led us to study this short-term and acute phase of the pandemic in Madrid. Furthermore, given that our study is limited to the population at one geographical areas of the community of Madrid, our results may not be generalized to either other communities in Spain or other countries.

In view of the severity and length of the COVID-19 pandemic situation, future studies should confirm our initial results on the analysis of the demand of adolescent mental health services (16). We agree with the suggestion concerning the necessity of adapting the conditions of psychiatric hospitalizations to the brand new COVID-19 pandemic ecosystem (28). The incorporation of technology to improve access and quality of care of patients with mental disorders represents an opportunity for digital psychiatry and may contribute to these aims (18, 37).

CONCLUSION

1. Adolescent mental health care demand decreased in the first month after the COVID-19 outbreak in the community of Madrid (Spain). Fear of contagion may partially explain this decreasing demand. Also, lockdown and social distancing measures taken may have had a protective effect in some adolescent disorders.
2. Average inpatient length of stay shortened during the pandemic. The COVID-19-preventive measures adopted during hospitalization could explain this finding.
3. Adolescents with pre-existing mental disorders are a population vulnerable to the worsening of their mental disorders as a consequence of the pandemic. Follow-up of their mental well-being must be done.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The study was approved by the PHUH-M ethics committee.

AUTHOR CONTRIBUTIONS

IP: leadership, writing introduction, and discussion. MD: design and results analysis. HB-F: review and contribution to discussion. LG: review and contribution to results analysis. AP-B and PD: recollected data. LM: contributed discussion. AF: analysis results. All authors contributed to the article and approved the submitted version.

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REVIEW
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The Management of Psychiatric Emergencies in Situations of Public Calamity

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The prevalence of mental health problems in the general population during a public calamity is high. In calamities, the number of patients who present with mental disorder outbreaks or crises may increase, but the necessary support systems to help them may be impaired if they have not been planned for. Although there are several models for addressing psychiatric emergencies, the general rules are the same, especially when it comes to making these services easily available to the affected population. In this article, we seek to review and present recommendations for the management of psychiatric emergencies in situations of public calamity, including disasters, physical and medical catastrophes, epidemics, and pandemics.

Keywords: humans, pandemics, psychiatric emergencies, mental health, outbreaks

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INTRODUCTION

To understand the effects of medical emergencies in public health, we can use various human calamities on a large scale as an example (1). These include disasters, physical and medical catastrophes, epidemics, and pandemics, such as the current outbreak of COVID-19 (2–4). Analysis of the relationship between natural catastrophes and human behavior is crucial in understanding both how to deal with its impact and consequences and how to manage its effects on mental health (3, 5).

In turn, the prevalence of mental disorders in disaster situations is two to three times higher than that in normal situations and varies from 8.6 to 57.3% in the affected population (6, 7). In addition, the affected community can exhibit many subsyndromal symptoms. Many reactions and acute disorders can be self-limiting, while others may require specialized assistance (7).

Nonetheless, one of the most critical issues concerning the effects of natural catastrophes is their impact on mental health (2, 3, 8), including the worsening of symptoms in patients and increases in psychiatric emergencies (1, 9, 10). Psychiatric disorders, such as posttraumatic stress disorder, anxiety, and depression, have frequently impacted both survivors directly affected by a calamity and health professionals who worked during the crisis (6, 9, 11, 12). In addition to the long-term consequences of calamities, the strategies used to address emergencies in health care during the acute crisis are crucial in minimizing their immediate long-term impact.

The problems discussed here can affect hospitals several times during a given period. A decrease in the number of employees and an increase in patients may temporarily compromise the hospital's service capacity, which makes it impossible to prevent bad outcomes that would have been avoidable previously (1). Hospitals must close their doors and divert patients as the first step. If hospitals have a general duty to be open to the health care needs of incoming patients, outbreaks and staff shortages can justify the diversion of ambulances to other nearby centers. Despite this delay, the goal is still to prevent bad outcomes using all available medical and nursing resources (1–3).

Medical emergencies are situations where the individual is at risk of imminent death; thus, they require immediate intervention. Changes in a patient's behavior that put them or others at risk and that require immediate therapeutic intervention (in a matter of minutes or a few hours) to prevent harm are called psychiatric emergencies. The most prevalent emergency situations are severe self-neglect, self-harm, suicidal behavior, depressive or manic episodes, aggressive psychomotor agitation, severely impaired judgment, intoxication, or withdrawal from psychoactive substances (13, 14).

In calamities, the number of patients in outbreak or crisis situations may increase, but the necessary support may be impaired if it has not been planned for (2, 3, 10). Although there are several models for addressing psychiatric emergencies, the general rules are the same, especially when it comes to making these services easily available to the population (10).

This review aims to propose strategies to address psychiatric emergencies in calamity situations and includes the discussion of attitudes toward public policies and codes of conduct for health professionals.

TABLE 1 | Management of psychomotor agitationin public calamities.

Assess the situation. Protect the patient, people, and staff
Use verbal de-escalation and other communication techniques
Move the patient to a more peaceful environment
Use rapid oral tranquilization
Recommended antipsychotics: Asenapine, haloperidol, risperidone, olanzapine. Avoid use in patients with arrhythmia, seizures, and head trauma Recommended benzodiazepines*: Clonazepam, diazepam (especially for alcohol withdrawal), and lorazepam. Avoid use with SNC depression drugs (i.e., alcohol)
Use rapid intramuscular tranquilization
Recommended antipsychotics: Aripiprazole, haloperidol, olanzapine. Avoid use in patients with arrhythmia, seizures, and head trauma Recommended benzodiazepines: Lorazepam and midazolam. Avoid use with SNC depression drugs (i.e., alcohol)
Use physical restraint with rapid tranquilization

**IV must be avoided. Exceptions are alcohol withdrawal, cocaine intoxication, and seizures where IV diazepam or lorazepam is indicated.*

SEARCH STRATEGY AND SELECTION CRITERIA

This is a review of the management of psychiatric emergencies in situations of public calamity. To identify relevant studies, we searched MEDLINE. The search terms were psychiatric emergencies and calamity or disasters or epidemic or pandemic. We applied no language or time restrictions. We supplemented the search results with important publications.

The main recommendations for agitation management are present in **Table 1**. In **Tables 2–5** we present main recommendations for some medications that could be used in emergencies. In **Table 6** we present key points about psychiatric emergencies in public calamities.

ASSURANCES TO THE AFFECTED POPULATION

The population affected by the calamity should receive general health care and support for psychiatric and mental health services. According to Ho et al. (15), in the COVID-19 pandemic crisis, it is important to use certain strategies to deal with a high-risk population under stress (e.g., foreigners under quarantine). They also argue that mental health care should include screening scales to assess the impact of outbreaks on mental health in people with frequently described COVID-19 symptoms and people with a history of psychiatric symptoms (15). In addition to the assistance provided by the emergency services specialist (which includes places for observation), access to outpatient treatment must also be guaranteed to affected individuals, since this provides care for mild cases and prevents future episodes or crises (16). Places for hospitalization must be guaranteed for the treatment of acute cases (2, 3). Mobile prehospital emergency care must be made available, and their staff must be trained to deal with psychiatric emergencies (2, 17, 18). All these settings should be supported by psychiatrists (10, 19).

Other tools should be made available to the population, both for screening acute cases and for support and prevention (16, 17, 20), and should include the following:

- Clear mechanisms to triage and referral (17)
- Psychosocial evaluation and recognition of vulnerable populations (2, 17, 20)
- Effective communication to the affected population (3, 17, 20)
- Assessment of psychopathology and psychophysiology of fear and related behavioral responses, focusing on psychiatric emergency events (17, 20)
- Assessment of cultural context of mental health (17, 20)
- Psychological first aid (20)
- Caring for the healthcare and support workers' mental state (17, 20)
- Services for differentiating normal distress from pathological stress (20)
- Digital access to relevant mental health information, support, and intervention (3, 12)

Telepsychiatry can be used as a support tool to provide care in places that are difficult to access. However, it is necessary to consider its cost effectiveness, the availability of equipment on site, and any related legal aspects. One caveat is that telepsychiatry should only be used as an instrument to mitigate the lack of stable patient care and thus prevent crises, but it is not recommended for addressing ongoing psychiatric emergencies.

TABLE 2 | Main warnings for antipsychotics.

Medication	Warning
Typical—Low potency	Drug interactions: Antihypertensives, antiarrhythmic medications, sedatives, other antipsychotics, ciprofloxacin, fluvoxamine, lithium, clinafloxacin, idrocilamide, oltipraz, rofecoxibe, etintidine, zafirlukast, chloroquine/hydroxychloroquine, ritonavir, azithromycin Diseases: CNS depressor intoxication (alcohol, psychotropic medications), dementia, cardiovascular disease, head injury, anticholinergic effects, hematologic toxic, liver disease, parkinsonism, renal dysfunction, respiratory disorders, seizures, thromboembolic events, seizures
Atypical—High potency	Drug interactions: Antihypertensives, antiarrhythmic medications, fluoxetine, sedatives, other antipsychotics, venlafaxine, escitalopram, divalproex, lithium, ondansetron, erythromycin, levofloxacin, moxifloxacin, pentamidine, toremifene, vandetanibe, rifampicin, itraconazole, chloroquine/hydroxychloroquine, ritonavir, azithromycin Diseases: CNS depressor intoxication (alcohol, psychotropic medications), dementia, cardiovascular disease, head injury, anticholinergic effects, hematologic toxic, liver disease, parkinsonism, renal dysfunction, respiratory disorders, seizures, thromboembolic events, dehydration, hyperthyroidism, neutropenia, seizures
Atypical	Drug interactions: Antihypertensives, antiarrhythmic medications, sedatives, other antipsychotics, metoprolol, lamotrigine, SSRI, lithium, pregabalin, carbamazepine, clonazepam, cimetidine, ketoconazole, rifampicin, ciprofloxacin, chloroquine/hydroxychloroquine, ritonavir, azithromycin, iodinated contrasts Diseases: CNS depressor intoxication (alcohol, psychotropic medications), dementia, cardiovascular disease, head injury, anticholinergic effects, hematologic toxic, liver disease, parkinsonism, renal dysfunction, respiratory disorders, seizures, thromboembolic events, hypotension, anticholinergic effects, seizure, aspiration, lipid alterations, hematologic abnormalities (clozapine: agranulocytosis), diabetes

TABLE 3 | Main warnings for mood stabilizers.

Medication	Warning
Lithium	Drug interactions: Acyclovir, angiotensin converting enzyme inhibitors, digoxin, diuretics, non-hormonal anti-inflammatory drugs, tricyclic antidepressants, beta blockers, chloroquine/hydroxychloroquine, ritonavir, lopinavir, streptomycin, phenytoin, levodopa, antipsychotics, tapazole, tenofovir, tetracycline, warfarin Diseases: Renal diseases, seizures, hypothyroidism, cardiac disease, diarrhea, sodium depletion, fever, neutropenia, dehydration
Valproate	Drug interactions: Antiretrovirals, antithyroid drugs, calcium channel blockers, carbamazepine, carbapenems, cimetidine, chloroquine/hydroxychloroquine, clozapine, chemotherapy, dapsone, digoxin, erythromycin, ethosuximide, phenytoin, phenobarbital, lamotrigine, ritonavir, salicylic acid, lopinavir, tricyclic antidepressants, warfarin Diseases: Liver disease, HIV/CMV, thrombocytopenia, renal disease, thyroid diseases
Lamotrigine	Drug interactions: Carbamazepine, citalopram, clozapine, desmopressin, phenytoin, phenobarbital, chloroquine/hydroxychloroquine, ritonavir, lopinavir, rifampicin, sulfamethoxazole-temoporfin Diseases: Rash, arrhythmias, blood dyscrasias, meningitis, renal disease, liver disease

STRUCTURE OF CARE

Psychiatric emergencies can occur anywhere and unexpectedly. Therefore, it is necessary to emphasize that the appropriate environment for dealing with crises will not always be available to health professionals (10, 19, 21, 22). The safety of the patient and those close to them should be the initial concern in the management of psychomotor agitation. Both the doctors and other team members should not put themselves in risky situations, such as attending the patient in a closed room with no accessible exit or attending them without personal safety equipment (13, 23, 24).

An adequate physical structure is essential for assisting patients in emergency situations. Psychiatric patients should be treated in a specific physical area reserved for such care, given the peculiarities of the clinical presentations of mental illness. The location must have adequate physical space for the nursing staff to provide specific care, with, for example, well-ventilated offices and bathrooms at the location (13, 21, 25, 26). There should be adequate lighting and guidance items, such as clocks and calendars, to help those who are confused (26). In the waiting room, the furniture must be organized, and the office must have easy access points for the patients and for healthcare professionals (21).

It is essential to ensure that patients are comfortable and to minimize external stimuli. Loud sounds, bright colors, and excessive heat or cold are inappropriate sensory stimuli and can aggravate some psychiatric symptoms. Care must be taken to ensure that patients are comfortable and that external stimuli are minimized. The psychiatric emergency department has adequate facilities for both entry and exit. Rooms must be quiet and individual, and waiting times must be minimized as much as possible (21, 24–28).

In the room used for attending psychiatric emergencies, there should be chairs and a table for the patient and family, a table for examination, and a sink for washing hands (13, 26, 29). The exit route from the room must be at the back of the professional who attends the patient and should be completely unobstructed so that it can be used in the case of a threat that cannot be managed (29, 30). It is important to note that doctors and other health professionals will care for patients who may be in crisis and who may behave in an unpredictable manner (29, 30). Objects that are potentially dangerous should always be removed (24, 28).

TABLE 4 | Main warnings for antidepressants.

Medication	Warning
Agomelatine	Drug interactions: Antidepressants, ciprofloxacin, betablockers, estrogens Diseases: Cutaneous reactions, hepatitis
Bupropion	Drug interactions: Alprazolam, aripiprazole, amphetamines, dextroamphetamine, citalopram, clonazepam, duloxetine, venlafaxine, lamotrigine, escitalopram, linezolid, lisinopril, paroxetine, fluoxetine, quetiapine, tramadol, trazodone, sertraline, ritonavir, efavirenz, betablockers, cyclophosphamide, tamoxifen, ticlopidine, clopidogrel, aminophylline theophylline Diseases: Heart diseases, seizures, glaucoma, hypertension, head trauma, delirium
Dual-action antidepressants	Drug interactions: Antidepressants, antihypertensives, cimetidine, clozapine, diuretics, lithium, metoclopramide, ondansetron, oxcarbazepine, phenytoin, tramadol, quinolones, tamoxifen, triptans, warfarin Diseases: Heart diseases, seizures, glaucoma, hypertension, head trauma, delirium
Mirtazapine	Drug interactions: Antidepressants, buspirone, sedatives, ketamine, ketoconazole, cimetidine, clonidine, erythromycin, phenytoin, hydroxyzine, levodopa, metoclopramide, olanzapine, propranolol, quetiapine, risperidone Diseases: Renal disease, liver disease, hypotension, neutropenia, hyponatremia, seizures, glaucoma
Monoamine oxidase inhibitors	Drug interactions: Adrenalin and sympathomimetic amines, anesthetics, antihistamine, antidepressants, caffeine, carbamazepine, cyproheptadine, clonidine, clozapine, decongestants, disulfiram, ginseng, insulin, levodopa, lithium, methyldopa, opioids, nitrates, oxcarbazepine, tyramine, triptans, tryptophan Diseases: Heart disease, cerebrovascular disease, use of sympathomimetics, thyrotoxicosis, pheochromocytoma, liver disease, renal disease
Selective serotonin reuptake inhibitors	Drug interactions: Amiodarone, antidepressants, betablockers, ciclosporin, cimetidine, clarithromycin, digoxin, fluconazole, glibenclamide, insulin, linezolid, aspirin, lorazepam, ibuprofen, lamotrigine, gabapentin, omeprazole, opioids, oral anticoagulants, ritonavir, triptans, tryptophan, warfarin, verapamil Diseases: Hyponatremia, seizures, QT prolongation, SIADH, liver disease, platelet function, renal disease, glaucoma, diabetes
Trazodone	Drug interactions: Amiodarone, antidepressants, antihypertensives, clonidine, digoxin, Ginkgo Biloba, linezolid, methyldopa, propranolol, ritonavir, selegilin, warfarin Diseases: Glaucoma, seizures, cardiovascular disease, hyponatremia, hypotension, liver disease, renal disease
Tricyclics	Drug interactions: Acetaminophen antihistamines, bupropion, duloxetine, cyclobenzaprine, gabapentin, opioids, lamotrigine, escitalopram, pregabalin, fluoxetine, levothyroxine, linezolid, sertraline, topiramate, trazodone, sulfamethoxazole trimethoprim, fluconazole Diseases: Anticholinergic effects, cardiovascular disease, seizures, glaucoma, urinary retention, neutropenia, bone marrow suppression
Vortioxetine	Drug interactions: Abciximab, anticoagulants, antidepressants, betablockers, buspirone, carbamazepine, efavirenz, protease inhibitors, linezolid, lithium, lopinavir, opioids, ritonavir

Psychiatric emergencies often have an organic etiology, and clinical complications inherent to the illness or treatment can occur. It is essential that emergency equipment, such as oxygen tanks, equipment for orotracheal intubation, secretion aspirators, vaporizers and nebulizers, carts, and trays with defibrillators, are easily accessible (26). Laboratory tests, such as capillary blood glucose tests, oximetry, and ECG (24), should be available on site. Materials for physical restraint, such as appropriate ranges, must also be available (13, 21, 26, 30).

The observation areas should be equipped with beds with raised heads and fixed bars where restraints may be attached if necessary. It is inadvisable that patients under observation remain on stretchers (26). The layout must be organized to facilitate observation with unobstructed lines of sight, and all blind spots must be eliminated (25). All services to handle behavioral changes must be provided in an area or room designed to reduce patient agitation (25).

To reduce the risk of transmission of infectious diseases, such as H1N1, COVID-19, or tuberculosis, health professionals who care for patients in psychiatric emergencies must be prepared for protective measures, including the provision of isolation areas, containment protocols, and the availability of personal protective equipment, whether they are in an emergency room or not. During an epidemic, the management of behaviorally aggressive or hostile patients will always be a difficult challenge, since it would not be clear if the agitated/aggressive patient is infected or not, so any psychiatric agitated patient should always be managed as a possible infected case.

Consideration should be given to opening observation areas and exclusive wards for mentally ill patients during an epidemic, to contain transmission or deal with emergency situations (such as agitation). The health care team should always be dressed and prepared for immediate intervention. In addition, many people with mental illness may not have the capability to understand preventive measures, such as frequent hand washing, wearing masks, and physical distancing.

The number of patients must not exceed the number of beds available, given that an excess number of patients can increase the tension between patients and staff (25). Whenever the management team engages with patients exhibiting agitated

TABLE 5 | Main anxiolytics for acute anxiety symptoms*,**,***.

Alprazolam	±11.2	Bupropion, cyclobenzaprine, furosemide, gabapentin, lisinopril, losartan, omeprazole, trazodone
Bromazepam	±17	Antifungals, macrolide antibiotics, HIV protease inhibitors, calcium channel blocking agents
Clonazepam	±35	Aripiprazole, antifungals, bupropion, duloxetine, fluoxetine, phenytoin, ranitidine, phenothiazines, monoamine oxidase carbamazepine, sertraline, pregabalin, lamotrigine, phenobarbital
Diazepam	±48	Baclofen, duloxetine, furosemide, cimetidine, lisinopril, omeprazole, prednisone, omeprazole, sertraline
Lorazepam	±18	Aripiprazole, citalopram, duloxetine, escitalopram, pregabalin, bupropion, sertraline

**Avoid use with Antihistamines, opioids, and other sedatives. Avoid use in acute alcohol intoxication, closed-angle glaucoma, drug dependence, renal/liver disease, respiratory depression seizures, prolonged hypotension.*

***Drug interactions and/or related problems: Cimetidine, oral estrogen-containing contraceptives, diltiazem, disulfiram, erythromycin, fluoxetine, fluvoxamine, grapefruit juice, itraconazole, ketoconazole, nefazodone, propoxyphene, ranitidine, and verapamil, which inhibit the oxidative metabolism of benzodiazepines, are less likely to affect lorazepam, which undergoes glucuronide conjugation.*

****Be careful in cases of depression, obesity, and in the presence of paradoxical reactions.*

TABLE 6 | Key points about psychiatric emergencies in public calamities.

Psychiatric emergencies are complications of mental illnesses that may be pre-existing or arise after the event
For this reason, full support services must be available including outpatient care, day hospitals, emergency services, and general and specialized wards
It is necessary for the population to have quick access to screening and rapid referral mechanisms during and after a disaster
The assessment must be complete and consider the differential diagnosis or comorbidities with physical diseases
Main emergencies include psychomotor agitation, suicide behavior, substance abuse, mood disorders, psychosis, and anxiety disorders

and violent behaviors, an effort must be made to manage the treatment in a less restrictive physical environment (25), such as in a small specialized observation unit with adequate space, equipment, security, and trained staff (13, 25, 30, 31). This is a small, specialized observation unit with suitable space, equipment, safety, and trained teams (25, 31). The Psychiatric Intensive-care Unit (PICU) has showed better results than even a psychiatric department specializing in the care of acute patients (32).

STAFF

The team should be trained, and there should be protocols for the therapeutic approach of the main psychiatric emergencies. These protocols provide each step of the approach to the patient and the role of each professional to that extent (13, 26).

Physicians working in intensive care settings must have the ability to perform multiple tasks simultaneously and tolerate rapid changes in patients' priorities (28). In this environment, it is important to tolerate and even enjoy dealing with agitated patients. This requires certain characteristics of temperament, and all doctors are encouraged to self-assess their own temperament for this kind of work (28). Agitated patients can be provocative and may challenge the clinician's authority, competence, or credentials. Some patients, to deflect their own sense of vulnerability, are very sensitive in detecting the clinician's vulnerabilities and thus focus on them (28).

It is necessary for everyone to assume a role in this type of service. It is necessary to wear appropriate clothing, such as a lab coat or non-provocative clothing in neutral colors and badges. Drop earrings, necklaces, or long hair are not recommended. The reason for such recommendations is to minimize or even avoid the possibility of being the victim of an attack by a more aggressive patient (13, 21, 33). Sudden movements and prolonged direct eye contact can be perceived as a threat and should be avoided. An adequate distance must be maintained from agitated patients to protect the team and the patient (21, 33).

In calamity situations involving infectious diseases, emergency professionals may suffer from interpersonal isolation and fear of transmitting the virus to their families. Medical teams have also stated that wearing protective clothing such as N95 masks can hinder communication between team members and with patients. During Korea's 2015 MERS-CoV outbreak, the effects of stigma and hardship had a direct impact on the mental health of health professionals who worked in public hospitals (34, 35). Psychological adaptation was described among health personnel who had access to well-equipped and structured environments (34).

Medical workers in Wuhan have been dealing with a high risk of infection, inadequate protection against contamination, overwork, frustration, discrimination, isolation, patients with negative emotions, a lack of contact with their families, and exhaustion in COVID-19 outbreak (2, 18, 34, 36). The current situation is causing mental health problems such as stress, anxiety, depressive symptoms, insomnia, denial, anger, and fear (34, 37). These mental health problems not only affect the attention, understanding, and decision-making capacity of medical workers, which could hinder the fight against COVID-19, but they could also have a lasting effect on their overall well-being of professionals (2, 18, 34, 36) and can result in an expected increase in cases of posttraumatic stress (PTSD).

Then, assistance to provide enough equipment, protocols, and psychological and psychiatric support is essential, since this will preserve the proper functioning of the team and, in turn, improve patient care.

ASSESSMENT

When patients and family members go to the emergency department due to any psychiatric emergency, one must quickly and effectively attempt to analyze the situation to implement the best treatment as soon as possible. The protocol to care for patients in psychomotor agitation can be extrapolated to other emergencies, since the main goals are screening and severity assessment (13, 21, 24, 30, 38, 39), and includes the following:

a. Objective and subjective anamnesis.
b. Physical and neurological examination.
c. Psychiatric examination.
d. Differential diagnosis.
e. Quick tranquilization.
f. Referral and orientation.

In some cases, it may be difficult to perform all these steps as soon as patients are seen by health workers. Because time is important in an emergency, we suggest the following four basic questions (13, 29):

A. *What is happening?*

Investigate what behavioral changes are observed that are of concern. It is important to determine the acute changes in behavior that can put the patient or others at risk and eliminate any organic causes.

B. *For how long?*

Investigate whether the patient has experienced such changes for a long or short period and confirm whether there have been any serious and acute changes in behavior. Even in the case of patients with a long history of agitation, the situation can be urgent. Sudden changes in behavior can also be caused by organic factors.

C. *Why today?*

Investigate why they chose this moment to seek help. Some crucial triggering factors may be considered circumstantial or irrelevant or simply were not mentioned by the patient or relatives.

D. *What is the diagnostic hypothesis or temporary diagnosis?*

Start the differential diagnosis process to identify the best approach. In the emergency room, syndromic diagnoses, such as psychotic disorder or mood disorder, are preferably used since the need for quick decision making will not allow a detailed diagnosis.

APPROACH TO THE MAIN SITUATION

General Support for Stress

As mentioned earlier, it is necessary for the population to have quick access to screening and rapid referral mechanisms during and after a disaster. Subsequently, patients should receive care focused on possible mental disorders (pre-existing) and for situations that represent a greater vulnerability to stress. This is especially true for people who exhibit an abnormal response to the disaster or calamity (7) such as the following:

- Survivor's guilt,
- Becoming mentally ill,
- Stress related to caring for a person with physical or mental illness,
- Fear of losing control of overwhelming emotions,
- Substance use,
- Death wishes and suicidal ideas. Through emotional validation, a sense of justification can be provided for these overwhelming emotions.

Some interventions suggested for these abnormal responses to a calamity are as follows:

- *Psychological First Aid*: Survivors can exhibit many physical, emotional, and cognitive symptoms. The patient may not be able to think and act rationally during the disaster. Psychological first aid techniques can be performed by non-professionals who have been minimally trained within the community (7, 40).
- *Crisis-focused intervention/psychotherapy*: The focus of this intervention is to stabilize patients, interrupt distress escalation, mitigate acute signs and symptoms, restore functionality, and establish bonds and agreement on therapy goals. This type of intervention is useful for the treatment of entrapment sensations, which are frequently observed in psychiatric emergencies (41).
- *Debriefing:* This is defined as group discussions that occur within 48–72 h after an event and are often referred to as 'psychological debriefings' (7). These sessions encourage participants to describe and share both factual and emotional aspects of their disaster experience (7, 11). The justification is that immediate processing gives an individual the ability to cognitively restructure the perceived disaster event so that it is remembered in a less traumatic way (7).
- *Cognitive Behavioral Intervention (CBT):* CBT has been found to be effective in reducing subsequent psychopathology after exposure to a disaster (7, 11). In emergencies, CBT should be used in brief sessions and includes a range of techniques, such as psychoeducation, breathing exercises, relaxation exercises, and cognitive restructuring. Techniques that address traumatic experiences should include imagery and/or *in vivo* exposure (42).
- *Community-Based Interventions:* These interventions include the structuring of daily activities to avoid displacement; promotion of family, cultural, and religious rituals; group discussions; validation of the survivor's emotions and the survivor's guilt; provision of factual information; education of parents and teachers; involvement of children in various informal methods of education with innovative ideas, such as drawing, singing, imitating, and so on, using available community resources; and involvement of adult survivors in activities at a disaster camp, such as cooking, cleaning, and helping with relief work. Schools in the area affected by the disaster should be re-opened as early as possible, so that the normalization and structuring of daily activities can occur in children, even if they just receive some informal education, learn simple sleep hygiene techniques, and are educated about the harmful effects of substance use. Community-based group interventions can be planned as well and include art therapy (painting/drawing), group discussions, dramas, narratives, planning of daily routines, and participation in activities, prayers, yoga, relaxation, and sports/games. While managing social worker stress is essential, it is also essential to involve

willing survivors in spiritual activities and to involve them in rebuilding their community (7).

- *Psychopharmacology:* Generally, the use of psychotropic drugs is discouraged in disasters because of popular notions such as "disaster reactions are usually normal people in abnormal situations" and "most symptoms are self-limiting." Prophylactic use of psychotropic drugs in survivors is often discouraged. There are no well-controlled studies to show that prophylactic drug use decreases psychiatric morbidity (7). The exception is when there is a diagnosis of mental disorder that may have arisen or worsened during the calamity, but in these cases, the treatment is aimed at the specific diagnosis.

Delirium

Delirium is a syndrome where there is mental confusion characterized by impaired consciousness, cognitive function, and attention, with an abrupt onset and a fluctuating course. It is associated with a rapid reduction in brain function and is caused by physical illnesses, usually of systematic involvement. It has a high impact on morbidity and a high risk of lethality (43, 44).

The treatment of delirium should be focused on resolving the underlying condition and must be combined with non-pharmacological interventions and specific pharmaceutical interventions. However, the diagnosis of delirium and the early identification of its causal factors depend on the training of the health team. After discharge, patients who have developed delirium will need continuous monitoring (21, 43, 44).

In a public calamity, all healthcare services must be prepared to identify and make the differential diagnosis of delirium, as well as to start treatment immediately. When identifying these cases, health professionals should already have their protocols in place for such assistance (10, 21). Delirium can be caused by different events such as trauma, hydroelectrolytic disorders, complications of pre-existing physical diseases, medications, substance abuse, and infections (especially kidney and lung). For calamities involving infectious diseases, it is important to remember that delirium is part of the set of symptoms and indicates greater severity of the patient's disorder (10).

Agitation

Psychomotor agitation caused by mental disorders should receive immediate attention. It is important for the clinician to proceed with the mental status examination and consider other psychological processes related to agitation. Despite the existence of psychometric self-report scales to assess agitation, the use of this type of tool is not always viable and can exacerbate agitated behavior (24). In these cases, the use of scales rated by observers could be useful in quantifying the symptoms and assessing the impact of intervention over time (13).

The management of patients, regardless of their environment, must follow the following steps: protection of the patient and people around them, communication and verbal de-escalation, medication approaches, and physical restraint, if all measures fail (13, 24, 28). The Consensus of the American Association of Emergency Psychiatry suggests the use of a de-escalation intervention to address aggressive and agitated patients. This technique includes 10 main domains: (1) respect personal space; (2) do not be provocative; (3) establish verbal contact; (4) be concise; (5) identify wants and feelings; (6) listen closely to what the patient is saying; (7) agree with the patient (agree with the truth, agree with the principle and/or agree with the odds); (8) lay down the law and set clear limits; (9) offer choices and optimism; (10) debrief the patient and staff (28).

The use of medications and physical restraint is recommended in an appropriate environment, such as the emergency room. Therefore, if agitation is so severe that it requires such a strict measure, the patient must be transported by ambulance to the emergency service. The use of medications for agitated patients should follow the principles of rapid tranquilization: medicating without overly sedating and using medications with the fewest possible side effects (30).

In places where patients remain for therapeutic interventions, there should be an observation area with quick access for the health team and support material for evaluation. The medication procedure is called rapid reassurance and requires periodic monitoring of vital signs and the patient's state of consciousness, as well as physical restraint (13, 21).

In calamities, agitated patients often also suffer from physical illnesses; therefore, they need to be managed in health service centers with general medical support, including that for trauma and infectious diseases (10). If there is a risk of contagion, agitated patients, most of whom are uncontrolled in their volition, need to be protected from contact with other people. In such cases, a private approach is essential, since the patients often may not accept the use of personal protective equipment (10).

Cases of psychomotor agitation require quick decisions and can often involve poorly planned and aggressive measures. In turn, in situations of public calamity, patients may not be accurately assessed. Therefore, extra care should be taken with the use of medications. Antipsychotic agents (aripiprazole, olanzapine, quetiapine, risperidone, and haloperidol, among others) are associated with a 1.7- to 3-fold risk of hospitalization due to pneumonia (45) and an increased risk of sudden death and thrombosis. The risk associated with second-generation antipsychotics is not lower than that associated with first-generation agents. These drugs, however, can also cause respiratory dyskinesia that may be mistaken for asthma or other lung conditions and can lead to inappropriate treatment. Benzodiazepines may be related to hypoventilation.

Even in public calamities, the principles of treatment should always be the same as in regular therapy: medicate only if necessary, with the lowest doses necessary to calm the patient (quick reassurance) and always consider side effects and drug interactions. The use of agitation protocols as a reference is recommended (13, 24, 28, 30, 46).

Suicide Risk

Although care is expected to reduce the rate of new infections or other physical complications, there is always a high risk of suicide during disasters. The secondary consequences of social distancing may increase the risk of suicide. It is important to consider changes in a variety of economic, psychosocial, and health-associated risk factors (19, 21, 38, 39).

Many studies have documented elevated suicide rates, even among medical professionals (47–50). This at-risk group is now serving at the front lines of the battle against COVID-19. A national discussion is emerging about health care workers' concerns about infection, exposure of family members, sick colleagues, shortages of necessary personal protective equipment, overwhelmed facilities, and work stress. This special population deserves support and prevention services.

The therapeutic approach to suicidal behavior, both ideation or attempts, must include the assessment of risk and protective factors associated with intervention measures (called the safety plan) (38, 39, 51, 52). For cases involving a high risk of suicide, strict observation of the individual is required, so they must stay in the emergency department or undergo hospitalization or home care. This last resource should only be used if a support network is present in the community, such as the following: having a family member or other person who constantly watches the patient, quick access to mental health care for complications and monitoring, and acceptance of the caregiver by the patient (10).

The assessment of the patient for suicide risk can include brief psychometric tools but they should never serve as the only source of information since their predictive value is only moderate (53). Clinicians should look beyond psychometry to perform a comprehensive assessment. According to Weber et al. (54), the patient assessment should include the identification of the present level of risk and the modifiable and fixed risk factors related to the intention. The risk (e.g., previous suicide attempt, psychiatric illness, substance dependence) and protective factors (e.g., interpersonal support, positive coping skills) should also be identified (38, 39).

In emergency service centers, patients at risk of suicide must first receive any general health care. Many suicide attempts are associated with severe trauma or intoxication, and such emergencies should not be neglected to assess psychiatric emergencies (they must be carried out together) (38, 39).

Despite these challenges, there are opportunities to improve suicide prevention efforts in this unique time. Maintenance of some existing efforts is also possible and includes the following movements: Physical Distance, Not Social Distance, Tele–Mental Health, Increase Access to Mental Health Care, and Distance-Based Suicide Prevention and Media Reporting (55).

Actions should be taken to mitigate potential unintended consequences on suicide prevention efforts, which also represent a national public health priority.

Disorders Due to Substance Use

The most common emergencies related to substance use and abuse are acute intoxication, withdrawal syndrome, severe dependence, and induced conditions, such as psychosis. Here, we will present considerations for each situation. An important warning is that many cases of substance abuse occur through medications, mainly psychotropic and narcotic drugs. For this reason, in times of disaster, health professionals and managers should provide tools for controlled and supervised prescription. In addition, many cases of substance abuse can be associated with suicidal behavior, which further reinforces the need for supervision (10, 19, 21).

Acute Intoxication

In the assessment of intoxication, basic life support must first be offered, followed by a brief assessment to identify the substance(s) used, followed by the use or not of measures to reduce absorption, increase excretion, or incorporate antidotes. For this, specific protocols must be used.

Withdrawal Syndrome

Patients in disaster situations may be more exposed to this syndrome due to abstinence from substances and medications. The protocol of care must include basic life support and specific services for abstinence. After improving patient abstinence, a specific therapeutic approach for addiction should be performed. Patients who are in isolation or hospitalized, due to physical or mental illness, and who are cigarette users need to receive support for nicotine abstinence. Therefore, health services must be prepared to provide nicotine replacement methods, such as patches.

Severe Dependence

Emergencies involve the use of substances that put the patient's life at risk. Examples of these situations include severe physical impairment, such as malnutrition, kidney and liver failure, psychotic symptoms, and other induced conditions and suicidal behavior. In serious cases, hospitalization is required. The healthcare system must be prepared to provide support to these patients.

Induced Disorders

Substance-induced mental disorders are a priori emergencies, as they represent a severe complication of substance abuse. The treatment, which should include measures aimed at discontinuing the substance, must be focused on the specific treatment of symptoms.

Psychosis

During calamities, patients that may be the most neglected are those with psychotic disorders. Such diseases interfere with the patient's critical thinking abilities and in turn with adherence to disaster measures. In addition, these patients are very susceptible to stigma and neglect (14). Treatment should be prioritized for the guidance and use of antipsychotics. Special attention must be paid to emergency cases that involve the following: refractoriness of psychotic symptoms associated with agitation or aggression, suicidal behavior, severe physical damage, risk presented to others (10).

Particular attention should be given to patients with schizophrenia since this mental illness is related to the high prevalence of comorbid disorders such as diabetes type II, pulmonary chronic disease, and hypertension/coronary heart disease (56).

Another important concern is outpatient support, which must be available to monitor patient compliance and prevent further outbreaks. Therefore, in addition to an integrated health network, it may be necessary to use medications that hinder adherence, such as long-acting antipsychotics. In cases where there is a need for observation or hospitalization, patients must remain under the care of specialized, protected, and trained staff members (10).

Mood Disorders

Mood disorders include depressive episodes in depressive and bipolar disorder and manic and mixed episodes in bipolar disorder. The same principles of treatment must be adopted as in psychotic disorders. Drug treatment and emergencies should also be prioritized. In the case of patients being hospitalized for physical illnesses, the use of antidepressant and mood-stabilizing medications, as well as antipsychotics, should be planned while considering their side effects and drug interactions (21, 57).

Anxiety Disorders

Anxiety disorders may not seem like emergencies, but they are associated with great suffering for patients, and may lead to substance abuse, suicidal behavior, and aggravation of other disorders. Anxiety disorders encompass a wide variety of disorders, including those related to trauma caused by calamities, such as acute reaction to stress and posttraumatic stress disorder. Screening of anxiety disorders for emergency identification must be available to the population. Psychotherapeutic approaches should be prioritized. Long-term drug treatment with antidepressants is more appropriate, but more immediate responses can be obtained with benzodiazepines. However, these medications are related to a higher risk of abuse, dependence, and suicide; therefore, they require strict supervision, as mentioned above (10, 21).

Special Populations

Some patients have cognitive and intellectual disabilities, while others require special considerations during disasters. Children cannot be kept in the hospital, isolated, or quarantined without caregivers for an extended period. Teenagers may have difficulty adhering to quarantine and isolation rules. Similar to health professionals, adolescents are more likely to break their quarantine (58). Children and adolescents need structured activities and routines. Their routine can be designed to look like the isolation period, or it can be a new routine (58).

Pregnant women also need special attention in cases of isolation or quarantine. Pregnant women may be particularly concerned about the well-being of their babies and the effect that the infection may have on the fetus. Pregnancy itself can cause emotional problems, and the presence of an infectious condition can further complicate the patient's fears (58).

The postpartum period exposes mothers to a greater risk of postpartum depression or postpartum exacerbation of existing mood disorders. Screening, support, and guidance should be provided, since they can have a positive effect on mothers who give birth in isolation (58).

FUTURE DIRECTIONS

In light of several tragedies that have occurred throughout history and in recent years, including the current COVID-19 pandemic, it is necessary to point out that during public calamities, an increase in the number of emergencies is to be expected, either due to the stress of the population or the number of health complications and difficulties in accessing care (2, 3, 18). Therefore, the public sector must be prepared to address such situations using the prevention and intervention measures mentioned above. Within this context, the application of guidelines through evidence-based medicine is essential [i.e., (13, 30, 38, 39, 57, 59–61)].

It is important to note that effective public policy should include both the prevention and treatment of mental disorder outbreaks during pandemics. Providing resources and training that involve all levels of health care is necessary. At the primary level, the prevention of mental health disorders includes attention to special populations that have been exposed to stressors during pandemics due, for example, to specific health conditions (8) or if they have been working in situations with a high risk of exposure to COVID-19 (3). However, secondary, and tertiary health care personnel should also be ready to receive patients in emergency situations and with chronic psychiatric conditions. This presents a double challenge of including resources for both professional training and reformulation of the ambulatory and hospital environment to avoid the risk of contagion. Furthermore, a new demand emerges in this situation since a patient in an acute stage of psychiatric illness may resist adopting behaviors needed to prevent contagion, resulting in an additional clinical target during psychiatric emergency care. In this context, the adoption of strategies described in this article should be integrated with specific behavioral strategies used during pandemics.

CONCLUSION

In public calamities, patients can present with psychiatric emergencies that require care and cannot be neglected. It is necessary to maintain protocols, trained teams, and appropriate locations for such support. Some emergencies may occur with the aggravation of pre-existing cases, while others may be new cases that arise because of the traumatic event. Therefore, all health services must consider this type of emergency during disasters, whether they are accidents or epidemics. Many countries do not have basic conditions of care for mental health disorders, and may not have places to support such care, both in terms of physical structure and human resources. However, addressing these issues and taking action to provide good mental health care services will facilitate emergency care. Governments and ministries of health should prepare for calamities, and protocols, plans, or programs should be prepared in advance. Additionally, it is advisable to acknowledge the lessons that we have learned from the COVID-19 pandemic so far.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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Less Social Support for Patients With COVID-19: Comparison With the Experience of Nurses

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Context: Since December 2019, more than 80,000 patients have been diagnosed with coronavirus disease 2019 (COVID-19) in China. Social support status of COVID-19 patients, especially the impact of social support on their psychological status and quality of life, needs to be addressed with increasing concern.

Objectives: In this study, we used social support rating scale (SSRS) to investigate the social support in COVID-19 patients and nurses.

Methods: The present study included 186 COVID-19 patients at a Wuhan mobile cabin hospital and 234 nurses at a Wuhan COVID-19 control center. Responses to a mobile phone app-based questionnaire about social support, anxiety, depression, and quality of life were recorded and evaluated.

Results: COVID-19 patients scored significantly lower than nurses did on the Social Support Rating Scale (SSRS). Among these patients, 33.9% had anxiety symptoms, while 23.7% had depression symptoms. Overall SSRS, subjective social support scores and objective support scores of patients with anxiety were lower than those of patients without anxiety. This result was also found in depression. In addition, all dimensions of social support were positively correlated with quality of life. Interestingly, in all dimensions of social support, subjective support was found to be an independent predictive factor for anxiety, depression, and quality of life, whereas objective support was a predictive factor for quality of life, but not for anxiety and depression via regression analysis.

Conclusion: Medical staffs should pay attention to the subjective feelings of patients and make COVID-19 patients feel respected, supported, and understood from the perspective of subjective support, which may greatly benefit patients, alleviate their anxiety and depression, and improve their quality of life.

Keywords: COVID-19, social support, medical staff, depression, anxiety

INTRODUCTION

Since December 2019, more than 80,000 individuals have been diagnosed with coronavirus disease 2019 (COVID-19), and more than 3,000 patients have died during the spread of COVID-19. China has immediately and decisively taken active and effective measures to support the anti-COVID-19 effort in Wuhan. To date, during the outbreak of the COVID-19 epidemic in Wuhan, ∼42,000 medical staffs have gone to Wuhan City and Hubei Province to provide medical assistance, where COVID-19 patients were isolated from their families and friends for treatment, possibly affecting their social support status. More importantly, the medical staffs were also isolated from the rest of society in order to provide medical service; thus, to some extent, their social support status would also be affected during their work with COVID-19 patients.

COVID-19 patients have higher levels of depression, anxiety and stress than healthy controls and the emotions experienced by COVID-19 patients are often shock, fear, despair, hope, and boredom (1). In addition, under the epidemic, healthcare workers in various countries are also suffering from different levels of psychological distress (2). Increasingly, evidence shows that social support is positively related to psychological health and quality of life, that is, enhancing social support would improve the mental health and quality of life of the recipients (3–5). It has been reported that social support has a protective effect on mental health; it plays a direct role via social relationships and exerts an indirect effect through the inhibition of excessive stress (6, 7). Several lines of evidence indicate that social support can provide beneficial effects to reduce the risk of depression in children, adolescents, young adults, middle-aged people, the elderly, and healthcare workers (8–11). Similarly, regarding anxiety assessment, a large number of studies suggest that the anxiety score is inversely related to social support (12). In other words, social support also has a protective effect against anxiety, and a low social support score can be used to predict the incidence of anxiety (13, 14). Therefore, during the spread and control of COVID-19, it is particularly important to pay attention to social support for the general public.

The purpose of this study was to observe and compare the social support received by COVID-19 patients and nurses as well as to explore the association between anxiety, depression, and social support for measuring the predictive factors of depression and anxiety in both groups. The results will shed light on how to provide sufficient social support for COVID-19 patients and medical staffs during the effort to control COVID-19, as well as objective evidence for the prevention and treatment of anxiety, depression, and other psychological problems, ultimately improving quality of life.

METHODS

Settings and Participants

For this descriptive study, we used a mobile phone app-based questionnaire survey during the COVID-19 pandemic from February 17, 2020 to Mar 17, 2020. The Ethics Committee of the First Affiliated Hospital of Nanjing Medical University approved this study (approval number: 2020-SR-111). We observed COVID-19 patients treated at the Wuhan Sports Center Mobile Cabin Hospital and frontline nurses working to control COVID-19 in Wuhan. Owing to the fact that the investigation was conducted during the COVID-19 pandemic, the isolation policy at the time called for reduced face-to-face contact and communication, as well as the avoidance of large gatherings and activities. Therefore, an anonymous questionnaire was constructed using a mobile app called Sojump (www.sojump.com) and sent to individuals via WeChat after obtaining informed consent as we previously reported (15). According to Kendall's sample size estimation method, the sample size is at least 5 times than that of the variable (16). Given that the loss of samples during the study (loss of 10%), a total of 420 individuals, including 186 COVID-19 patients and 234 nurses, filled in the questionnaire. Individuals who have the pre-existing psychiatric abnormalities have been excluded and all the nurses with work license are full-time employees in medical institutions.

Assessment of Patient-Reported Outcomes

Demographic data, including gender, age, educational background, marriage status, habitation, employment, income, tobacco and alcohol usage, and comorbidities, were recorded. Social support was assessed using the Social Support Rating Scale (SSRS), which is currently widely used to measure the social support for the general public, patients, and medical staff. The SSRS used in our study was created primarily for the Chinese population (17). It includes three dimensions (subjective social support, objective social support, and utilization of support). The total social support score is the sum of the score of the three dimensions, and higher scores indicate higher levels of perceived social support.

Anxiety and depression symptoms were assessed using the Hospital Anxiety and Depression Scale (HADS) (18). The HADS is a self-rated scale and consists of 14 items, seven for anxiety

TABLE 1 | General characteristics of COVID-19 and nurses.

	COVID-19 (n = 186)	Nurses (n = 234)	P-value
Gender, %			<0.001[a]
Male	108 (58.06)	28 (11.97)	
Female	78 (41.94)	206 (88.03)	
Age, median (IQR), year	38(31–48)	29.5 (26-34)	<0.001[b]
Education background, %			<0.001[a]
College degree or lower	111 (59.68)	43 (18.38)	
Bachelor or higher degree	75 (40.32)	191 (81.62)	
Marriage, %			<0.001[a]
Unmarried	28 (15.05)	123 (52.56)	
Married	143 (76.88)	105 (44.87)	
Divorce or others	15 (8.06)	6 (2.56)	
Habitation, %		NA	
Urban	156 (83.87)		
Rural area	30 (16.13)		
Employment, %		NA	
Yes	174 (93.55)		
No	12 (6.45)		
Income/person/year, %, RMB		NA	
<15,000	27(14.52)		
15,000–33,000	43 (23.12)		
>33,000	116 (62.37)		
Tobacco usage, %		NA	
Yes	142 (76.34)		
No	44 (23.66)		
Drinking history, %		NA	
Yes	131 (70.43)		
No	55 (29.57)		
Comorbidities, %		NA	
Yes	26 (13.98)		
No	160 (86.02)		

COVID-19, corona virus disease 2019; IQR, interquartile range; NA, not applicable.
[a] *Chi-square-test.*
[b] *Mann–Whitney U-test.*

(HADS-A) and seven for depression (HADS-D), with a 4-point scale (ranging from 0 = not at all to 3 = very much indeed). Both the HADS-A and HADS-D scores range from 0 to 21. A patient with a HADS-A score or HADS-D score $\geq$ 8 is identified as having anxiety or depression. The HADS is a reliable instrument for detecting states of depression and anxiety among hospital patients, and it is also a valid measurement of the severity of mental disorders.

Quality of life was assessed by using the World Health Organization Quality of Life instrument (WHOQOL-BREF), which consists of 26 questions (19). It includes two separate items used to evaluate the general quality of life (question 1) and satisfaction with one's state of health (question 2), while the other 24 questions involve the following four domains: physical health, psychological health, social relationships, and environment. In this study, the total quality of life score is the sum of the scores of four domains. Higher WHOQOL scores indicate a better quality of life.

Statistical Analysis

For this study, continuous and normally distributed variables were used for the means and the standard error of the mean, and an independent sample t-test was conducted to assess the two groups' differences. Abnormally distributed data were described using the median and interquartile range (IQR: 25–75%), whereas the Mann–Whitney U-test was used to assess two group differences. Descriptive statistics involved frequencies (%) for categorical variables, and the chi-square test and Fisher's exact-test were used to assess the two groups' differences. Spearman's rank correlation analysis was used to evaluate the relationship between the two variables. Moreover, multiple linear regression and binary logistics regression analyses were used to determine the risk factors associated with quality of life, anxiety, and depression. Results were presented as odds ratio (OR) and 95% confidence intervals (CIs). Receiver operating characteristic (ROC) was used to evaluate the performance of the regression model. Data were considered statistically significant when $P < 0.05$. Analyses were performed using Statistical Package for the Social Sciences (SPSS) software version 20.0 (IBM Co. LTD, Chicago, IL, USA).

RESULTS

General Characteristics of COVID-19 Patients and Nurses

A total of 420 individuals (i.e., 186 COVID-19 patients and 234 nurses) were enrolled in the study. **Table 1** shows the general characteristics of COVID-19 patients and nurses (partial data on the general characteristics of 234 nurses are available in our previously published study) (15). Gender, age, educational background, and marriage status all were statistically significant among COVID-19 patients and nurses ($P < 0.001$).

The total SSRS score consists of subjective support, objective support, and support utilization. More importantly, the total SSRS scores for COVID-19 patients (42; IQR = 38–48) were significantly lower as compared with those of nurses (45; IQR = 40–51; $P < 0.001$). No significant difference was found for objective support between COVID-19 patients (10; IQR = 8–13) and nurses (11; IQR = 8–14; $P = 0.805$). On the contrary, the subjective support scores were significantly lower in COVID-19 patients (24; IQR = 21–28) as compared with those of nurses (26; IQR = 22–30; $P = 0.007$). The support utilization scores were also significantly lower in COVID-19 patients (7; IQR = 6–8) than those of nurses (8; IQR = 7–10; $P < 0.001$). The details are displayed in **Figure 1** and **Table 2**.

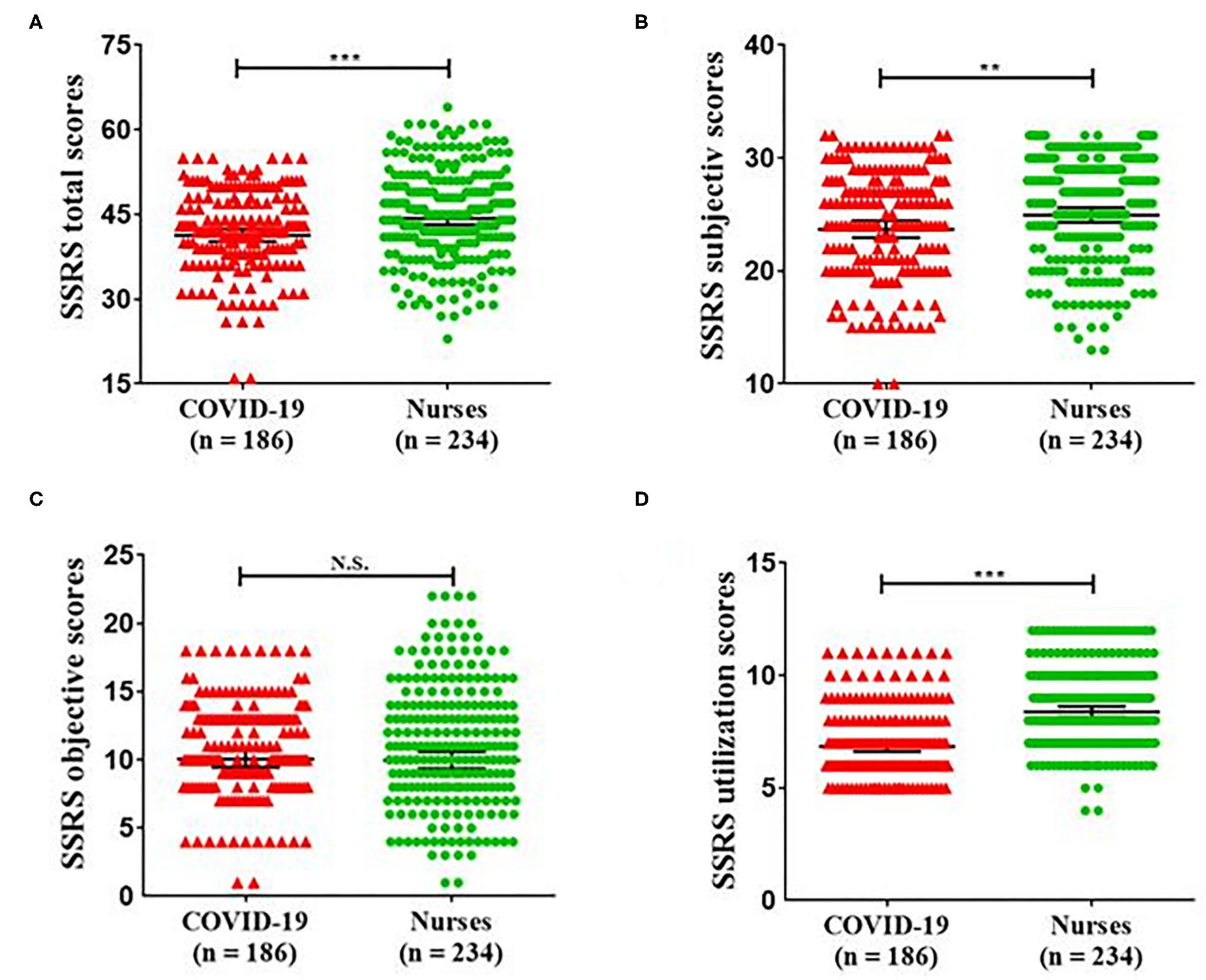

FIGURE 1 | Scores for SSRS total **(A)**, SSRS subjective **(B)**, SSRS objective **(C)**, and SSRS utilization **(D)** between COVID-19 patients and nurses. SSRS total scores ($P = 0.008$); SSRS subjective scores ($P = 0.023$); SSRS objective scores ($P = 0.986$); SSRS utilization scores ($P < 0.001$). COVID-19, coronavirus disease 2019; SSRS, Social Support Rating Scale. $^{**}p < 0.05$, $^{***}p < 0.01$.

Comparison of SSRS in COVID-19 Patients With or Without Anxiety/Depression Symptoms

A total of 186 COVID-19 patients were enrolled in the study. The anxiety score was 6 [4–8, median (IQR)], and 63 (33.9%) COVID-19 patients had anxiety symptoms according to the HADS evaluation (**Table 2**). The SSRS rendered the following results:

- total support, including anxiety (39; IQR = 36–43) and non-anxiety (43; IQR = 40–50; $P < 0.001$), which showed a statistical difference;
- subjective support, including anxiety (23; IQR = 20–26) and non-anxiety (26; IQR = 22–29; $P < 0.001$), also demonstrating a statistical difference;
- objective support, including anxiety (10; IQR = 8–12) and non-anxiety (11; IQR = 9–13; $P = 0.010$), exhibiting significant difference; and

All showed a significant difference between COVID-19 patients with and without anxiety symptoms. Intriguingly, support utilization (anxiety: 6; IQR = 6–7 and non-anxiety: 7; IQR = 6–8; $P = 0.122$) failed to show a statistical difference (**Table 3**).

As for depression symptoms, the depression score was 5 (2–7) (median [IQR]), and 44 (23.7%) COVID-19 patients had depression symptoms (**Table 2**). The SSRS results are as follows:

- total support, including depression (36; IQR = 31.3–42.8) and non-depression (43; IQR = 39–48.5; $P < 0.001$);

TABLE 2 | Basic conditions of social support, anxiety, depression and quality of life in COVID-19.

	COVID-19 (n = 186)
SSRS-Social support, median (IQR)	
Total support	42 (38–48)
Subjective support	24 (21–28)
Objective support	10 (8–13)
Utilization of support	7 (6–8)
HADS-Anxiety	
Yes, %	63 (33.9)
No, %	143 (66.1)
Median (IQR)	6 (4–8)
HADS-Depression	
Yes, %	44 (23.7)
No, %	142 (76.3)
Median (IQR)	5 (2–7)
WHO-Quality of life, median (IQR)	
Total quality of life	58.5 (53.9–62.7)
Physical health	15.4 (14.3–16.7)
Psychological health	14.7 (13.3–16)
Social relationship	14.7 (13.3–16)
Environment	14.5 (13–15.5)

COVID-19, corona virus disease 2019; HADS, hospital anxiety and depression scale; IQR, interquartile range; SSRS, social support revalued scale; WHO, world health organization.

- subjective support, including depression (21; IQR = 17–25.5) and non-depression (26; IQR = 22–29; $P < 0.001$); and
- objective support, including depression (8; IQR = 7–12) and non-depression (11; IQR = 9–13; $P = 0.001$).

All showed a significant difference between COVID-19 patients with and without depression symptoms. Intriguingly, support utilization (depression: 6; IQR = 5.3–7 and non-depression: 7; IQR = 6–8; $P = 0.149$) failed to show a statistical difference (**Table 3**).

Correlation Between Anxiety, Depression, Quality of Life, and SSRS in COVID-19 Patients

We found that the anxiety scores were negatively associated with the total SSRS scores ($R = -0.268$; $P < 0.001$), subjective support ($R = -0.264$; $P < 0.001$) and objective support ($R = -0.195$; $P = 0.008$). The depression scores were negatively associated with all dimensions of social support (total SSRS: $R = -0.458$, $P < 0.001$; subjective support: $R = -0.427$, $P < 0.001$; objective support: $R = -0.290$, $P < 0.001$; support utilization: $R = -0.211$, $P = 0.004$). Similarly, the total quality of life scores were positively associated with all dimensions of social support (total SSRS: $R = 0.315$, $P < 0.001$; subjective support: $R = 0.298$, $P < 0.001$; objective support: $R = -0.203$, $P = 0.005$; support utilization: $R = 0.265$, $P < 0.001$) (**Table 4**).

Predictive Factors of Anxiety, Depression, and Quality of Life

A binary logistics regression analysis was performed to evaluate the predictive factors for anxiety and depression, whereas a multiple linear regression analysis was carried out to evaluate predictors of quality of life. Interestingly, the results showed that subjective support—but not objective support or support utilization—was a predictor of anxiety (OR = 0.729; 95% CI = 0.648–0.820; $P < 0.001$) and depression (OR = 0.745; 95% CI = 0.668–0.831; $P = 0.004$). Furthermore, anxiety was predicted by gender (OR = 13.259; 95% CI = 4.164–42.215; $P < 0.001$), age (OR = 1.083; 95% CI = 1.028–1.141; $P = 0.003$), employment (OR = 0.099; 95% CI =0.014–0.671; $P = 0.018$), income (OR = 2.110; 95% CI =1.085–4.101; $P = 0.028$) and comorbidities (OR = 0.057; 95% CI = 0.015–0.221; $P < 0.001$), whereas gender (OR = 5.937; 95% CI = 2.229–15.808; $P < 0.001$) and income (OR =2.234; 95% CI = 1.183–4.221; $P = 0.013$) were also a predictive factor for depression (**Table 5**). Results of ROC analysis showed that the strongest predictor for anxiety was the age (AUC: 0.674; 95% CI: 0.443–0.619) while for depression was the gender (AUC: 0.568; 95% CI: 0.470–0.665). Quality of life was predicted by gender (OR = −3.524; 95% CI = −5.954–−1.680; $P = 0.001$), drinking history (OR = −2.955; 95% CI = −5.825–−1.160; $P = 0.034$), comorbidities (OR =4.682; 95% CI = 0.284–0.698; $P = P < 0.001$), and objective support (OR = 2.918; 95% CI =0.277–1.432; $P = 0.004$) (**Table 5**).

DISCUSSION

In the present study, social support, including subjective support, objective support, and support utilization among patients with COVID-19 were significantly lower than among nurses. In addition, we found that 33.9% of the 186 COVID-19 patients had anxiety, and 23.7% had depression. Furthermore, the social support of COVID-19 patients with anxiety or depression was significantly lower than that of those without anxiety or depression. It is noteworthy that, although the three dimensions of social support are related to anxiety, depression, and the quality of life of patients with COVID-19, subjective support serves as an independent predictor for anxiety, depression, and quality of life. It can be seen that the social support of patients with COVID-19 is lower, and their anxiety and depression are more serious. Compared with objective support and support utilization, subjective support is the key factor that affects patients' psychological status and quality of life. Moreover, it is well-recognized that anxiety, depression, and quality of life are highly related to gender. Female patients with COVID-19 are more likely to be anxious and/or depressed with lower quality of life, and that the presence of chronic comorbidities (e.g., diabetes, hypertension, etc.) also makes COVID-19 patients more prone to anxiety and lower quality of life. Collectively, these results suggest that female patients with COVID-19 and other chronic diseases are more likely to have mental disorders.

It is well-known that, during the spread of COVID-19, China has taken active and effective measures to establish more than 10 mobile cabin hospitals to treat patients effectively and

TABLE 3 | Comparison of social support in COVID-19 patients with or without anxiety/depression symptoms.

	HADS-Anxiety		*P*	HADS-Depression		*P*
	≥8 score	<8 score		≥8 score	<8 score	
SSRS, median (IQR)						
Total support	39 (36–43)	43 (40–50)	<0.001	36 (31.3–42.8)	43 (39–48.5)	<0.001
Subjective support	23 (20–26)	26 (22–29)	<0.001	21 (17–25.5)	26 (22–29)	<0.001
Objective support	10 (8–12)	11 (9–13)	0.010	8 (7–12)	11 (9–13)	0.001
Utilization of support	6 (6–7)	7 (6–8)	0.122	6 (5.3–7)	7 (6–8)	0.149

COVID-19, corona virus disease 2019; HADS, hospital anxiety and depression scale; SSRS, social support revalued scale; IQR, interquartile range.

TABLE 4 | Correlation coefficient matrix for social support, anxiety, depression and quality of life in COVID-19 patients.

	1	2	3	4	5	6	7	8	9	10	11
1. Total social support	1.000										
2. Subjective support	0.822**	1.000									
3. Objective support	0.716**	0.320**	1.000								
4. Utilization of support	0.253**	0.041	0.082	1.000							
5. Anxiety	−0.268**	−0.264**	−0.195**	−0.113	1.000						
6. Depression	−0.458**	−0.427**	−0.290**	−0.211**	−0.724**	1.000					
7. Total quality of life	0.351**	0.298**	0.203**	0.265**	−0.455**	−0.599**	1.000				
8. Physical health	0.285**	0.196**	0.194**	0.250**	−0.499**	−0.567**	0.879**	1.000			
9. Psychological health	0.352**	0.285**	0.182*	0.266**	−0.372**	−0.609**	0.823**	0.641**	1.000		
10. Social relationship	0.340**	0.406**	0.121	0.144	−0.194**	−0.385**	0.787**	0.557**	0.626**	1.000	
11. Environment	0.283**	0.201**	0.207**	0.242**	−0.358**	−0.469**	0.799**	0.692**	0.596**	0.463**	1.000

COVID-19, corona virus disease 2019. **P* < 0.05, ***P* < 0.01.

quickly control the epidemic. Common people have given strong response and support to the government's rapid and effective measures. Meanwhile, the patients left their families and friends for treatment in isolation in the mobile cabin hospitals. The unfamiliar living environment and inability to contact family and friends may be the possible reasons underlying the problems of social support in COVID-19 patients (20, 21). In addition, COVID-19 is not well-understood, and its pathogenesis has not yet been determined. This lack of knowledge of COVID-19 and worries about the health and living conditions of family and friends may induce the onset of fear, anxiety, and depression. In the process of providing medical treatment for patients with COVID-19, we should pay more attention to the social support and psychological status of these patients while solving problems in a timely manner and taking active and effective countermeasures.

Social support is highly related to patients' psychological status and quality of life (13), as our results also confirm: the lower the social support, the more serious the anxiety and depression symptoms; by contrast, the higher the social support, the higher the quality of life. It has been reported that better psychological conditions improve patients' treatment compliance and immunity (22, 23), a great advantage for COVID-19 patients. In addition, social support can be divided into three categories: subjective social support (emotional support), objective support (visible or actual support), and support utilization (individual response to external support) (17). It must be emphasized that subjective social support is the main factor that affects the mental state and quality of life of patients with COVID-19. Subjective social support is closely related to the individual's subjective feelings. It refers to the emotional experience and satisfaction that an individual is respected, supported, and understood in the society. Therefore, we should focus on improving the strength of subjective support for patients, as well as encouraging and comforting patients in the treatment process (24). Although objective support and support utilization are not independent factors affecting COVID-19 patients, they still cannot be ignored.

Increasingly, evidence shows that gender is an independent predictor for mental disorders (25, 26). Women with COVID-19 are more likely to have anxiety and depression symptoms during the spread of epidemics, which may be related to the fact that women are more sensitive to personal growth and interpersonal relationships than men (27, 28). In addition, chronic diseases have a deleterious psychological impact on patients (29). Our study also suggests that patients with comorbidities are more likely to suffer from anxiety and lower quality of life. Therefore, we should pay more attention to female patients with COVID-19 and actively intervene to help these patients avoid serious psychological problems.

We previously observed the status of vicarious traumatization (VT) in nurses and general public, but not in COVID-19 patients

TABLE 5 | Regression analysis of anxiety, depression and quality of life in COVID-19 patients.

	Anxiety[a]			Depression[b]			Quality of life[c]		
	β	OR (95% CI)	*P*	*β*	OR (95% CI)	*P*	*β*	OR (95% CI)	*P*
Gender	2.585	13.259 (4.164, 42.215)	**<0.001**	1.781	5.937 (2.229, 15.808)	**<0.001**	−3.817	−3.524 (−5.954, −1.680)	**0.001**
Age	0.080	1.083 (1.028, 1.141)	**0.003**						
Habitation	−22.237	0.000 (0.000, N.S.)	0.997	−21.769	0.000 (0.000, N.S.)	0.997			
Employment	−2.316	0.099 (0.014, 0.671)	**0.018**						
Income	0.746	2.110 (1.085, 4.101)	**0.028**	0.804	2.234 (1.183, 4.221)	**0.013**			
Drinking history							−3.493	−2.955 (−5.825, −1.160)	**0.034**
Comorbidities	−2.869	0.057 (0.015, 0.221)	**<0.001**				3.133	2.142 (0.246, 6.019)	**<0.001**
Subjective support	−0.316	0.729 (0.648, 0.820)	**<0.001**	−0.294	0.745 (0.668, 0.831)	**0.004**	0.491	4.682 (0.284, 0.698)	**<0.001**
Objective support							0.855	2.918 (0.277, 1.432)	**0.004**

Variables excluded by regression model: [a]education background, marriage, tobacco usage, alcohol usage, objective support, utilization of support; [b]age, education background, marriage, employment, tobacco usage, alcohol usage, comorbidities, objective support, utilization of support; [c]age, education background, marriage, habitation, employment, income, tobacco usage, utilization of support.
COVID-19, corona virus disease 2019; OR, odds ratio. CI, confidence interval.
Bold values represent $p < 0.05$ (significant).

(15), since VT could only be adopted to evaluate the non-patient, especially the rescuers or caregivers. Very recently, a study reported the psychological status of medical staffs via the scores of Patient Health Questionnaire-9, which is a scale only evaluated for depression symptoms (30). However, in the present study, we majorly focused on the social support and its relationship with anxiety, depression, and quality of life of COVID-19 patients in this study. In addition, during COVID-19 isolation, internet-based education, training, and treatment can be used to receive social support, reduce anxiety and depression, making psychotherapy not only more convenient, but also more cost-effective (31, 32).

This study has several limitations. First, this study has a small sample size, although there are more patients with COVID-19, our study follows the voluntary principles. Second, the medical staffs enrolled in this study consisted of nurses only, not included physicians. Larger-number of medical workers should be included in future studies. Third, this is a single-center and descriptive cross-sectional study and mainly used self-reported questionnaires to measure psychosocial symptoms, while the gold standard for establishing psychosocial diagnosis involved clinical interviews and functional neuroimaging (33). Therefore, a large longitudinal study is necessary to further determine the causal linkage between the social support and mental health.

In conclusion, the results suggest that COVID-19 patients suffer from a lack of social support, which may exacerbate their psychological problems. Therefore, early intervention should be implemented to improve COVID-19 patients' social support to relieve their psychological problems, which would aid them in their recovery from COVID-19.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by The Ethics Committee of The First Affiliated Hospital of Nanjing Medical University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

ZL, JG, CY, and CL: concept and design. ZL and CY: drafting of the manuscript. ZL, JF, MY, CY, and CL: critical revision of the manuscript. ZL, JG, and CY: statistical analysis. MY, CL, and CY: supervision. All authors: acquisition, analysis, and interpretation of data.

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Depressive and Anxiety Symptoms Among People Under Quarantine During the COVID-19 Epidemic in China: A Cross-Sectional Study

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Background: During the coronavirus disease 2019 (COVID-19) pandemic, quarantine as an effective public health measure has been widely used in China and elsewhere to slow down the spread, while high-risk psychological response populations remain under-reported.

Objective: The aim of the study is to investigate the depressive and anxiety symptoms among the high-risk individuals quarantined during the COVID-19 pandemic in China.

Methods: An online survey was conducted from February 29 to April 10, 2020, among individuals quarantined for at least 2 weeks due to the high-risk exposure. Chinese versions of the nine-item Patient Health Questionnaire (PHQ-9) with a seven-item Generalized Anxiety Disorder (GAD-7) were applied to assess depressive and anxiety symptoms, respectively. Compliance with quarantine and knowledge of COVID-19 was also assessed. An unconditional logistic regression model was performed to identify the correlators.

Results: Of the 1,260 participants completing the full survey, 14.0% (95% CI: 12.2–16.1%), 7.1% (95% CI: 5.9–8.7%), and 6.3% (95% CI: 5.1–7.8%) had at least moderate symptoms of depression, anxiety, and a combination of depression and anxiety (CDA), respectively; 14.8% (95% CI: 13.0–16.9%) had at least one condition. Multivariate analysis showed that participants with an undergraduate or above degree were more likely to report depressive (OR = 2.98, 95% CI: 1.56–5.72) and anxiety symptoms (OR = 2.95, 95% CI: 1.14–7.63) than those with middle school education. Those who were unemployed (OR = 0.37, 95% CI: 0.21–0.65 for depression; OR = 0.31, 95% CI: 0.14–0.73 for anxiety), students (OR = 0.14, 95% CI: 0.04–0.48 for depression; OR = 0.11, 95% CI: 0.01–0.85 for anxiety), and more knowledgeable of COVID-19 (OR = 0.84, 95% CI: 0.73–0.96 for depression, OR = 0.82, 95% CI: 0.68–0.98 for anxiety) were less likely to report depressive and anxiety symptoms. Higher quarantine compliance correlated with lower risks of depressive (OR = 0.94, 95% CI: 0.91–0.96) and anxiety symptoms (OR = 0.95, 95% CI: 0.91–0.98).

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Conclusion: Individuals under quarantine during the COVID-19 pandemic suffered prevalent depressive and anxiety symptoms. Consequently, comprehensive interventional measures, including knowledge dissemination, timely virus tests, and strengthened communication, may minimize quarantine's adverse effects.

Keywords: COVID-19, quarantine, depression, anxiety, cross-sectional study

INTRODUCTION

A cluster of pneumonia cases of coronavirus disease 2019 (COVID-19) was first detected in Wuhan City in December 2019. The number of patients affected with COVID-19 drastically increased throughout the nation in a month, followed by geographical expansion of the spread worldwide. On March 11, 2020, the World Health Organization (WHO) assessed the international public health emergency regarding COVID-19 and characterized it as a pandemic (1). Up to May 20, there were 4,789,205 confirmed cases, and 318,789 deaths due to COVID-19 have been reported from 216 countries, areas, or territories worldwide (2). Additionally, the transmission classifications in most countries were clusters of cases and community transmission.

Although substantial knowledge gaps regarding COVID-19 remain, increasing evidence suggests that efficient person-to-person transmission of COVID-19 occurs, even during the incubation period, in asymptomatic individuals (3–5). Public health measures, including quarantine, isolation, and case tracking, might be the practical tools to contain the virus spread before a preventive vaccine and specific treatment are available (6). The WHO, combined with various bodies, recommends guidelines for stopping the spread under different situations, including at home, during or after travel, in the workplace, etc. (7, 8). Unprecedented quarantine measures have been taken during the COVID-19 pandemic in China. Those individuals with a history of travel to or residence in high-risk areas or countries (where continuous transmission of local cases has been identified) were forced to apply 14 days of self-isolation in dedicated facilities (9).

Quarantine means separation and restriction of movement of persons who have potentially been exposed to a contagious disease but are seemingly healthy (10). As early as the year 1127, quarantine was used in Venice, Italy, to control leprosy. Community- and city-wide quarantine was also imposed during the severe acute respiratory syndrome (SARS) epidemic in the year 2003, and during the outbreak of the Ebola and the Middle East Respiratory Syndrome (MERS) in very recent years. These measures played an essential role in controlling public health events (11).

In China, all individuals are monitored for temperature, and any flu-like symptoms during the quarantine period are separated from their family members and follow other quarantine measures. However, a previous study has shown that the loss of freedom, uncertainty over the possibility of being infected, boredom, and social stigma caused by quarantine may have a psychological impact (11). Mental health evaluation for individuals quarantined in the past epidemic of infectious disease epidemics has revealed that these individuals are more likely than the general population to experience depressive, anxiety symptoms, posttraumatic stress symptoms, and emotional exhaustion (12–14). Longitudinal studies among the general population suggested that depression, anxiety, and stress in response to COVID-19 is not just an initial reaction but potentially the start of a persistent problem that extends beyond the pandemic (15, 16).

During the COVID-19 pandemic, many research studies have reported the mental health of medical health workers, college students, and the general community residents (17–20). However, few studies evaluated mental health outcomes in quarantined persons in the context of COVID-19, and the correlation between psychological response and behavioral compliance toward quarantine and knowledge of COVID-19 in the quarantined population is still under-reported. The present study aimed to investigate the depressive and anxiety symptoms among the high-risk population quarantined during the COVID-19 pandemic in China and identify the correlators. We hypothesized that depressive and anxiety symptoms were prevalent in individuals during the quarantine, and compliance toward quarantine, knowledge of COVID-19, and some other variables may correlate with psychological response among people under quarantine due to COVID-19.

MATERIALS AND METHODS

Participants and Procedure

A cross-sectional study was performed via an online survey through a platform (https://www.wjx.cn/app/survey.aspx) from February 29 to April 10, 2020. Individuals who had a travel history to high-risk areas or countries and placed under mandatory quarantine in Ningxia Province, China, were eligible for this study's potential participation. The exclusion criteria included individuals who could not access the Internet or other mobile devices due to vision or other disabilities leading to an inability to finish the online questionnaire.

An invitation letter was sent to all the possible participants through WeChat (the most popular social media app in mainland China, with 1 billion daily active users). The research team, who provided medical care in the quarantine facility, provide scanning QR codes to access the online survey after completing the informed content. The survey took approximately 8–15 min. In total, 1,385 eligible participants agreed to participate in the survey. After removing the participants with missing values in the mental health outcome measures, data of 1,260 participants were included in the final analysis.

Measurements

Depressive and Anxiety Symptoms

Chinese versions of the nine-item Patient Health Questionnaire (PHQ-9) (21) and the seven-item Generalized Anxiety Disorder Scale (GAD-7) (22) were used to assess the depressive and anxiety symptoms, respectively. These two brief screening instruments have been widely used in medical and community settings to screen, diagnose, monitor, and measure depression and anxiety severity. Each item, rated on a four-point scale from 0 (Not at All) to 3 (Nearly Every Day), measures the frequency of depressive and anxiety symptoms in the last 2 weeks. The PHQ-9 has the total scores categorized as follows: minimal/normal (0–4), mild (5–9), moderate (10–14), and severe (15–27) (21). The GAD-7 has the total scores categorized as mild (5–9), moderate (10–14), and severe (15–21) (22). The Chinese versions of the PHQ-9 and GAD-7 both have strong internal and test–retest reliability as well as construct and factor structure validity in patients and the general population (23, 24). Previous studies have defined a cut-off point of 10, an optimal algorithm scoring method, to detect depression and anxiety symptoms, respectively (25, 26). In this sample, the Cronbach's alpha values for the PHQ-9 and GAD-7 were 0.94 and 0.95, respectively.

Behavioral Compliance Toward Quarantine Measures

Compliance during the quarantine period was assessed by asking, "Do you think these quarantine measures (such as remaining inside a room alone, measuring temperature twice daily, or wearing a mask when contact with others in the same space) are necessary?" The five-point Likert scoring response was, very unnecessary (one point), unnecessary (two points), undecided (three points), necessary (four points), and very necessary (five points). There were seven questions; the total score could range from 7 to 35, and higher scores indicated higher compliance with the quarantine measures. The full questionnaires are shown in **Supplementary Table 1**.

The Knowledge of and Attitudes Toward COVID-19

A 10-question questionnaire (developed by epidemiologists and clinicians from two universities and a designated hospital) was used to measure the knowledge of and attitude toward COVID-19 according to the guidelines for the diagnosis and treatment of COVID-19 (standard version) (27). **Supplementary Table 2** shows that these questions mainly consisted of epidemiological characteristics, suspected symptoms, and personal protection measures regarding COVID-19. A correct answer recorded one point, and an incorrect/unknown answer recorded zero points. The higher score indicated a better knowledge of COVID-19. Two questions measured attitudes toward COVID-19: "Do you worry about being infected with COVID-19?" and "Do you agree with that for the final control of COVID-19, humans will win the battle against COVID-19?"

Statistical Analysis

Data analyses were performed using SPSS statistical software (version 22.0, IBM Corp), and p-values ≤ 0.05 were considered statistically significant with a two-tailed test. Categorical variables are presented as frequencies and percentages, while continuous variables are presented as the means and standard deviations with ranges. The percentage differences in depressive or anxiety symptoms across categorical variables were examined using the chi-squared tests. Spearman correlation coefficients were used to investigate the correlations between the PHQ-9 and GAD-7 scores. An unconditional regression model was performed to identify the correlators of mental health outcomes after controlling for covariates. The adjusted odds ratios (ORs) and their 95% confidence intervals (95% CIs) of the independent variables were calculated.

RESULTS

Demographic Characteristics

The participants finished the survey on the 13th or 14th day of the quarantine or within 1 week after the end of the quarantine. The median time from the start of quarantine to completing the survey was 14 days (interquartile range, 13–18 days). As shown in **Table 1**, more than half of the participants were male (56.2%), were aged 31–50 years (57.1%), and were living in the urban area (57.9%). Approximately one-third of the participants (34.3%) had an educational level of undergraduate or above. Most participants were married (73.7%) and had been employed (65.6%).

Knowledge Scores and Attitudes Toward COVID-19

The mean score for knowledge toward COVID-19 was 8.11 $\pm$ 1.26 (range:3–10); the accuracy rate for each question on the COVID-19 knowledge questionnaire was 40.6–99.9%. The three questions with the lowest accuracy rates were as follows: the primary infection source was the patients who had been infected by the COVID-19 (40.56%); the main clinical symptoms of COVID-19 are fever, fatigue, dry cough, dyspnea, with or without nasal congestion, runny nose, or other upper respiratory symptoms (57.06%); and the main route of transmission of COVID-19 is respiratory droplet transmission, and it can also be transmitted through contact (71.83%). As shown in **Table 1**, females had a higher score for knowledge toward COVID-19 than males (8.19 $\pm$ 1.21 vs. 8.05 $\pm$ 1.30, respectively, $P = 0.045$), and individuals living in urban areas had higher scores than those living in rural areas (8.18 $\pm$ 1.23 vs. 8.01 $\pm$ 1.30, respectively, $P = 0.014$). The vast majority of the participants did not worry about being infected with COVID-19 (88.5%), and nearly all individuals had confidence that the spreading of the virus can ultimately be controlled (97.1%).

Compliance Scores Regarding the Quarantine Measures

The mean compliance score for the quarantine measures was 29.60 $\pm$ 5.39 (range: 7–35). Most quarantined persons held that measuring temperature twice daily (67.9%), self-health monitoring (65.6%), remaining inside a room alone (62.1%), preventing the sharing of cutlery, towels, or drinking cups (61.5%), and washing hands frequently (55.3%) were necessary. Meanwhile, 42.1% insisted on opening the windows often, and 46.7% continued to wear a mask when in contact with

TABLE 1 | Demographic characteristics and the scores of knowledge toward COVID-19 and compliance with quarantine measures of participants.

Variables	*N* (%)	Knowledge toward COVID-19, M ± SD	Compliance with quarantine measures, M ± SD
Overall	1,260 (100)	8.11 ± 1.26	29.60 ± 5.39
Gender			
Male	708 (56.2)	8.05 ± 1.30	29.71 ± 5.36
Female	552 (43.8)	8.19 ± 1.21	29.47 ± 5.43
Age			
18–25	225 (17.9)	8.10 ± 1.32	31.25 ± 4.61
26–30	207 (16.4)	7.98 ± 1.33	28.84 ± 6.31
31–40	398 (31.6)	8.12 ± 1.22	29.49 ± 5.22
41–50	321 (25.5)	8.20 ± 1.21	29.19 ± 5.43
≥51	109 (8.7)	8.05 ± 1.31	29.26 ± 4.88
Education level			
Middle school	330 (26.2)	7.84 ± 1.29	30.21 ± 4.62
High school	260 (20.6)	7.98 ± 1.38	28.87 ± 5.78
Junior college	238 (18.9)	8.18 ± 1.25	29.57 ± 5.36
Undergraduate and above	432 (34.3)	8.27 ± 1.15	29.60 ± 5.39
Marriage			
Unmarried	331 (26.3)	8.09 ± 1.30	30.43 ± 5.37
Married[a]	929 (73.7)	8.11 ± 1.25	29.31 ± 5.37
Occupation			
Employed	827 (65.6)	8.12 ± 1.23	29.33 ± 5.57
Unemployed/retired	338 (26.8)	8.03 ± 1.32	29.65 ± 5.29
Students	95 (7.5)	8.24 ± 1.31	31.78 ± 3.30
Place of residence			
Urban	729 (57.9)	8.18 ± 1.23	29.36 ± 5.52
Rural	531 (42.1)	8.01 ± 1.30	29.93 ± 5.20
Worried about being infected			
Yes	145 (11.5)	8.26 ± 1.06	29.22 ± 5.09
No	1,115 (88.5)	8.09 ± 1.28	29.65 ± 5.43
Worried about the epidemic can not be controlled			
Yes	36 (2.9)	8.06 ± 1.41	28.58 ± 7.40
No	1,224 (97.1)	8.11 ± 1.26	29.63 ± 5.32

M, mean; SD, standard deviation.
[a]Married including divorced and widowed respondents.

others in the same space. The compliance score regarding the quarantine measures among different characteristic populations is shown in **Table 1**. The 18–25 age group had higher compliance scores than the older age group ($P < 0.001$). The compliance scores in students were significantly higher than in other groups ($P < 0.001$).

Depressive and Anxiety Symptoms

As shown in **Table 2**, the mean scores on the PHQ-9 and GAD-7 in the total sample were 3.76 ± 5.19 (range: 0–27) and 2.64 ± 4.01 (range: 0–21), respectively. Approximately one-third had mild to severe depressive symptoms, whereas the proportions of mild, moderate, and severe depressive symptoms were 17.3, 9.1, and 4.9%, respectively. Nearly one-quarter of the participants had mild to severe anxiety symptoms, and the proportions of those with mild, moderate, and severe anxiety symptoms were 17.7, 5.0, and 2.1%, respectively. The PHQ-9 scores were strongly correlated with GAD-7 scores ($r = 0.825$, $P < 0.001$).

According to the criteria (PHQ-9 ≥ 10, GAD-7 ≥ 10), the percentage of participants in the total sample with depressive and anxiety symptoms was 14.0% (95% CI: 12.2–16.1%) and 7.1% (95% CI: 5.9–8.7%), respectively. The percentage of individuals with at least one condition (anxiety or depression) was 14.8% (95% CI: 13.0–16.9%). The percentage of individuals with both depression and anxiety was 6.3% (95% CI: 5.1–7.8%). As shown in **Table 3**, the individuals with depressive and anxiety symptoms were associated with lower behavioral compliance scores (29.93 ± 5.24 vs. 27.57 ± 5.87, $P < 0.001$ for depression; 29.76 ± 5.34 vs. 27.57 ± 5.71, $P < 0.001$ for anxiety).

Correlators of Depressive and Anxiety Symptoms

As shown in **Tables 4**, **5**, the individuals with junior college and undergraduate degrees or above were more likely to experience depressive and anxiety symptoms than those with middle school degrees; those who were unemployed/retired and students were less likely to experience depressive and anxiety symptoms. After controlling for covaries (education level, gender, residence area, and age), those with higher knowledge scores regarding COVID-19 were less likely to have depressive (OR = 0.84, 95% CI: 0.73–0.96) and anxiety (OR = 0.82, 95% CI: 0.68–0.98) symptoms. Higher behavioral compliance scores regarding the quarantine measures were associated with a lower risk of suffering depressive (OR = 0.94, 95% CI: 0.91–0.96) and anxiety (OR = 0.95, 95% CI: 0.91–0.98) symptoms. Compared with those unmarried individuals, the adjusted odds for anxiety were greater among married individuals (OR = 3.19, 95% CI: 1.48–6.87).

DISCUSSION

During major infectious disease outbreaks, especially when in the absence of vaccines and specific treatments, quarantine is an essential and efficient preventive public health measure. However, previous studies have found that quarantine is associated with adverse psychological outcomes during the epidemics of SARS (12), Ebola (28), MERS (14), and influenza 2009 (29). Related studies have suggested that a quarantine's psychological impact is substantial, wide-ranging, and long-term suffering (11). To our knowledge, the psychological effects of quarantine during the COVID-19 pandemic on the individuals have not been well reported. The present study found that depressive and anxiety symptoms were prevalent in individuals during the quarantine in China. The findings are consistent with the studies mentioned above (28, 29). This study also provides the primary evidence for improving quarantine strategies and promoting their effectiveness and social acceptability by delivering better health education.

TABLE 2 | The severity categories of depression and anxiety symptoms in a quarantined population (n = 1,260).

	Scores M ± SD (range)	The severity of the symptoms, *n*(%)			
		Normal	**Mild**	**Moderate**	**Severe**
Depression (PHQ-9)	3.76 ± 5.19 (0–27)	865 (68.7)	218 (17.3)	115 (9.1)	62 (4.9)
Anxiety (GAD-7)	2.64 ± 4.01 (0–21)	948 (75.2)	223 (17.7)	63 (5.0)	26 (2.1)

M, mean; SD, standard deviation.

TABLE 3 | Percentage of depression and anxiety symptoms among participants with different characteristics (n = 1,260).

Variables	Category	Depression			Anxiety		
		***N* (%)**	**95% CI[a]**	***P* value**	***N* (%)**	**95% CI[a]**	***P* value**
Total		177 (14.0)	12.2–16.1		90 (7.1)	5.9–8.7	
Gender	Male	98 (13.8)	11.5–16.6	0.812	50 (7.1)	5.4–9.2	0.900
	Female	79 (14.3)	11.6–17.5		40 (7.3)	5.4–10.8	
Age	≤25	26 (11.6)	8.0–16.4	0.665	12 (5.3)	3.1–9.1	0.783
	26–30	39 (18.8)	14.1–24.7		24 (11.6)	7.9–16.7	
	31–40	54 (13.6)	10.5–17.3		24 (6.0)	4.1–8.8	
	41–50	47 (14.6)	11.2–18.9		22 (6.9)	4.6–10.2	
	≥51	11 (10.1)	5.7–17.2		8 (7.3)	3.8–13.8	
Education level	Middle school	18 (5.5)	3.5–8.5	<0.001	7 (2.1)	1.0–4.3	<0.001
	High school	26 (10.0)	6.9–14.3		12 (4.6)	2.7–7.9	
	Junior college	42 (17.6)	13.3–23.0		22 (9.2)	6.2–13.6	
	Undergraduate and above	91 (21.1)	17.5–25.2		49 (11.3)	8.7–14.7	
Marriage	Unmarried	40 (12.1)	9.0–16.0	0.231	14 (4.2)	2.5–7.0	0.017
	Married	137 (14.8)	12.6–17.2		76 (8.2)	6.6–10.1	
Occupation[b]	Employed	156 (18.9)	16.3–21.7	<0.001	82 (9.9)	8.1–12.4	<0.001
	Unemployed/Retired	18 (5.3)	3.4–8.3		7 (2.1)	1.0–4.2	
	Students	3 (3.2)	1.1–8.9		1 (1.1)	0.1–5.7	
Residence place	Urban	121 (16.6)	14.1–19.5	0.002	64 (8.8)	6.9–11.1	0.008
	Rural	56 (10.5)	8.2–13.5		26 (4.9)	3.3–7.1	
Worried about being infected	Yes	44 (30.3)	23.5–38.3	<0.001	33 (22.8)	16.7–30.2	<0.001
	No	133 (11.9)	10.2–14.0		57 (5.1)	6.4–9.5	
Worried about the epidemic can not be controlled[b]	Yes	5 (13.9)	6.1–28.7	0.978	3 (8.3)	2.9–21.8	0.739
	No	172 (14.1)	12.2–16.1		87 (7.1)	5.8–8.7	

CI, confidence interval.
[a] *95% CI means 95% confidence interval of the percentage of depression and anxiety symptoms.*
[b] *Fisher exact test.*

The Prevalence of Anxiety and Depressive Symptoms

Our findings are consistent with the studies out of China during the COVID-19 pandemic. There are systematic reviews reported that quarantine status is a predictive factor for depressive and anxiety symptoms among the general population. The prevalence of depressive symptoms ranged from 14.2 to 53.5%, and from 6.33 to 50.9% for anxiety symptoms (30–32). In our sample, the prevalence of depressive and anxiety symptoms was within this range. An increased prevalence of depressive symptoms was reported in this quarantined population (14.0%), which was higher than that of the Shenzhen quarantined population (6.21%) (33) and the Vietnamese outpatients (7.44%) (34), but lower than the prevalence of the Spanish population (18.7%) (20). It should be cautious to compare the prevalence among different studies due to the various instruments used. Even when the same scale is used, the researchers adopted different cut-off points. For example, some studies reported participants with scores above the cut-off point (moderate-to-severe symptoms), while others included any participants with mild-to-severe symptoms. Also, it has been proved that the people's mental state is affected by geographical and temporal distributions (35), so differences in the time points and geographical location of mental health assessment may also associate with inconsistency in these results. Several studies have assessed mental health outcomes among community populations and health care workers during the COVID-19 pandemic in China and used the same instruments and cut-off points as ours. Lai et al.'s data from Chinese

TABLE 4 | Univariate and multivariate analyses of the depression symptoms among the quarantined population (n = 1,260).

Variables	OR (95% CI)	*P* value	aOR[a] (95% CI)[a]	*P* value
Gender				
Male	Ref		Ref	
Female	1.04 (0.76–1.43)	0.812	0.89 (0.62–1.26)	0.499
Age				
≤25	Ref		Ref	
26–30	1.78 (1.04–3.04)	0.036	0.68 (0.37–1.26)	0.221
31–40	1.20 (0.73–1.98)	0.471	0.63 (0.36–1.21)	0.117
41–50	1.31 (0.79–2.19)	0.298	0.82 (0.45–1.50)	0.522
≥51	0.86 (0.41–1.81)	0.690	0.47 (0.21–1.07)	0.073
Education level				
Middle school	Ref		Ref	
High school	2.05 (1.09–3.86)	0.027	1.51 (0.80–2.92)	0.223
Junior college	4.53 (2.53–8.12)	<0.001	2.77 (1.46–5.25)	0.002
Undergraduate and above	4.64 (2.70–7.98)	<0.001	2.98 (1.56–5.72)	0.001
Occupation				
Employed	Ref		Ref	
Unemployed/retired	0.24 (0.15–0.40)	<0.001	0.37 (0.21–0.65)	<0.001
Students	0.14 (0.04–0.45)	0.001	0.14 (0.04–0.48)	0.002
Residence place				
Urban	Ref		Ref	
Rural	0.59 (0.42–0.83)	0.002	0.78 (0.52–1.18)	0.242
Worried about being infected				
Yes	Ref		Ref	
No	0.31 (0.21–0.46)	<0.001	0.35 (0.23–0.54)	<0.001
Knowledge score of COVID-19	0.92 (0.81–1.04)	0.175	0.84 (0.73–0.96)	0.012
Compliance score toward quarantine measures	0.93 (0.91–0.96)	<0.001	0.94 (0.91–0.96)	<0.001

Ref, Reference category; OR, odds ratio; aOR, adjusted odds ratio; CI, confidence interval.
[a]*Adjusted for gender, age, educational level, and residence place.*

medical health workers reported a considerable proportion of participants with depressive (50.4%) and anxiety (44.6%) symptoms (17). Zhang et al. found that the prevalence of anxiety and depressive symptoms was 8.5 and 9.5%, respectively, in the general population (36). In this cross-sectional survey, the prevalence of depressive symptoms among high-risk quarantined persons during the COVID-19 epidemic in China was higher than that among the general population and lower than that among health care workers, consistent with several comparative studies reported that depressive and anxiety symptoms arise during the COVID-19 epidemic (33, 37).

Correlators of the Psychological Response Among the Quarantined Population

The risk of experiencing depressive and anxiety symptoms was associated with some sociodemographic variables among the high-risk quarantined people. Those with an undergraduate education level or above reported the highest percentage of depressive and anxiety symptoms among all education levels, although studies among the general population found that lower education levels are a risk factor of depressive and anxiety symptoms (30–32). The possible explanation may be because individuals with higher educational degrees probably have a more heightened self-awareness of their health (38). Additionally, Zhou et al. had reported that being overloaded was a risk factor for all measured psychological disturbances, including depression and anxiety (39). The highly educated people are more likely to be employed, hold a higher level or more prominent position in companies and organizations, and have more workload. They may worry about delays in work and subsequent deprivation of their income due to quarantine. The participants with jobs have a higher risk than their counterparts. It is worth mentioning that most of the employed individuals in this sample planned to return to work. One study reported that migrant workers experienced the highest psychological distress level among all occupations during the COVID-19 epidemic in China (40). They were also concerned about exposure to the viruses in public transportation when returning to the city where they worked. Those who are married reported a higher risk of anxiety symptoms than unmarried individuals, probably because they were more worried about their children and other family members and wanted to return to their families as soon as possible. However, in general, divorced or widowed persons were more likely to experience depressive and anxiety symptoms, while pregnant women showed less depressive and anxiety symptoms (31, 41). The participants who worried about being

TABLE 5 | Univariate and multivariate analyses of the anxiety symptoms among the quarantined population (n = 1,260).

Variables	OR(95% CI)	*P* value	aOR[a](95% CI)[a]	*P* value
Gender				
Male	Ref		Ref	
Female	1.03 (0.67–1.58)	0.900	0.88 (0.55–1.40)	0.585
Age				
≤25	Ref		Ref	
26–30	2.33 (1.13–4.79)	0.022	0.81 (0.37–1.82)	0.814
31–40	1.14 (0.56–2.32)	0.720	0.54 (0.24–1.20)	0.541
41–50	1.31 (0.63–2.70)	0.470	0.70 (0.30–1.61)	0.698
≥51	1.41 (0.56–3.55)	0.471	0.66 (0.37–1.16)	0.760
Education level				
Middle school	Ref		Ref	
High school	2.23 (0.87–5.75)	0.096	1.66 (0.62–4.45)	0.314
Junior college	4.70 (1.97–11.19)	<0.001	2.73 (1.05–7.02)	0.038
Undergraduate and above	5.9 (2.64–13.21)	<0.001	2.95 (1.14–7.63)	0.025
Marriage				
Unmarried	Ref		Ref	
Married	2.02 (1.13–3.62)	0.019	3.19 (1.48–6.87)	0.003
Occupation				
Employed	Ref		Ref	
Unemployed/retired	0.19 (0.09–0.42)	<0.001	0.31 (0.14–0.73)	0.007
Students	0.10 (0.01–0.70)	0.021	0.11 (0.01–0.85)	0.034
Residence place				
Urban	Ref		Ref	
Rural	0.54 (0.33–0.86)	0.009	0.66 (0.37–1.16)	0.148
Worried about being infected				
Yes	Ref		Ref	
No	0.18 (0.11–0.29)	<0.001	0.20 (0.12–0.34)	<0.001
Knowledge score of COVID-19	0.89 (0.76–1.05)	0.173	0.82 (0.68–0.98)	0.031
Compliance score toward quarantine measures	0.94 (0.91–0.97)	<0.001	0.95 (0.91–0.98)	0.003

Ref, Reference category; OR, odds ratio; aOR, adjusted odds ratio; CI, confidence interval.
[a]*Adjusted for gender, age, educational level, and residence place.*

infected tended to experience depressive and anxiety symptoms, which is consistent with general population. They may fear being infected or infecting others, and this fear commonly occurs among the high-risk population (42). This might be exacerbated by the participants experiencing some physical symptoms during the quarantine period or being misled by inadequate information received from social media. Therefore, adequate medical resources and as much accurate information as possible during the quarantine period are still needed. The systematic reviews (30–32) reported that the female, younger age group (≤40 years), and living in urban areas have a greater level of anxiety and depressive symptoms, which is inconsistent with our study due to the participants' demographic difference.

This study also found that quarantined persons had higher scores of knowledge of COVID-19 and behavioral compliance toward quarantine measures, and these two factors were associated with psychological outcomes. Most subjects held a positive attitude toward the battle against COVID-19. Education attainment positively correlated with COVID-19 knowledge scores. This finding is consistent with one study that showed community dwellings with a master's degree were more knowledgeable than those who held lower-level degrees (43). Consequently, we controlled for covariates including educational attainment, gender, residence area, and age, and found that individuals with less knowledge about COVID-19 and lower behavioral compliance to quarantine measures were more likely to have depressive and anxiety symptoms.

Knowledge and understanding of the experiences of quarantined persons may contribute to maximizing infectious disease containment and minimizing the adverse effects on those quarantined, their families, and social networks (12).

The Comorbidity of Depressive and Anxiety Symptoms

Furthermore, the PHQ-9 scores of the quarantined individuals were strongly correlated with their GAD-7 scores. On the one hand, many studies have reported that depressive and anxiety disorders are strictly related and frequently comorbid (38, 44). On the other hand, these two scales were highly correlated owing to a higher-order factor in analytic models, which consists of nonspecific symptoms common to depression and anxiety (45).

Possible Measures to Mitigate the Psychological Impact of COVID-19

In summary, the present findings suggested that effective efforts to reduce the psychological impact should be put in place as part of the quarantine planning process. First, safe living conditions and adequate supplies are essential. The infrastructure and space of the quarantine facility should be well organized to limit potential transmission. Adequate supplies, including food, water, appropriate accommodation, and personal protective equipment, should be provided in a timely manner. Meanwhile, the quarantine facility should be staffed by health care workers who can monitor physical symptoms and take measures with suspected cases. Second, the dissemination of knowledge and health promotion strategies should be implemented. Targeted and acceptable health education programs will provide individuals with a good understanding of COVID-19 and help them have a good understanding of why they were quarantined and how it will work. Merino et al. found that people in the intrinsic orientation group (meaning those who are taking advantage of confinement to enjoy being with the family, personal development, and so on) show higher levels of psychological well-being and subjective well-being (46). So reinforcing the sense of altruism and cultivating a conscious appreciation of the social and individual values will reduce the mental health effects and improve their compliance (47). Third, timely and accurate examination involving computed tomography (CT) imaging and the nucleic acid test may (48) eliminate their worries and fears. Fourth, improving communication and providing phone-based or online psychological support (49) or appropriate psychological intervention can maintain and promote mental health. Finally, quarantine requires collaborative efforts from multiple organizations and institutions. The quarantine not only needs planning and implementation by health departments and cooperation by a high risk population but also needs reasonable job and social security for quarantined individuals by the government and society.

LIMITATIONS

Some potential limitations may affect the interpretation and generalizability of the results reported here. First, although an online survey is suitable for larger samples and rapid assessment, if the people were too stressed to respond or not interested in this survey, it may have led to response bias and affected the results. Second, we controlled for many covariates in the logistic regression model. Nevertheless, some possible residual confounding may have been caused by unmeasured variables, such as degree of exposure, family members in quarantine, workload, and social support. Finally, due to the cross-sectional design, the causal relationships between variables and mental outcomes cannot be determined. Therefore, the interpretation of those results should be taken cautiously.

CONCLUSIONS

Individuals under quarantine during the COVID-19 pandemic suffered prevalent symptoms of depression and anxiety. Consequently, comprehensive interventional measures, including dissemination of knowledge, timely examination, and strengthened communication, should be built to minimize the quarantine's adverse effects.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The survey was designed as anonymous. An online informed consent was obtained by asking participants to check a box on the device's screen with the response (I agree to participate in the survey; I do not agree to participate in the survey). If the answer was "I do not agree," the computer program was immediately and automatically terminated. This study was approved by the institutional review board of Ningxia Medical University (document number: 2020112).

AUTHOR CONTRIBUTIONS

WZ, ZJZ, and TY conceptualized and designed the study. TY, WZ, YY, LJ, LG, and ZJJ acquired the subjects and data. TY prepared the manuscript. WZ and ZJZ revised the manuscript for critical intellectual content. All the authors performed the analysis, interpretation of the data and contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

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Promoting the Resilience of the Italian Population Against SARS-CoV-2

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The COVID-19 pandemic, due to its exceptional level of impact on the populations of the richest and most technologically advanced nations—which are experiencing unprecedented widespread mortality, fear, and social isolation—and due to the considerable difficulties faced by health services in coping with the emergency and the uncertainty regarding the evolution of the pandemic and its foreseeable heavy economic repercussions on a global scale, requires a change in the approach to the prevention and treatment of the infection based on the integration of biomedical and psychological sciences and professions. A survey of the Italian pandemic population, the results of which we report here, shows a widespread state of psychological distress, which, based on decades of scientific and clinical evidence on the relationship between mental states and immune system efficiency that we summarize in this paper, plausibly weakens the resistance of individuals and the population to SARS-CoV-2 infection. Italy can deploy a great force, represented by tens of thousands of psychologists and psychotherapists, who, as health workers, could be employed, alongside local and hospital medicine, in primary care and in promoting the resilience of citizens and health workers themselves, who are subject to a deadly work stress that also includes a widespread threat to their lives.

Keywords: immune system, pandemic, COVID-19, mental health, stress, resilience

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EPIDEMIOLOGY OF SARS-COV2 INFECTION

Almost 500 years ago, in 1546, Italian doctor Girolamo Fracastoro (1) proposed, for the first time, the interhuman transmission of pathogens (which he called *seminaria*) as the cause of epidemic infections (contagion). The COVID-19 pandemic is caused by the interhuman infection of a pathogen, a new coronavirus, classified as SARS-CoV-2 by the International Committee on Taxonomy of Virus (2) due to its similarity to SARS-CoV, which gave rise in 2002 to the severe acute respiratory syndrome (SARS) epidemic in the Chinese province of Guangdong. In December 2019, SARS-CoV-2, in Wuhan, China, caused an epidemic (3) that, in January 2020, affected the whole of the province of Hubei and that, as of February, affected Lombardy, Veneto, Emilia Romagna, and subsequently the whole of Italy.

Currently, confirmed cases of coronavirus disease (COVID-19) are on the rise in Europe and the United States and virtually the entire planet (4). Its fatality rate, which varies from country to country and presents high levels of uncertainty and likely underestimation, is, in any case, higher than the initial forecasts: It ranges from just over 5% of confirmed infections declared by China to more than 17% recorded in Lombardy, which alone accounts for ∼50% of all Italian mortality from COVID-19. However, researchers and local administrators put forward the hypothesis that the numbers of infected people and deaths are much higher than official estimates in both China and Italy, particularly in the most affected areas, such as in the provinces of Bergamo and Brescia in Lombardy (5). The elderly, who most frequently have comorbidities, and the male gender are the most affected groups. In Italy, the mortality rate from COVID-19 as of September 2020 recorded by the Istituto Superiore di Sanità, concerned 57.4% men and 42.6% women. The fact that, in the 60–69 age group, the male mortality rate is even lower for women is significant. Last, according to this survey, 49% of the deceased were 80 years of age or older (6). According to another survey by the Istituto Superiore di Sanità carried out on Residenze Sanitarie Assistenziali and other nursing homes for the elderly the facilities in Lombardy are particularly affected by the epidemic: It is estimated that, in March, more than half of the mortality recorded in these centers is attributed to COVID-19 (7). The United States, Spain, Italy, France, England, and Germany are the most affected countries, but the infection is rapidly spreading globally (https://coronavirus.jhu.edu/map.html). SARS-CoV-2 is more invasive than other human coronaviruses (SARS-CoV and MERS-CoV, responsible for SARS and Middle East respiratory syndrome outbreaks, respectively), likely due to mutations in gene sequences coding for the viral spike protein (8), which made it more suitable for interaction with the cellular protein angiotensin-converting enzyme 2, which acts as a gateway for the virus in cells of the human respiratory mucosa.

The Mental States of the Population During Lockdown

The COVID-19 pandemic, which, unlike SARS and MERS, was not limited to some eastern areas (China and the Middle East), affecting the heart of the West, has generated astonishment and disbelief among the population. In the imagination of the Western citizen, epidemics were a memory, mostly literary, of the past and, in the present, a phenomenon of the most unfortunate areas of the world, living without hygiene, food, or medicine. In this case, however, the epidemic is a dramatic reality of the wealthy, technological West, the cradle of scientific medicine. In addition, the infection usually has a trivial onset with fever, cough, sore throat, and asthenia, symptoms that everyone has experienced many times during their lives without serious consequences. However, in the pandemic context, the subject who experiences them can interpret them in a much more threatening way, like the beginning of a chain that, quite quickly, can lead to a serious disease condition. For these and other reasons, the new epidemic reality is still struggling to be mentally processed by people, upon whom, above all, weigh the restrictive measures that, moreover, the governments of Western countries themselves have taken with great reluctance and wavering attitudes (in particular the American and English governments).

TABLE 1 | Stress index score variation among adult population before and after the announcement of the nationwide lockdown in Italy.

Stress index score	Date of detection: 3/2/20	Date of detection: 3/9/20	Date of detection: 4/6/20
High	27%	43%	41%
Medium	45%	45%	38%
Low	28%	12%	21%

The survey was carried out by the Piepoli Institute for the National Council of the Order of Psychologists (April 8, 2020) on a total sample of 501 subjects representative of the Italian population. On 9 March 9, 2020, the government of Italy extended lockdown to the entire country: This raised the stress index national trend toward the higher scores, and it remained high after 1 month. The stress index score is a 10-point scale on which 1 is little or no stress and 10 is a great deal of stress. The indicator was calculated by transforming the stress scale from 1 to 10 points into a percentage from 1 to 100%, and the score obtained was then classified as low (1–40%), medium (41–70%), or high (71–100%).

TABLE 2 | Main forms of psychological distress.

Psychological distress	Total	Men	Women
Stress/Anxiety	42%	40%	43%
Sleep disorders	24%	19%	28%
Irritability	22%	21%	22%
Depressed mood	18%	15%	21%
Eating problems	10%	10%	10%
Problem in relationships	7%	6%	8%
Problem with partner	3%	5%	5%
Problem with sons	1%	5%	1%
None	28%	31%	25%

The survey was carried out by the Piepoli Institute for the National Council of the Order of Psychologists (April 8, 2020) on a total sample of 501 individuals representative of the Italian population divided by gender.

The Psychosocial Distress of the Italians During Lockdown

Before the pandemic, according to international studies that also include Italy, the prevalence data of the most common mental disorders were in a range of between 4 and 6.7% for anxiety and between 4 and 5.4% for depression (9, 10). The Italian Central Institute of Statistics (11) notes the prevalence of these problems in a "Multi-purpose survey of Italian households" limited, however, to subjects aged between 16 and 65 years. In this context, it is found that 5.14% of respondents reported current depressive symptoms, and 3.6% reported symptoms of anxiety. After the announcement of the nationwide lockdown in Italy on March 9, 2020, the stress index score trended toward the higher scores as shown in the survey carried out by the Piepoli Institute for the National Council of the Order of Psychologists (April 8, 2020) (see **Table 1**). Data on the main sources of distress reveal high levels of anxiety, sleep disorders, irritability, depressed mood, relationship problems, and eating problems (see **Table 2**).

The majority of Italians (80% of interviews) attribute these forms of distress to the pandemic (34% greatly and 46% fairly), a percentage that has increased from the beginning of the survey

TABLE 3 | Percentage of depressed subjects during the pandemic among adult population in Italy, Spain, and the United Kingdom.

Total	Italy	Spain	United Kingdom
61%	59%	67%	57%

The survey was carried out by Open Evidence, a spinoff of Universitat Oberta de Catalunya (UOC), realized with the contribution of BDI- Schlesinger Group and Università degli Studi di Milano, Universitat Oberta de Catalunya, Universidad Nacional de Colombia, Università di Trento, University of Glasgow, on a total sample of 1,000 subjects divided by the countries involved in the survey. The percentages refer to those who reported to have been depressed in the last 7 days (reference period: from 4/24/2020 to 5/1/2020). The Depression, Anxiety and Stress Scale (21 Items) and Stanford Acute Stress Reaction Questionnaire were used to quantify depressive symptoms.

to date: on February 24, it was 62%. Since the beginning of the COVID pandemic, 67% of Italians say that their level of distress has increased. The sources of this distress are linked to the specific restrictions and living conditions (51% social, 27% not being able to do outdoor activities, 24% having little space available, 20% not being able to go to work, 9% forced cohabitation), 58% declare distress associated with financial prospects, and 31% are worried about their worsening psychological experience. What emerges is a sharp increase in psychological distress, which is based not only on the conditions/restrictions of the pandemic (51%) but also—and increasingly—on concerns regarding social and financial prospects (58%).

A recent European survey conducted in three countries (Italy, Spain, and the United Kingdom) confirms that there is a widespread state of psychological distress in the general population. Predictive analyses show that the mental health of a large proportion of the population is at high risk for stress, anxiety, and depression in these countries (59, 67, and 57%, respectively; see **Table 3**) due to socioeconomic vulnerabilities and worsened conditions since the pandemic onset (12). An Italian study conducted between the end of April and the beginning of May 2020, which followed other research carried out in the first phase of the lockdown, documents the persistence of high levels of stress and depression, particularly in people with preexisting stressful conditions, especially young people and people with poor ability to cope with difficulties and with tendencies toward isolation and lack of motivation (13). A Chinese study, conducted after a month of lockdown, reported an increase in cases of post-traumatic stress disorder with a prevalence in women (14).

The additional surge in infections in the United States, Brazil, India, and Europe after summer 2020 could potentially worsen mental illness in large sectors of the population. Particular attention should be paid to COVID-19 survivors who present anxiety, depression, sleep disorders, loss of memory, and quality of life deterioration in significant percentages after months post-discharge from hospital (15). The health emergency involves the psychological well-being of both individuals (e.g., insecurity, confusion, emotional isolation, stigma) and communities (concerns regarding the economy, work, school, treatment, etc.), triggering widespread situations of psychological distress (which sometimes lead to psychiatric disorders), negative behavior, and non-compliance with safety guidelines (16). Alongside this widespread distress are the more specific forms of distress and disorders present in people with COVID-19 who are hospitalized or in quarantine at home, the relatives of sick and deceased people, and health workers and those no longer exposed to the pandemic who have been the subject of initial international studies (17).

WHAT DO WE KNOW ABOUT THE PATHOGENESIS OF COVID-19?

The majority of individuals who have come into contact with SARS-CoV-2 have few or often no symptoms. In a smaller proportion of those infected—we do not know exactly in what proportion—the infection can evolve into an interstitial pneumonia that can give rise to acute respiratory distress syndrome (ARDS) with a possible fatal outcome. The virus is transmitted to humans through droplets and aerosols and other routes of transmission have been reported, such as contact with contaminated surfaces, especially plastics (18). A fecal–oral transmission route is also reported based on the identification of RNA or live infectious SARS-CoV-2 in feces of some Chinese patients with COVID-19 (19).

From the upper airways, the virus, if not contained, spreads to the bronchi and lungs and then to the intestines and other organs, especially the kidney, heart, and brain. The vascular system is fully affected with altered coagulation and the formation of clots, which can also give rise in a proportion of cases (20) to disseminated intravascular coagulation (21). The severity of the disease depends on the level of systemic inflammation and the degree of involvement of the lungs, which may present on computed tomography as "patchy ground-glass opacities" (17) and other signs affecting the pleura (22). In the early phase of the disease, non-specific clinical symptoms occur: fever, cough, and dyspnea as well as immune changes, such as a high neutrophil–lymphocyte ratio (23), functional exhaustion of T cells (24), and overproduction of IL-1β and IL-6 and in contrast low production of IFN-γ (25). If the disease evolves into a more severe form alongside these alterations, there are other signs of systemic inflammation, particularly in the vessels: a condition produced by a so-called "cytokine storm," i.e., a high concentration of inflammatory cytokines released by immune cells and also by other damaged cells. In patients who develop more severe forms of the disease, SARS-CoV-2 is able to evade the immune response that could block it, which is based on a T helper type I (Th1) response and activated CD8+ cytotoxic T lymphocytes. Instead of this antiviral immune circuit, there is an increase in the activity of neutrophils. Neutrophilia and lymphopenia on complete blood count tests seem to be a consistent feature of COVID-19. Neutrophil activity, if not accompanied by the involvement of B lymphocytes together with cytotoxic T lymphocytes and the Th1 circuit, not only does not eliminate infection, but may also be at the origin of the state of hyperinflammation frequently observed in the advanced disease, which characterizes the clinical transition from pneumonia to ARDS and the overproduction of inflammatory biomarkers, such as cytokines and neutrophil-derived extracellular traps (NET).

The NET formation, a phenomenon discovered and studied in recent years, reflects the ability of neutrophils to expel their DNA and create extracellular networks composed of chromatin fibers, cytosolic and granule proteins, and inflammatory and oxidizing substances that are able to trap and destroy pathogens (26). NET formation, when unregulated, is a key factor in the production of a highly inflammatory state (27). The involvement of NET scaffolds in autoimmune vasculitis and systemic lupus erythematosus (28) as well as in ARDS in the context of SARS-CoV–related pneumonia has been documented (29). It is not difficult to assume that NET formation also is likely involved in advanced COVID-19; findings from postmortem series of direct autopsies conducted on patients who died from COVID-19 demonstrate thrombi and neutrophilic plugs in the lungs, heart, kidneys, liver, spleen, and brain (30).

A PNEI APPROACH TO IDENTIFYING THE MAIN FACTORS OF RESISTANCE TO INFECTION AND MASS RESILIENCE DURING THE PANDEMIC

The vast majority of the population has endogenous resources to fight the infection, which can be silent or with few symptoms. The psychoneuroendocrinoimmunological (PNEI) approach, which studies the two-way relationships between the psychic dimension and biological systems in the environmental and social context (31, 32), provides an appropriate model for the identification of risk factors and resistance to infection. It also describes how to understand the effects of infection on an affected person's overall health, including the person's mental state (33).

As described, the central issue is the balanced immune response to SARS-CoV-2. A number of factors can regulate or unbalance the antiviral response, including both individual and group factors. Individual factors related to diet, physical activity, stress, and mental states are discussed in the next paragraph. Here, we briefly point out the effects of air pollution on lung inflammation and the development of COVID-19.

Recent research by the European Environment Agency estimates that PM2.5 pollution in 2016 was responsible for ∼412,000 premature deaths in Europe caused by heart attacks, strokes, and lung disease (34).

It is demonstrated that chronic exposure to air polluted by fine particulate matter (i.e., PM10, PM2.5, and ultrafine PM < 0.1 matter) causes damage to the respiratory system. These by-products of combustion derived principally of fossil fuels, mainly PM2.5 matter, can penetrate the bronchial and pulmonary tract, and ultrafine PM < 0.1 particulate matter can pass directly into the bloodstream and spread to the organs. The alteration of the respiratory defensive systems caused by PM2.5 concerns damage to the mucosal barrier, respiratory microbiota, and immune cells (35). This immune dysregulation can be a determining factor for serious respiratory diseases, such as lung cancer and chronic obstructive pulmonary disease, or can cause chronic low-grade inflammation of the upper and lower airways by activating granulocytes (neutrophils) and mast cells in the respiratory mucosa and macrophages in the alveoli and lung interstices. In turn, chronic low-grade inflammation can promote the pathogenic action of various respiratory bacteria and viruses, including SARS-CoV-2.

A research study in progress at Harvard University, in the Department of Biostatistics, School of Public Health, recorded a direct relationship between PM2.5 particulate matter exposure to air pollution and COVID-19 mortality in the United States. Harvard epidemiologists find that the increase of just 1 $\mu g/m^3$ in PM2.5 is associated with a 15% increase in mortality rate from COVID-19 (36). An intriguing and disturbing fact is the overlap between levels of fine particulate pollution in Lombardy and the incidence of COVID-19, which is highest in areas of maximum air pollution, which has been particularly high in the last two decades. At the beginning of January 2020, at the time when the contagion was thought to be beginning to spread, the Lombardy Environmental Protection Agency reported very high concentrations of "PM10 of up to 180 $\mu g/m^3$, i.e., 3.6 times the legal limit for several consecutive days in different areas of Lombardy, including Milan" (37).

Obviously, fine particulate pollution is not the only factor explaining the exceptional mortality rate recorded in some provinces of Lombardy; there are other factors, on which in-depth public health investigations are expected to be conducted. The fact remains that, if the spread of the infection is to be effectively countered by increasing the population's defensive capacity toward SARS-CoV-2, particularly during the phase of resuming work, the abatement of air pollution is a major antiviral measure as well as for containing the circulation of the infection.

SUPPORTING THE EQUILIBRIUM OF THE IMMUNE SYSTEM

The immune system is influenced by several factors, including diet, physical activity, psychological state, and air and environmental pollution. We have just dealt with the latter aspect; therefore, let us briefly look into the others.

Nutrition and Microbiota

The severe form of COVID-19 with ARDS and cytokine storm syndrome is more frequently observed in patients with diabetes, hypertension, cardiovascular disease, and obesity due to a preexisting systemic chronic inflammation and pro-inflammatory cytokine hyperproduction (mainly IL-6).

Hyperglycemia, often observed in cases of stress and infection, has been reported in 51% of patients with COVID-19 (25). It is also demonstrated that a condition of hyperglycemia and high lactate production reduces innate immune type I interferon (IFN I) production, weakening the host defense against viruses (38).

A diet low in protein is one of the main causes of immunodeficiency in the elderly population (39), and the lack of an adequate pool of amino acids has been associated with low production of immunoglobulins, thymic atrophy, reduced proliferation of naive lymphocytes, and poor cell maturation with lytic activity (natural killer and lymphocytes with cytotoxic activity). Adequate intake of essential micronutrients at all stages of life contributes significantly to the proper maturation of the immune system and efficient response to infection. There are numerous studies on the specific effects of essential micronutrients on the functioning of the immune system: Monounsaturated fatty acids (oleic acid), B group vitamins, fat-soluble vitamins (A, D, E), beta-carotene, iron, copper, zinc, and selenium have gathered the most evidence (40).

As is well-known, diet selects and profoundly shapes the microbiota, a complex set of resident microbial populations (bacteria, viruses, and fungi) that form colonies in contact with the mucous membranes of the body and, therefore, also in the respiratory mucosa. A state of dysbiosis, which can occur as a result of several conditions, including the use of drugs (antibiotics, antacids), an inflammatory diet, surgery, and hospitalization, can be associated with several life-threatening infectious conditions: infection with multiresistant germs, pseudomembranous colitis from *Clostridium difficile*, or sepsis (39).

On April 4, 2020, the Italian Scientific Societies of Clinical Nutrition and Anesthesia-Resuscitation published a joint document (41) in which they drew up recommendations for the nutritional treatment of patients affected by COVID-19 and hospitalized in intensive and subintensive care units in Italian hospitals. The clinical features of COVID-19–critical patients show widespread malnutrition. Malnourished COVID-19 patients in intensive and subintensive care are associated with higher hospital costs, prolonged stays, and increased mortality. The Faculty of Medicine of Zhejiang, in its "COVID-19 Disease Therapy and Prevention Manual" released in March 2020 (42), includes nutritional therapy and the use of probiotics in the standard of care of hospitalized patients in order to reduce the rate of bacterial superinfections, reduce hospitalization in intensive care, and accelerate functional organ recovery. The early initiation of nutritional therapy is, therefore, vital, particularly in patients with organ failure and sepsis, but could significantly change the course of the disease even in non-critical patients hospitalized on ordinary wards or treated at home (43).

Physical Activity

One of the main effects of forced quarantine during a pandemic is reduced mobility. Although everyone may suffer from a prolonged period of almost total physical inactivity, the elderly population may, once again, pay the highest price. Reduced mobility in the elderly (44), in fact, raises the fragility index dangerously upward, rapidly depletes muscle reserve, and accelerates bone turnover, promoting sarcopenia, osteo-articular degeneration, repeated falls, and osteoporotic fractures; it worsens respiratory function, increasing the risk of acute seasonal airway diseases and chronic bronchopathies, and alters metabolism and blood pressure regulation, increasing the use of specific drugs and, therefore, health expenditure. Regular physical activity is also a trophic stimulus for the brain; i.e., it effectively counteracts neurodegeneration (in key brain areas, such as the hippocampus) and the onset of dementia. An elderly person with reduced mobility who is hospitalized leads to an exponential increase in the burden of care and an increase in the average length of hospitalization and related pathologic consequences (bedding syndrome, bedsores, infectious risk, sarcopenia, worsening of cognitive functions, or risk of delirium or psychotic dissociation).

Regular physical activity also modulates immune function, making the response against viruses and cancer cells (Th1 circuit) more efficient. A significant example is studies on women with breast cancer (45) in which a change in immune profile (increase in natural killers and CD8+ lymphocytes) was recorded in response to a regular physical activity program. It has been demonstrated in several studies on elderly subjects (46) that it is mainly moderate aerobic exercise that counteracts immunosenescence, reducing inflammatory cytokines, such as TNF-α and IL-6; increasing the anti-inflammatory IL-10; and increasing the number of CD4+ and CD8+ lymphocytes and regulatory T lymphocytes. Physical activity also slows down cellular aging, which is at the root of many chronic diseases among the elderly, measured by the length of the telomeres (the end of the chromosomes) of the immune and skeletal cell genes of well-exercised elderly subjects (47).

Stress and Its Regulation

During a pandemic, quarantine is in itself a highly stressful situation, in which several factors fuel psychological suffering: prolonged social isolation, fear of infection, sense of frustration, boredom, inadequate support, inadequate information, financial loss, and social stigma. Recent work published on the Chinese population (48) shows that there is a high level of psychological stress, anxiety, and depression and a lower quality of life in people affected by COVID-19 and in close family members than in those not directly affected. Family and social support and access to accurate and comprehensive information on one's own health and that of the community as well as clear communication on precautionary measures to be taken greatly reduce the stress load and risk of developing anxiety-depressive illness (49). A condition of prolonged stress brings profound adaptive changes in the psycho-neuro-endocrine-immunity network (32, 50): The psychological state is dominated by anxiety, depression, altered sleep–wake rhythm and anhedonia; the biological side is characterized by altered hypothalamic-pituitary-adrenal axis response and release of awakening and stress-induced cortisol, unbalanced activation of autonomic nervous system and increased adrenergic tone, pathological alterations in metabolic and cardiovascular functions, immune dysregulation, and a systemic and central inflammatory state.

Several experimental research studies focus on the two-way relationship between mental state, immune system, and inflammation, the latter defined as a silent killer at the basis of many current chronic degenerative diseases with high mortality (cardiovascular diseases, cancer, diabetes mellitus). Social isolation, low socioeconomic status, loneliness, previous trauma, or current living conditions dominated by fear or violence not only shorten life expectancy and increase morbidity for the most common chronic diseases, but are also associated with a higher level of inflammation (51) and lead to or aggravate the depressive state. In addition, the progressive increase in average age in itself constitutes a risk for the onset of depression, cognitive decline, and reduced self-sufficiency.

Aging is a physiological process that is accompanied by progressive alterations in immune function, dominated by reduced specific immunity response and non-specific increase in inflammation *(inflammaging*) (52). Loneliness (53) and social isolation (54), conditions that certainly affect many older people and are increasingly affecting larger sections of the population, emerge as independent and synergistic predictors of morbidity and mortality as well as the best known disease risk factors (55).

The depressive state correlates positively with an increased concentration of inflammatory molecules (cytokines). Abnormal inflammation appears clearly in a subset but not in the whole population of those suffering with depression. This subset is more resistant to psychological treatment (56). Depression, in these cases, can, therefore, be seen as a form of low-grade inflammation (57) particularly active in brain circuits involved in adaptive behavior and emotional state processing (limbic and prefrontal cortex); this leads to a pathological condition that, in its chronicization, is continuously fed by inadequate lifestyle behaviors (i.e., high sugar and fat diet, alcohol and illicit drug consumption, smoking, sedentariness, social avoidance) that, in turn, support the inflammatory state and worsen the psychological state in a vicious circle (33).

A recent population study (58) conducted on 24,325 Italian citizens living in Molise investigated the correlation between aspects of psychological health, such as the degree of resilience; depressive symptoms, and quality of mental life and an aggregate index of low-grade inflammation (the INFLA score) that measures the blood concentration of C-reactive protein, platelet count, and white blood cell concentration (neutrophil–lymphocyte ratio). The results of the study, conducted on a healthy population, showed higher INFLA scores in subjects with higher scores for depression, and the opposite condition, that is, reduced inflammation, was observed in the case of a high score for mental well-being. The correlation between INFLA score and depression is even more significant if lifestyle is associated, i.e., with a positive history for cigarette smoking, poor adherence to the Mediterranean diet, overweight/obesity, and reduced physical activity. The INFLA score also demonstrates, in depressed patients, a vigorous activation of innate immunity (high number of neutrophils, activation of monocytes, high neutrophil–lymphocyte ratio), increased synthesis of inflammatory cytokines and reduced lymphocyte activation.

The results are in line with a recent study of genetic analysis (59) that demonstrates the activation of at least 165 genes in major depressive disorder in humans, 90 of which are hyperexpressed mainly in cells of the innate immunity (neutrophils, monocytes, dendritic cells) and regulate through stable epigenetic changes inflammation and immune response. The pathophysiological interplays in the psyche-brain-immune network are particularly at risk among the elderly population in this historical era characterized by sudden and destructive environmental factors, such as the pandemic and the resulting state of isolation due to quarantine.

Several COVID-19 patient-management guidelines have highlighted the need to protect the mental health of citizens affected by the pandemic. Starting from the indications given by the WHO (60), several strategies have been identified to counteract the growing psychological distress. Yoga, mindfulness meditation and relaxation, and breathing exercises are the most commonly mentioned (61) and recommended techniques given that they are safe, free from side effects, and applicable in any emergency context from COVID wards to the homes of isolated patients (62). There are numerous randomized controlled trials conducted in elderly individuals, neoplastic and immunodepressed patients, or subjects at high cardiovascular risk, which have documented a statistically significant reduction in serum inflammation markers (C-reactive protein, cytokines) (63) and an enhancement of natural antiviral and anticancer immunity (increase in number and activity of natural killer cells) and the Th1 immune circuit among meditating subjects compared with controls (64).

PROMOTING PSYCHOLOGICAL RESILIENCE AS PART OF AN INTEGRATED MEDICAL AND PSYCHOLOGICAL APPROACH AS A MEANS OF COMBATING THE SPREAD OF THE EPIDEMIC

The real challenge is to intercept the widespread psychosocial distress and the more structured psychiatric disorders and provide an appropriate and comprehensive response.

The widespread nature of the emergency requires a stratification of the population in relation to the type of problems and consequent level of assistance. However, on the basis of Italian experience and international literature, the following areas can be hypothesized in potentially descending order:

1) The "front line": People ill with COVID-19 confined at home and hospitalized, family members, bereaved people, the first-line health workers.
2) The "second line": people in quarantine and people not affected by COVID but who are particularly at high risk due to physical or psychological frailty, such as people with chronic pathologies, intellectual or physical disabilities, psychiatric problems, lonely elderly people, workers in critical areas.
3) The "inner front" formed by the tens of millions of healthy people at risk of home confinement.

Faced with such a large potential target, it is necessary to deploy an integrated strategy that provides various options that have as their first objective to intercept the needs and provide answers.

- For the first line, a specific action must be guaranteed especially in hospitalization contexts with three main targets: infected ill people, their relatives, and health care workers. About the last category the surveys show high levels of depression, anxiety, sleep disorders, and distress, especially among the female gender and those working on the front line (65). In this context, it is necessary that the psychologists recruited are present in health care contexts and that their action is coordinated with the overall health care action. This includes remote home care for COVID-sick and non-hospitalized patients.

- The second line has intermediate needs compared with the above lines and includes all situations of people in quarantine, those suffering from physical or mental disorders, carriers of situations of fragility, or those requiring special support.
- For the extensive inner front, it is necessary to start from widespread proactive strategies of prevention and promotion of resources (at the social, community, group, and individual levels) and from the provision of psychological skills within the facilities with the greatest cost–benefit impact of the social network: primary care, regional health care services, social services, schools, community contexts, world of work. This network must guarantee an initial and widespread response—with remote or onsite methodologies—in terms of primary and secondary prevention as well as selecting and facilitating second-level interventions (e.g., for more structured and severe psychiatric diseases of psychopharmacological type).

The subgroups to which attention must be paid include the prison population, people with disabilities and their families, children with disorders or family problems, women in the peripartum period, and lonely elderly people. There is also the problem of support for workers who fall into situations of greater or lesser exposure to risk in relation to the type of work and who generally suffer from problems related to organizational changes (e.g., flexible working) and employment prospects.

As highlighted, there is a need for a program of initiatives that, proceeding from the widespread front to the front line, involves a shift from large-scale forms of primary prevention (e.g., dissemination of psychoeducational advice), promotion of resources and empowerment, listening, information, and telephone guidance to more targeted forms of intervention, such as psychological support, stress management, or psychotherapy in the form of remote or face-to-face assistance.

Given that in Italy there are more than 100,000 members of the Order of Psychologists classified as health professionals, half of whom specialize in psychotherapy, there are qualified professional resources to implement this strategy, and they are able to implement the current small number of psychologists structured in the Italian National Health Service (∼6,500).

The activation of an initial-level psychological network, structured within the main health care hubs (GPs, regional services) as well as in support of schools, social services, and work contexts, is fundamental to intercept and respond to the widespread need.

Psychological interventions should assess and monitor COVID-related stress (e.g., exposure to infection, sick or deceased relatives), secondary adversities (e.g., financial problems), psychosocial effects (anxiety, depression, psychosomatic problems, sleep disorders, situations of conflict, and violence), and vulnerability indices (e.g., social conditions, preexisting psychophysical conditions) (16).

In this context, the initial level can proceed to dispatch any need for primary (GP, nurse), social, or other care that may be intercepted and act as a filter for the activation of second-level health interventions, such as mental health or neurodevelopmental disorders.

As regards remote psychological services, guidelines have been issued by the National Council of the Order of Psychologists (66), and for integrated medical and psychological teleassistance services for people in quarantine or in situations of special needs, there are indications from the Istituto Superiore di Sanità based on a triple stratification of care needs (67)

A particular issue is that of work stress and the high risk of burnout among health care workers. Suffice it to think of the number of deaths among the health professionals in Italy (more than 200) and the request of the President of the Italian Nurses to the Minister of Health to solicit urgent psychological help for these professionals. In relation to this emergency, the Italian National Institute for Occupational Accident Insurance (INAIL) in collaboration with the Order of Psychologists has prepared a methodology of psychological intervention for health care workers (68).

There is currently an overall difficulty in launching a strategy capable of articulating and integrating psychological intervention into health care and the social network, both due to the forced priority given to medical assistance emergencies in the first phase and, above all, due to a widespread cultural problem that tends to separate psychological aspects from health-related issues and health interventions in general—a cultural problem that does not seem to concern the Italian population, yet which, on the contrary, is very favorable to a greater presence of psychologists in primary care services (i.e., hospitals, nursing homes, social services, family physicians' offices) in order to counteract the COVID-19 pandemic effects (Piepoli Institute for CNOP, 20 April 2020) (see **Table 4**).

TABLE 4 | Italian opinion on psychological assistance during the pandemic.

Question 1. In your opinion, how important is it, in this emergency, that psychological assistance is guaranteed by the public system?

Very Important (37%)	Quite Important (42%)	Total 79%
Very + Quite important	Men 75%	Women 83%

Question 2. In which health care facilities should psychological assistance be used?

Healthcare facilities	Total	Men	Women
Hospital	90%	87%	93%
Nursing home for the elderly	87%	85%	89%
Social services	84%	83%	86%
To help family doctors	79%	75%	83%

The survey was carried out by the Piepoli Institute for the National Council of the Order of Psychologists (April 20, 2020) on a total sample of 1,004 subjects representative of the Italian population aged 18 and over, segmented by gender.

THE NEED FOR MORE MENTAL HEALTH TO ACHIEVE MORE GLOBAL HEALTH

About 14% of the global burden of disease has been attributed to neuropsychiatric disorders, mainly represented by severe depression, substance abuse disorders, and psychoses (69). However, mental disorders increase the risk of communicable and non-communicable diseases just as many physical problems increase the risk of mental disturbances. Physical consequences of mental illness and vice versa are often neglected by health care system policies worldwide, affecting the quality of mental health services with direct consequences on the grade of disability and prognosis of people with mental illness. The pandemic worsened health care accessibility and safety, particularly for people suffering from mental diseases who were prone to higher health risks and mortality (17, 35, 70) and who experienced more frequent psychiatric symptoms during the lockdown periods than the general population (71). Specific efforts and intense preventive interventions, thus, might be urgently dedicated to this category of people.

The Bidirectional Associations Between COVID-19 and Psychiatric Disorder

Wang et al. (72) analyzes a nationwide database of electronic health records of 61 million adult patients from 360 hospitals and 317,000 providers across 50 states in the United States, up through July 29, 2020, and compares COVID-19 infection rates among people with and without a recent psychiatric diagnosis. The analysis shows a higher risk of COVID-19 infection among people with recent psychiatric illness with a more than 7-fold increase in risk for people with depression and schizophrenia diagnoses. Increased risk was observed also for diagnoses of bipolar disorder and attention-deficit/hyperactivity disorder. There is also evidence of greater hospitalization and mortality rates among COVID-19 cases with a previous psychiatric history. Patients with both a recent diagnosis of a mental disorder and COVID-19 infection had a death rate of 8.5 vs. 4.7% among COVID-19 patients with no mental disorder and a hospitalization rate of 27.4% (vs. 18.6% among COVID-19 patients with no mental disorder, $p < 0.001$). Women were at higher risk than men.

The findings reported by Taquet et al. show a similar pattern. They compare 1,729,837 individuals with a psychiatric diagnosis in the previous year with a matched sample of the same size with no psychiatric history. There is a 65% increase in risk of COVID-19 for people with a recent psychiatric history. Older people (older than 75 years) were at higher risk with no differences observed between men and women.

Yang et al. (73) show that psychiatric hospitalization before the pandemic was associated with elevated odds of COVID-19 diagnosis (OR 1.44, 95% CI 1.28–1.62), COVID-19 inpatient hospitalization (1.55, 1.34–1.78), and COVID-19–related death (2.03, 1.59–2.59).

Hao et al. shows that levels of anxiety, depression, stress, and insomnia are higher in psychiatric patients during the pandemic and the lockdown, and psychiatric patients have more health concerns, impulsivity, and suicidal ideation with more than one third of them who fulfill the diagnostic criteria for PTSD. Poor physical health is also associated with higher levels of anxiety, depression, and stress-related symptoms.

Chevance et al. (74) identify four types of major vulnerabilities in patients suffering from mental disorders and who have to face the pandemic: (1) medical comorbidities that are more frequently found in psychiatric patients and that represent risk factors for severe COVID-19; (2) old age as an independent risk factor for both psychiatric diseases and COVID-19; (3) cognitive and behavioral troubles that can hamper compliance with confinement and hygiene measures; (4) psychosocial vulnerability due to stigmatization and/or socioeconomic difficulties.

As suggested by Steptoe (75), many COVID-19 symptoms are non-specific, and they might not be quickly recognized as originating from a SARS-CoV-2 infection, particularly by people with mental health problems who daily experience many physical symptoms. This could lead to a delay in recognition of the infection and in prompt therapeutic intervention, possibly resulting in rapid worsening of the disease. On the other hand, according to Steptoe's hypothesis, it is nevertheless possible to speculate that people with psychiatric problems are more likely to attend health care facilities where they could come into close contact with potentially infectious patients or with super-spreader hospital staff.

In the cited retrospective analysis by Taquet et al. (70), COVID-19 infection increases risk of psychiatric sequelae in the 3 months following diagnosis. COVID-19 patients have a greater likelihood of being diagnosed for the first time with a psychiatric disease compared with other subsequent health problems, such as influenza, upper respiratory tract infections, skin infections, bone fractures, and lithiasis diseases, with HR ranging from 1.3 to 2.5. The greatest risks were found for anxiety disorder, insomnia, and dementia.

The Alliance Between Psychiatrists and Psychologists

In this time of pandemic emergency, mental health workers appear more vulnerable to work-related stress than other colleagues employed in different health care categories. A survey on mental health workers in Lombardy, the epicenter of the Italian COVID-19 epidemic, shows ∼31% of the participants obtained a severe score in at least one of the burnout dimensions, 11.6% had moderate or severe levels of anxiety, and 6.6% had moderate or severe level of depression (76). Mental health workers' efforts to maintain the continuity of psychiatric care during the pandemic are challenging, especially in Italy where the number of psychiatrists, psychologists, and other figures (nurses, social workers, occupational therapists, rehabilitation counselors, and auxiliary staff) is chronically under-dimensioned. According to the 2018 report of the Italian Ministry of Health, the total number of psychiatrists and psychologists employed in Italian public and accredited mental health departments is 3.870 and 2.384, respectively (77). This dramatically small number of mental care specialists should be rapidly increased through specific health care policies in view of the predictable rise of the number of new diagnoses of post-COVID mental illness in the next months and years.

CONCLUSIONS

The COVID-19 pandemic, which is at an exceptional level due to its interconnected implications on people's lives and well-being, on the functioning of health services, and on the economy of all nations, imposes the need to adopt a non-reductionist vision that does not examine and address the problems in a separate and parceled manner but that is capable of reading the complexity of the phenomenon. From this point of view, having a clear link between biomedical, psychological, and social aspects—which have already been highlighted by extensive evidence (32, 78, 79)—is essential if we want to overcome the challenge and allow for there to be a new start that can only take place on a new scientific and governance basis on a supranational scale.

To this end, we believe it is useful to participate in and support research programs that propose a multidisciplinary approach to the study of the pandemic and its multiple and interconnected global effects (80).

The studies on the Italian pandemic, the results of which we have analyzed, show a widespread state of psychological distress which, according to decades of scientific and clinical evidence on the relationship between mental states and immune system efficiency that we review in this work, plausibly weakens the resistance of individuals and the population to SARS-CoV-2 infection. Italy can deploy a great force, represented by tens of thousands of psychologists, psychotherapists, and psychiatrists, who could be employed, alongside local and hospital medicine, in primary care and in promoting the resilience of citizens and health workers themselves, who are subject to work stress that also includes a threat to their lives.

It is urgent to cement the alliance between medicine and psychology and between psychologists and psychiatrists with other mental health professionals in a framework of integration of mental health care to make real the unifying concept "no health without mental health" (69, 81) even during this threatening time.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

All authors have contributed equally to the design, writing, and revision of the text.

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Mental Health Impacts in Argentinean College Students During COVID-19 Quarantine

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Background: We aimed to: (1) analyze differences in both general (in terms of psychological well-being/discomfort, social functioning and coping, and psychological distress) and specific (depression, trait-anxiety, negative alcohol-related consequences, and suicidal risk) mental health state (MHS) in college students, residing in four different Argentinean regions (center, north, south, and the most populated) exposed to different spread-rates of the COVID-19; (2) analyze between-group differences in both general and specific MHS indicators at four quarantine sub-periods (twice prior, and twice following the first quarantine extension).

Methods: We used a cross-sectional design with a convenience sample including 2,687 college students. Data was collected online during the Argentinean quarantine. We calculated one-way between-groups ANOVA with Tukey's *post hoc* test.

Results: Regionally, the center and the most populated area differed in psychological well-being/discomfort and negative alcohol-related consequences, but not in the remaining MHS indicators. According to the quarantine sub-periods, there were differences in psychological well-being/discomfort, social functioning and coping, psychological distress, and negative alcohol-related consequences. Negative alcohol-related consequences were the only MHS indicator improving over time. For all of the remaining MHS indicators, we found a similar deterioration pattern in the course of time, with mean scores decreasing from the first to the 2nd week of the quarantine pre-extensions, then increasing toward the 1st week of the quarantine post-extension (with some MHS indicators reaching mean scores worse than the start), and then continued to increase.

Conclusion: A worsened mean MHS during quarantine suggests that quarantine and its extensions contribute to negative mental health impacts.

Keywords: coronavirus disease (COVID-19), quarantine, anxiety, learned helplessness, social isolation, depressive symptoms, COVID-19

INTRODUCTION

Coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered coronavirus. The current outbreak started in China during late 2019 and subsequently spread around the world. On 11th March 2020, the World Health Organization (WHO) declared this outbreak as a pandemic (1). Until when effective vaccines against COVID-19 are available on a large scale, social-distancing including travel bans, is one of the most effective interventions to contain the spread of the pandemic. Isolation and quarantine are the control and preventive measures most used by governments. While isolation consists of separating people who have been diagnosed with a contagious disease, from the general population, quarantine consists of separating and restricting the movement of people who are not sick, but may potentially been exposed to a contagious disease, thus reducing the risk of infecting others (2).

By the end of March 2020, a third of the world's population was living under quarantine (3). In Latin America, Argentina was one of the countries earliest in adopting varied social-distancing preventive interventions and related socio-economic decisions since 10th March 2020 (4). A presidential decree (number 297/2020) established that quarantine became mandatory for all Argentinean inhabitants—except for those working in essential services—from 20th to 31st March 2020. However, on 29th March, the first quarantine extension was announced for until 13th April. Then on 10th April, a second extension was implemented by the Government for until 26th April, and subsequently several additional extensions were implemented thereafter, reaching a quarantine duration of 285 days.

Reviews on the psychological impact of previous quarantine situations reported negative psychological effects related to quarantine, e.g., post-traumatic stress, depressive and anxiety symptoms, anger, distress, and other general psychological symptoms (5). Moreover, some of these quarantine effects would be long-lasting (6). As for the current COVID-19 pandemic, negative psychological impact including depression and anxiety symptoms have also been reported in China during the initial stage of this pandemic (7). Strikingly, in younger aged groups, there are contradictory findings suggesting both that quarantine does not have immediate negative psychological effects (e.g., in undergraduate students) (8) and that young people experience greater anxiety and depression compared to older people [Urquijo as cited in (9)].

Evidence is also not conclusive on pre-quarantine predictors of psychological impact, but a younger age (16–24 years) and the female gender were reported to be associated with such impacts (10). Having a history of psychiatric illness was associated with anxiety even several months after quarantine has ended (6). Stressors during quarantine included quarantine duration, fears of infection, frustration and boredom, inadequate supplies, and inadequate information (5). Notwithstanding, longer durations of quarantine (e.g., 10-day duration) (11) were reported to either result in higher negative psychological effects (11, 12) or having no significant effect (e.g., in anxiety levels) [Urquijo as cited in (9, 13)], and it was even suggested that a kind of accustoming would occur [Urquijo as cited in (9)]. In parallel, it was described that an extension of quarantine duration, irrespective of how small, is likely to exacerbate negative psychological effects (14).

Taken together, there is certitude that the current *world quarantine* was unprecedented and the psychological effects of quarantining a city, a country, or a third of the world, are unknown. However, regardless of whether it succeeds in controlling the pandemic, it is expected that the widespread quarantine will inevitably have a psychological effect (15). Equally, in Argentina, having the whole country population under quarantine was unprecedented and the subsequent psychological impacts are unknown. The effect of large-scale disease outbreaks on adolescents' mental health is an important gap for research (16). College closures substantially disrupt the lives of students (16, 17). In addition, the psychological impacts in Argentinean populations from different regions may differ among them due to two main reasons. One, they have different idiosyncratic features. Two, they were exposed to different spread-rates of the COVID-19 (18). The aims of this research are 2-fold: (1) to analyze differences in both general (i.e., in terms of psychological well-being/discomfort, social functioning and coping, and psychological distress) and specific (i.e., in terms of depression, trait-anxiety, negative alcohol-related consequences, and suicidal risk) mental health state (MHS) in college students, residing in provinces from four different regions (north, center, south, and the most populated) of Argentina exposed to different spread-rates of the COVID-19; (2) to analyze between-group differences in both general and specific MHS indicators at four quarantine sub-periods (twice prior, and twice following the first quarantine extension).

METHOD

Sample and Procedure

This study used a cross-sectional design. Sampling was one of convenience. Data were collected since 17th March (i.e., 3 days before quarantine became mandatory, but when quarantine was already strongly recommended by the Government to all Argentinean inhabitants) until 29th April 2020 (i.e., during the mandatory Argentinean quarantine). Collection procedure was carried out *via* online, by using the LimeSurvey software (UNC license). For data collection, this study was posted many times on social networks (Facebook, Twitter, and Instagram) and then liked, re-tweeted, and/or shared by many people, throughout the period of Argentina's quarantine analyzed in this study. The invitations to participate contained a brief mention to the general aim, inclusion criteria (being a college student at any public or private university in Argentina, being Argentinean, having 18 years of age or older, currently residing in one of the following Argentinean provinces: Jujuy, Salta, Santa Cruz, Tierra del Fuego, Córdoba or Buenos Aires), and the link for the online survey. Upon accessing the survey, participants were initially presented with the information sheet and informed consent form approved by the Ethics Committee of the Institute of Psychological Research, Faculty of Psychology, National University of Córdoba. After giving their consent to participate, participants were presented with a series of questions aimed to check compliance with the inclusion criteria. Safety procedures included a feedback

FIGURE 1 | Map of Argentina showing the location of the northern, central, most populated, and southern regions. The most populated area corresponds to the Buenos Aires City (CABA) and the Buenos Aires Province.

email to each subject after participation, which contains the scores obtained in each instrument along with a brief description on what these scores mean, and contact information on mental health services available free of charge. These emails also had the function to raise awareness of their own-mental health status.

A total of 3,870 Argentinean college students participated in the online survey, but 1,183 (30.57%) did not complete the survey. In this paper, we focused only on the sample that completed the online survey. Therefore, the sample was composed of 2,687 college students (81.58% women, 17.60% men, 0.82% other) from 18 years of age (M_{age} = 22.74, standard deviation [±SD] ±3.64), residing in one of six different Argentinean provinces (**Figure 1**).

Instruments

(A) *General Mental Health State (GMHS)*

Psychological well-being/discomfort and *Social functioning and coping*. We used the General Health Questionnaire (GHQ-12) (19), in its Argentinean validation (Cronbach's alpha = 0.80) (20). This is a 12-item measure, which evaluates the general dimension of self-perceived health and allows for discrimination in two dimensions (six items each): (a) unspecific psychological well-being/discomfort, and (b) social functioning and coping. The higher the score, the worse is the self-perceived health.

Psychological distress. We used the Kessler Psychological Distress Scale (K-10) (21), in its Argentinean validation (Cronbach's alpha = 0.88) (22). This is a 10-item global dimensional measure of non-specific psychological distress, which evaluates symptoms related to depression and anxiety, indicating the risk to suffer psychological distress but does not specify the disorder. Higher scores indicate higher psychological distress.

(B) *Specific Mental Health State (SMHS)*

Depression. We used the Beck Depression Inventory (BDI-II) (23) in its Argentinean version (Cronbach's alpha = 0.86) (24). This is a 21-item instrument measuring depression and its severity. Its items describe the most frequent clinical symptoms of depressed subjects. In non-clinical populations, scores above 20 indicate depression (25).

Trait-Anxiety. We used the 20-items subscale for trait-anxiety of the State-Trait Anxiety Inventory (STAI) in its Spanish version (Cronbach's alpha = 0.84/0.87) (26). This subscale measures anxiety-related symptoms, such as restlessness, nervousness, and agitation. Higher scores indicate more anxiety symptoms.

Negative alcohol-related consequences. We used the Brief Young Adult Alcohol Consequences Questionnaire (B-YAACQ) (27), in its Argentinean version (Cronbach's alpha = 0.78) (28). This is a 24-item measure on negative alcohol-related consequences over the past year among college students. Higher scores indicate worse alcohol-related consequences.

Suicidal risk. We used the Inventory of Suicide Orientation (ISO-30) (29), in its Argentinean validation (Cronbach's alpha = 0.88) (30), a 30-item evaluation tool which helps in identifying suicidal risk. Higher scores indicate higher suicidal risk.

Data Analysis

We performed all data analysis with RStudio version 3.6.3 (31). We considered p-values $\leq$ 0.05 as statistically significant. We reported exact p-values, except for p-values under 0.001, where we reported as $<$ 0.001. Likewise, 95% confidence intervals (CI) were informed when corresponded. Skewness and kurtosis were calculated in all factors of both general and specific MHS. Since these scores were in the range of acceptable values or near to (−3 and 3) (32), parametric tests were applied. Given that during data collection all items were marked as mandatory response, there were no missing data to handle. For addressing the two aims of this research, we applied one-way between-groups ANOVA with Tukey's *post hoc* test.

For analyses corresponding to the first aim, we divided the entire sample into four groups: (a) participants residing in Jujuy and Salta provinces, named as the *north* region (n = 371); (b) participants residing in Córdoba province, named as the *center* region (n = 1,048); (c) participants residing in Santa Cruz and Tierra del Fuego provinces, named as the *south* region (n = 89); (d) participants residing in Buenos

Aires [including both the Buenos Aires City (CABA) and the Buenos Aires Province], named as the *most populated* region ($n = 1,179$).

For analyses corresponding to the second aim, we divided the entire sample into four groups: (a) participants answering during 17–23 March 2020, i.e., 1st week of data collection before the quarantine extension, named as *1st week of quarantine pre-extension* ($n = 1508$); (b) participants answering during 24–29 March 2020, named as *2nd week of quarantine pre-extension* ($n = 525$); (c) participants answering during 30 March to 05 April 2020, named as *1st week of quarantine post-extension* ($n = 364$); (d) participants answering during 06–29 April 2020, named as *remaining weeks of quarantine post-extension* ($n = 290$).

RESULTS

Differences in Mental Health State by Regions

Regarding general MHS by regions, a statistically significant difference was found in psychological well-being/discomfort [$F_{(3)} = 4.57$, *p-value* $= 0.003$]. This difference was observed between the center and the most populated region, but not between the remaining regions (**Table 1**). Mean scores (±SD) of psychological well-being/discomfort were (in decreasing order) 3.21 (±1.83) in the most populated region, 3.15 (±1.84) in the north, 3.10 (±1.73) in the south, and 2.92 (±1.84) in the center. Conversely, no significant differences by regions were found in social functioning and coping [$F_{(3)} = 1.51$, *p-value* $=$ 0.21] (**Table 1**), with mean scores of 2.26 (±1.96) in the north, 2.19 (±1.90) in the most populated region, 2.18 (±1.87) in the south, and 2.06 (±1.83) in the center. Likewise, no significant differences by regions were found in psychological distress [$F_{(3)} = 1.31$, *p-value* $= 0.27$] (**Table 1**), with mean scores of 26.30 (±7.80) in the south, 25.76 (±8.09) in the most populated region, 25.46 (±8.20) in the north, and 25.16 (±8.12) in the center.

Regarding specific MHS by regions, a statistically significant difference was found in negative alcohol-related consequences [$F_{(3)} = 6.90$, *p-value* < 0.001]. This difference was observed between the most populated and the center region, but not between the remaining regions (**Table 1**). Mean scores were 4.33 (±4.23) in the south, 4.02 (±3.88) in the center, 3.82 (±4.21) in the north, and 3.33 (±3.66) in the most populated region. Conversely, no significant differences by regions were found in depression [$F_{(3)} = 1.94$, *p-value* $= 0.12$], anxiety [$F_{(3)} = 1.24$, *p-value* $= 0.29$], nor in suicidal risk [$F_{(3)} =$ 1.78, *p-value* $= 0.15$] (**Table 1**). In depression, mean scores were 19.09 (±10.76) in the south, 18.61 (±11.00) in the north, 18.26 (±11.16) in the most populated region, and 17.40 (±10.83) in the center. In anxiety, mean scores were 30.68 (±10.27) in the south, 29.48 (±11.57) in the most populated region, 29.41 (±11.09) in the north, and 28.79 (±11.35) in the center. In suicidal risk, mean scores were 36.62 (±15.92) in the south, 35.06 (±15.47) in the north, 34.99 (±16.60) in the most populated region, and 33.72 (±16.45) in the center.

TABLE 1 | Multiple comparisons[a] of means in mental health state scores by regions.

Regions	Dif	Lower	Upper	*p* adj
Psychological well-being/discomfort				
Most populated–Center	0.28	0.08	0.48	0.002
North–Center	0.23	−0.05	0.51	0.16
South–Center	0.18	−0.34	0.70	0.82
North–Most populated	−0.05	−0.33	0.23	0.96
South–Most populated	−0.10	0.62	0.41	0.95
South–North	−0.05	−0.61	0.50	0.99
Social functioning and coping				
Most populated–Center	0.14	−0.07	0.34	0.31
North–Center	0.20	−0.09	0.49	0.28
South–Center	0.12	−0.41	0.66	0.93
North–Most populated	0.06	−0.22	0.35	0.94
South–Most populated	−0.01	−0.55	0.52	0.99
South–North	−0.08	−0.65	0.49	0.98
Psychological distress				
Most populated–Center	0.60	−0.28	1.48	0.30
North–Center	0.30	−0.96	1.56	0.93
South–Center	1.14	−1.16	3.44	0.58
North–Most populated	−0.30	−1.54	0.94	0.92
South–Most populated	0.54	−1.75	2.83	0.93
South–North	0.84	−1.62	3.30	0.81
Depression				
Most populated–Center	0.86	−0.34	2.06	0.25
North–Center	1.21	−0.50	2.92	0.26
South–Center	1.69	−1.43	4.81	0.50
North–Most populated	0.35	−1.33	2.03	0.95
South–Most populated	0.83	−2.28	3.93	0.90
South–North	0.48	−2.86	3.81	0.98
Anxiety				
Most populated–Center	0.69	−0.55	1.94	0.47
North–Center	0.63	−1.14	2.39	0.80
South–Center	1.90	−1.33	5.13	0.43
North–Most populated	−0.07	−1.81	1.67	0.99
South–Most populated	1.20	−2.01	4.42	0.77
South–North	1.27	−2.18	4.72	0.78
Negative alcohol-related consequences				
Most populated–Center	−0.69	−1.11	−0.27	0.0002
North–Center	−0.19	−0.79	0.40	0.84
South–Center	0.31	−0.78	1.40	0.89
North–Most populated	0.49	−0.10	1.08	0.14
South–Most populated	0.99	−0.09	2.08	0.09
South–North	0.50	−0.66	1.67	0.68
Suicidal risk				
Most populated–Center	1.27	−0.51	3.06	0.26
North–Center	1.34	−1.20	3.88	0.53
South–Center	2.90	−1.74	7.54	0.38
North–Most populated	0.07	−2.44	2.57	0.99

(Continued)

TABLE 1 | Continued

Regions	Dif	Lower	Upper	*p* adj
South–Most populated	1.63	−3.00	6.25	0.80
South–North	1.56	−3.41	6.52	0.85

Dif, Difference; Lower–Upper, Lower and upper limits of 95% confidence intervals; p adj, Adjusted p-value; North, Jujuy and Salta provinces; Center, Córdoba province; South, Santa Cruz and Tierra del Fuego provinces; Most populated, City of Buenos Aires (Ciudad Autónoma de Buenos Aires, CABA) and the Buenos Aires Province.
[a] Multiple comparison of means based on Tukey's post hoc test.

Differences in Mental Health State by Quarantine Sub-Periods

Regarding general MHS by quarantine sub-periods, statistically significant differences were found in psychological well-being/discomfort [$F_{(3)} = 8.31$, *p-value* < 0.001], in social functioning and coping [$F_{(3)} = 8.14$, *p-value* < 0.001], and in psychological distress [$F_{(3)} = 3.65$, *p-value* $= 0.01$]. These differences were observed between several quarantine sub-periods (**Table 2**). In psychological well-being/discomfort, social functioning and coping, and psychological distress, mean scores decreased from the 1st to the 2nd week of quarantine pre-extension, followed by an increase during the 1st week of quarantine post-extension (where mean scores were higher than the initial measurements in psychological well-being/discomfort and in social functioning and coping), and continued to increase in the remaining weeks of quarantine post-extension (**Table 3**; **Supplementary Figures 1–3**).

Regarding specific MHS by quarantine sub-periods, a statistically significant difference was found in negative alcohol-related consequences [$F_{(3)} = 2.86$, *p-value* $= 0.03$]. This difference was observed between the 1st week of quarantine pre-extension and the remaining weeks of quarantine post-extension, but not between the other sub-periods (**Table 2**). Mean scores of negative alcohol-related consequences decreased as quarantine sub-periods progressed (**Table 3**; **Supplementary Figure 6**). Conversely, no significant differences by quarantine sub-periods were found in depression [$F_{(3)} = 1.09$, *p-value* $= 0.35$], anxiety [$F_{(3)} = 1.14$, *p-value* $= 0.33$], nor in suicidal risk [$F_{(3)} = 2.53$, *p-value* $= 0.055$] (**Table 2**). In depression, anxiety, and suicidal risk, mean scores decreased from the 1st to the 2nd week of quarantine pre-extension, followed by an increase during the 1st week of quarantine post-extension (where mean scores were higher than the initial measurements in depression), and continued to increase in the remaining weeks of quarantine post-extension (**Table 3**; **Supplementary Figures 4, 5, 7**).

DISCUSSION

Toward the end of April, available official data (18) indicates that spread-rates of the COVID-19 were high in provinces such as Buenos Aires, were relatively high in center provinces (e.g., Córdoba), were medium in southern provinces (e.g., Tierra del Fuego), and were low in northern provinces (e.g., Jujuy and Salta). Our findings indicate that worse self-perceived health, in terms of unspecific psychological discomfort, affected more college students residing in the region with the highest COVID-19 spread-rates (i.e., most populated region), compared to those residing in the center region, where spread-rates are relatively high. Conversely, negative alcohol-related consequences affected less college students in the former region as compared to the latter.

On the other hand, living in regions with higher, medium or lower spread-rates of the COVID-19 do not appear to produce significant differences in social functioning and coping, psychological distress, depression, anxiety, nor suicidal risk. This would imply that such mental health impacts during quarantine may be attributed to aspects related to social distancing, isolation, and routine disruptions, rather than the objective risk of contagion.

Based on the literature, a negative psychological impact of quarantine was expected to be found (5, 15). Our findings confirmed this expectation, with additional insights upon duration, a relevant aspect in the impact of quarantine. Our findings indicated that, for people already in quarantine, an extension of quarantine duration exacerbated negative mental health impacts, escalating a sustained worsening on MHS as time went by. Therefore, our findings support the assertion that indefinite quarantine duration may be more detrimental on mental health than applying limited periods (5).

Negative alcohol-related consequences was the only MHS indicator that improved over time, suggesting that higher alcohol consumption among college students is dependent on contexts of consumption (33, 34) and positive alcohol expectancies (33, 35, 36). Except for negative alcohol-related consequences, our findings revealed a similar worsening pattern for all the remaining MHS indicators as time went by. This pattern consisted in mean scores decreasing from the 1st to the 2nd week of quarantine pre-extension, then increasing toward the 1st week of quarantine post-extension (with some MHS indicators reaching mean scores worse than initially measured), and continued to increase thereon.

We disagree with the viewpoint that enquiring on suicidal thoughts or behaviors during quarantine may be "counterproductive" and, thus, should be avoided [Urquijo as cited in (9, 37)]. This kind of viewpoint both in research and clinical settings creates a catch-22 situation (38). Contrary to this, we based our standpoint from the available literature indicating that, by asking and talking about suicide may in fact reduce, rather than increase, suicidal ideation and may lead to improvements in mental health in treatment-seeking populations (38, 39). For these reasons, in this study we have administered a specific instrument for measuring suicidal risk, which demonstrated that suicidal risk follows the same worsening pattern as the other MHS indicators.

There are opposing findings on whether quarantine does [Urquijo and Andrés as cited in (9)] or does not (8) cause negative psychological effects in young people. Conspicuously, different studies presented a similar argument based on typical behaviors, customs, and responsibilities of young people in order to interpret these divergent findings. Indeed, it was

TABLE 2 | Multiple comparisons[a] of means in mental health state scores by quarantine sub-periods.

Quarantine sub-periods	Dif	Lower	Upper	*p* adj
Psychological well-being/discomfort				
1. 1st week of quarantine pre-extension−2. 2nd week of quarantine pre-extension	−0.14	−0.37	0.10	0.46
1. 1st week of quarantine pre-extension−3. 1st week of quarantine post-extension	0.20	−0.07	0.48	0.23
1. 1st week of quarantine pre-extension−4. Remaining weeks of quarantine post-extension	0.48	0.18	0.78	0.0003
2. 2nd week of quarantine pre-extension−3. 1st week of quarantine post-extension	0.34	0.02	0.66	0.03
2. 2nd week of quarantine pre-extension−4. Remaining weeks of quarantine post-extension	0.61	0.27	0.96	0.00003
3. 1st week of quarantine post-extension−4. Remaining weeks of quarantine post-extension	0.27	−0.10	0.64	0.23
Social functioning and coping				
1. 1st week of quarantine pre-extension−2. 2nd week of quarantine pre-extension	−0.03	−0.27	0.22	0.99
1. 1st week of quarantine pre-extension−3. 1st week of quarantine post-extension	0.30	0.02	0.58	0.03
1. 1st week of quarantine pre-extension−4. Remaining weeks of quarantine post-extension	0.50	0.19	0.81	0.0002
2. 2nd week of quarantine pre-extension−3. 1st week of quarantine post-extension	0.33	0.002	0.66	0.05
2. 2nd week of quarantine pre-extension−4. Remaining weeks of quarantine post-extension	0.53	0.18	0.88	0.0006
3. 1st week of quarantine post-extension−4. Remaining weeks of quarantine post-extension	0.20	−0.18	0.58	0.53
Psychological distress				
1. 1st week of quarantine pre-extension−2. 2nd week of quarantine pre-extension	−0.53	−1.58	0.53	0.57
1. 1st week of quarantine pre-extension−3. 1st week of quarantine post-extension	−0.20	−1.42	1.01	0.97
1. 1st week of quarantine pre-extension−4. Remaining weeks of quarantine post-extension	1.39	0.05	2.72	0.04
2. 2nd week of quarantine pre-extension−3. 1st week of quarantine post-extension	0.32	−1.09	1.74	0.94
2. 2nd week of quarantine pre-extension−4. Remaining weeks of quarantine post-extension	1.91	0.39	3.44	0.007
3. 1st week of quarantine post-extension−4. Remaining weeks of quarantine post-extension	1.59	−0.05	3.23	0.06
Depression				
1. 1st week of quarantine pre-extension−2. 2nd week of quarantine pre-extension	−0.52	−1.95	0.91	0.79
1. 1st week of quarantine pre-extension−3. 1st week of quarantine post-extension	0.17	−1.48	1.83	0.99
1. 1st week of quarantine pre-extension−4. Remaining weeks of quarantine post-extension	0.91	−0.90	2.73	0.56
2. 2nd week of quarantine pre-extension−3. 1st week of quarantine post-extension	0.70	−1.23	2.62	0.79
2. 2nd week of quarantine pre-extension−4. Remaining weeks of quarantine post-extension	1.44	−0.63	3.50	0.28
3. 1st week of quarantine post-extension−4. Remaining weeks of quarantine post-extension	0.74	−1.49	2.97	0.83
Anxiety				
1. 1st week of quarantine pre-extension−2. 2nd week of quarantine pre-extension	−0.83	−2.31	0.66	0.48
1. 1st week of quarantine pre-extension−3. 1st week of quarantine post-extension	−0.50	−2.20	1.21	0.88
1. 1st week of quarantine pre-extension−4. Remaining weeks of quarantine post-extension	0.51	−1.37	2.38	0.90
2. 2nd week of quarantine pre-extension−3. 1st week of quarantine post-extension	0.33	−1.66	2.32	0.97
2. 2nd week of quarantine pre-extension−4. Remaining weeks of quarantine post-extension	1.33	−0.81	3.48	0.38
3. 1st week of quarantine post-extension−4. Remaining weeks of quarantine post-extension	1.00	−1.30	3.31	0.68
Negative alcohol-related consequences				
1. 1st week of quarantine pre-extension−2. 2nd week of quarantine pre-extension	−0.30	−0.80	0.20	0.42
1. 1st week of quarantine pre-extension−3. 1st week of quarantine post-extension	−0.38	−0.96	0.20	0.32
1. 1st week of quarantine pre-extension−4. Remaining weeks of quarantine post-extension	−0.62	−1.26	0.01	0.05
2. 2nd week of quarantine pre-extension−3. 1st week of quarantine post-extension	−0.08	−0.76	0.59	0.99
2. 2nd week of quarantine pre-extension−4. Remaining weeks of quarantine post-extension	−0.32	−1.05	0.40	0.66
3. 1st week of quarantine post-extension−4. Remaining weeks of quarantine post-extension	−0.24	−1.02	0.54	0.86
Suicidal risk				
1. 1st week of quarantine pre-extension−2. 2nd week of quarantine pre-extension	−2.09	−4.22	0.04	0.06
1. 1st week of quarantine pre-extension−3. 1st week of quarantine post-extension	−0.37	−2.82	2.09	0.98
1. 1st week of quarantine pre-extension−4. Remaining weeks of quarantine post-extension	0.62	−2.08	3.31	0.94
2. 2nd week of quarantine pre-extension−3. 1st week of quarantine post-extension	1.72	−1.15	4.58	0.41
2. 2nd week of quarantine pre-extension−4. Remaining weeks of quarantine post-extension	2.70	−0.37	5.78	0.11
3. 1st week of quarantine post-extension−4. Remaining weeks of quarantine post-extension	0.99	−2.32	4.30	0.87

Dif, Difference; Lower–Upper, Lower and upper limits of 95% confidence intervals; p adj, Adjusted p-value; 1. 1st week of quarantine pre-extension, participants answering during 17–23 March 2020, i.e., 1st week of data collection before quarantine extension; 2. 2nd week of quarantine pre-extension, participants answering during 24–29 March 2020, i.e., 2nd week of data collection before quarantine extension; 3. 1st week of quarantine post-extension, participants answering during 30 March to 05 April 2020, i.e., 1st week of data collection after quarantine extension; 4. Remaining weeks of quarantine post-extension, participants answering during 06–29 April 2020, remaining weeks of data collection after quarantine extension.
[a]Multiple comparison of means based on Tukey's post hoc test.

TABLE 3 | Central tendencies and variability measures in mental health state scores by quarantine sub-periods.

Mental health state indicators	Mean (±SD)			
	1st week pre-ext.	**2nd week pre-ext.**	**1st week post-ext.**	**Rem. weeks post-ext.**
Psychological well-being/discomfort	3.03 (±1.82)	2.90 (±1.82)	3.24 (±1.89)	3.51 (±1.80)
Social functioning and coping	2.06 (±1.84)	2.03 (±1.83)	2.36 (±1.97)	2.56 (±1.99)
Psychological distress	25.48 (±7.98)	24.96 (±8.22)	25.28 (±8.00)	26.87 (±8.57)
Depression	17.98 (±10.91)	17.46 (±10.90)	18.16 (±10.80)	18.90 (±11.88)
Anxiety	29.42 (±11.23)	28.59 (±11.58)	28.92 (±11.25)	29.92 (±11.94)
Negative alcohol-related consequences	3.88 (±3.85)	3.58 (±3.73)	3.49 (±4.00)	3.25 (±3.93)
Suicidal risk	34.95 (±16.42)	32.86 (±16.04)	34.58 (±16.11)	35.56 (±16.87)

±SD, standard deviation; 1st week-pre., 1st week of quarantine pre-extension (participants answering during 17–23 March 2020, i.e., 1st week of data collection before quarantine extension); 2nd week-pre., 2nd week of quarantine pre-extension (participants answering during 24–29 March 2020, i.e., 2nd week of data collection before quarantine extension); 1st week post-ext., 1st week of quarantine post-extension (participants answering during 30 March to 05 April 2020, i.e., 1st week of data collection after quarantine extension); Rem. weeks post-ext., Remaining weeks of quarantine post-extension (participants answering during 06–29 April 2020, remaining weeks of data collection after quarantine extension).

suggested that quarantine does not cause negative mental health effects in young people, such as undergraduate students, as they have fewer responsibilities than adults who are employed full-time (5). Similarly, it was argued that young people currently under quarantine would experience the highest levels of anxiety and depression as they are accustomed to socialization and to have more community relationships outside of their homes than adults [Urquijo as cited in (9)]. While it is tacitly assumed that young people have fewer liabilities and/or responsibilities than adults, young people—for instance, college students—have liabilities and responsibilities related to their studies and, in many cases, also related to their parallel employments. Likewise, such interpretation does not comment on the influence of relevant factors, such as significantly reduced face-to-face social interactions, limited outdoor opportunities, living space adequacy (e.g., size, brightness, and privacy), disruption of routine activities, and experiences and attitudes toward COVID-19, among others, acting upon young people during quarantine. These latter factors are postulated to have more relevance, than the amount of responsibilities, in the interpretation of psychological impacts of quarantines (40–42). Concerning routines aforementioned, Urquijo [as cited in (9)] as well as Canet Juric et al. (37) suggested that current depressive and anxiety symptoms, and negative emotions decrease in the Argentinean population as time passes, by reason of accustoming to the quarantine. However, our observations are not in-line with this assertion and thus, we propose an alternative hypothesis for interpreting such findings. In this regard, we hypothesize that subjective perceptions of symptoms may have changed gradually, perhaps mimicking a passage from egodystonic to egosyntonic perception—which can be confounded with a health improvement or a positive adaptive behavior—although, as it is known, egosyntonic is not always a synonym of health [see, e.g., (43)]. As a result, self-reported scores on anxiety decreased [Urquijo and Andrés as cited in (9, 37)], but for a different reason from what was argued by these authors. We think that such a decrease does not imply that isolation or quarantine may be natural for human beings or, in other words, that people become accustomed to this situation. During quarantine, alike other situations (e.g., marital violence), people may tend to accept or naturalize situations, behaviors or reactions that are abnormal or unhealthy, but it is the role of healthcare workers and scientists to warn about these processes rather than legitimize it. Indeed, we propose that such a decrease in self-reported scores on anxiety and the increase in scores on depression [Urquijo as cited in (9, 37)] are more likely caused by a state of learned helplessness instead of a positive adaptive "accustoming" as stated by these authors.

Regarding the learned helplessness paradigm, this has long been proven to be a valid and reliable depression-like behavior model in animals (44) and has been shown to be reproducible in human subjects (45). The developmental trajectory described in animal models as learned helplessness or social defeat consists, in brief: 1°) the organism exhibits increasing anxiety-like behaviors, searching for ways of escaping or controlling an environment that has become threatening, 2°) the organism generalizes the learning that he/she has no control over its environment and anxiety-like behaviors decrease, 3°) further generalizes that the environment is inherently threatening and depression develops or increases, and 4°) ultimately leads the organism to give up (46). Our findings—and to some extent, results reported by Urquijo and Andrés [as cited in (9)], and Canet Juric et al. (37)—may correspond, point-by-point, with this developmental trajectory: steps 1° and 2° of this trajectory would correspond to our results during the first and second period of the quarantine pre-extension, e.g., with anxiety decreasing from the 1st to the 2nd week; step 3° of this trajectory would correspond with the worsening in MHS indicators (1st week of quarantine post-extension), e.g., mean scores on depression worsen than at the start and then approaching clinical depression; and step 4° of this trajectory would be represented in our results by the increased deterioration in MHS indicators (remaining weeks of quarantine post-extension). The effects of learned helplessness have a strong impact not only on behavior but also on physiological functioning, e.g., producing stress-induced analgesia and the activation of endogenous opiate systems (47). Fortunately, these effects can be reversed, for instance, by antidepressant treatment (48, 49), therapy (50), and also *via* experiencing controllable events (51). Evidently, in order for treatments and prevention to be possible, we need to be familiar with these processes rather than simply assuming that people naturally become accustomed to being quarantined.

Findings of our study may be useful for public health officials and government officials who must decide upon sanitary measures, public policies, and communication; however, they need to be interpreted with caution and considered within the context of several limitations. First, this study was cross-sectional, and prospective research is warranted to test hypotheses emerged from here. Second, our sample was one of convenience and it is unclear to what extent our results could be representative of the Argentinean population. However, we have used a sample as representative as possible, by including participants from different Argentinean regions, each one representing different idiosyncratic features and exposed to different spread-rates of the COVID-19. Third, this study has focused on university students, which could differ from young people not in the university (52), but who are also quarantined. Fourth, along with the quarantine and its extensions, additional factors not assessed in this study, such as fear of COVID-19 infection, pre-existing vulnerabilities, and financial consequences, among others, could have influence on the mental health outcomes. Despite these limitations, we think that our findings remain valuable and help shed light for further research on mental health impacts of the current quarantine, which is a pressing public health concern.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study and the reproducible R code for data analysis are available in the Open Science Framework (OSF) repository, doi: 10.17605/OSF.IO/ZRX6T.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Comité de Ética del Instituto de Investigaciones Psicológicas de la Facultad de Psicología de la Universidad Nacional de Córdoba y del CONICET. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

LL has elaborated the research project, designed the online protocol for this research, participated in the data collection, has written the R code, performed the data analysis, and written the manuscript. CL and MD have participated in the data collection and carried-out bibliography searches. SF has participated in the data collection, made bibliography searches, and revised the manuscript for English grammar. RS has participated in the data collection, made bibliography searches, elaborated the **Figure 1**, and revised the manuscript. JG has participated in the data collection, made bibliography searches, supervised the study, and revised the manuscript. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2021.557880/full#supplementary-material

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COVID-19: Mental Health Prevention and Care for Healthcare Professionals

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The Coronavirus Disease 2019 (COVID-19) pandemic exposed health professionals to high stress levels inducing significant psychological impact. Our region, *Grand Est*, was the most impacted French region during the first COVID-19 wave. In this context, we created CoviPsyHUS, local mental health prevention and care system dedicated explicitly to healthcare workers affected by the COVID-19 pandemic in one of this region's tertiary hospitals. We deployed CoviPsyHUS gradually in 1 month. To date, CoviPsyHUS comprises 60 mental health professionals dedicated to 4 complementary components: (i) a mental health support hotline (170 calls), (ii) relaxation rooms (used by 2,120 healthcare workers with 110 therapeutic workshops offered), (iii) mobile teams (1,200 contacts with healthcare staff), and (iv) a section dedicated to patients and their families. Among the critical points to integrate mental health care system during a crisis, we identified: (i) massive dissemination of mental health support information with multimodal communication, (ii) clear identification of the mental health support system, (iii) proactive mobile teams to identify healthcare professionals in difficulty, (iv) concrete measures to relieve the healthcare professionals under pressure (e.g., the relay in communication with families), (v) support for primary needs (body care (physiotherapy), advice and first-line therapy for sleep disorders), and (vi) psychoeducation and emotion management techniques. The different components of CoviPsyHUS are vital elements in meeting the needs of caregivers in situations of continuous stress. The organization of 4 targeted, modular, and rapidly deployable components makes CoviPsyHUS an innovative, reactive, and replicable mental health prevention and care system that could serve as a universal support model for other COVID-19 affected teams or other exceptional health crises in the future.

Keywords: COVID-19, healthcare professionals, continuous stress exposure, mental health, psychological crisis prevention, pandemic

INTRODUCTION

In May 2020, the Coronavirus Disease 2019 (COVID-19) pandemic affected the entire world (1). In France, the *Grand Est* (region of eastern France) was early-on massively impacted by the COVID-19 (see **Figure 1**). This region was one of the two main initial disease clusters. Due to a gathering of 2000 people (February 24–29, 2020), a favorable context to intense interindividual contamination and viral spread throughout the *Grand Est* territory emerged. In total, to date (May 07, 2020), 12,274 people were hospitalized in the Great East, and 4,665 people have died, which corresponds to 237 hospitalizations and 89 deaths per 100,000 inhabitants.

In this context, healthcare practitioners of one of the *Grand Est* reference hospitals located in Strasbourg (*Hôpitaux Universitaires de Strasbourg*, HUS; Strasbourg University Hospital; 13,000 agents) worked hard in the care of COVID-19 patients. The sudden and massive arrival of hundreds of COVID-19 patients with severe symptoms required an unprecedented increase in intensive care beds' capacity with a transition from a usual capacity of 95 beds to 207 to cope with the patient influx. The health situation quickly required the transfer of patients under mechanical ventilation by train or military planes to other French hospitals and abroad. Like many frontline clinicians fighting COVID-19, they were subjected to high stress levels inducing significant psychological impact (2–7).

Based on local, national, and international observations (8–10), the increasing need for mental health support for hospitalized patients and healthcare professionals became obvious. In this context, we created CoviPsyHUS, local mental health prevention and care system dedicated explicitly to healthcare workers affected by the COVID-19 pandemic in Strasbourg University Hospital. Initially inspired by our Asian colleagues' contributions, this system evolved to integrate caregivers' local needs optimally. We integrated CoviPsyHUS into a more extensive regional system (CoviPsy) organized concentrically according to the entire population's mental health needs, from the most exposed to the least exposed (see **Figure 2**). Indeed, previous studies highlighted the importance of such nested systems capable of guaranteeing essential care levels for all people in crisis times (11).

This article will focus on the innovative implementation of CoviPsyHUS - the subsection of CoviPsy dedicated to our hospital center - organization, clinical feedback, and progressive development. We will analyze critical elements of its rapidly deployable and efficient organization to transpose this innovative delivery of prevention and care in mental health to other teams and countries affected by COVID-19 or similar future exceptional health crises.

LOCAL CONTEXT

The care of COVID-19 patients required a rapid and massive daily reorganization of Strasbourg University Hospital activity. There was a need for changes in practices with new skills to be acquired quickly, new teams to integrate, and profound changes in relations with patients and families for all teams. In this context, Strasbourg University Hospital healthcare workers described a significant state of distress, mainly related to a feeling of vulnerability. Among distress factors, healthcare workers evoked: unfamiliarity with the virus, infectious risk (590 agents out of a total of 13,000 presented with COVID-19 symptoms), high morbidity and mortality, perceived insufficiencies of protective equipment, and unpredictability (patients' admission rapid increase, daily protocol changes). All these elements led to a feeling of losing control in a context where many professional (changes in attributed units, isolation) and personal standards (risk of contamination of loved ones, the anxiety of death, guilt, confinement) had changed. This exceptional health situation has led to unprecedented, regularly and long-lasting physical and mental pressure, placing great demands on caregivers' adaptive mechanisms to stress, both individually and collectively.

COVIPSY, A PRIMARY PREVENTION AND MENTAL HEALTH CARE SYSTEM

In Strasbourg, the CoviPsy team's knowledge and skills in medical and psychological support during exceptional sanitary situations are based on both the local Medico-Psychological Emergency Unit (*Cellule d'Urgence Médico-Psychologique*, CUMP) and of the Regional Psychotrauma Center (*Centre Régional du Psychotraumatisme CRP Grand Est*). The CUMP (12) constitutes a unique French mental health emergency system for immediate on-site intervention during and after traumatic events. The French government has recently created ten regional CRP to enhance the expertise and interventions in managing psychotrauma in the long term and complicated situations such as those encountered with the COVID-19 pandemic. Both previously existing care systems thus combine clinical expertise, responsiveness, and organizational skills. The CoviPsy system benefited from and included professional teams from CUMP and CRP.

COVIPSYHUS, A PRIMARY PREVENTION AND MENTAL HEALTH CARE SYSTEM FOR COVID-19 PATIENTS, THEIR FAMILIES, AND HEALTHCARE PROFESSIONALS

CoviPsyHUS involved mental healthcare professionals (adult psychiatrists, child and adolescent psychiatrists, psychologists, psychiatry nurses) allocated to different action sectors. This variety of actions offered a gradual preventive and care response based on the team's clinical needs (see **Figure 3**). The system's components' deployment was progressive, starting from the patients and families component to components dedicated to healthcare professionals to provide global mental health support.

CoviPsyHUS Dedicated to Patients and Their Families

As the consultation-liaison psychiatry team usually consults in all University Hospital wards, they continued visiting patients who required psychiatric attention, although consultations by phone or through videoconference were preferred. However, the

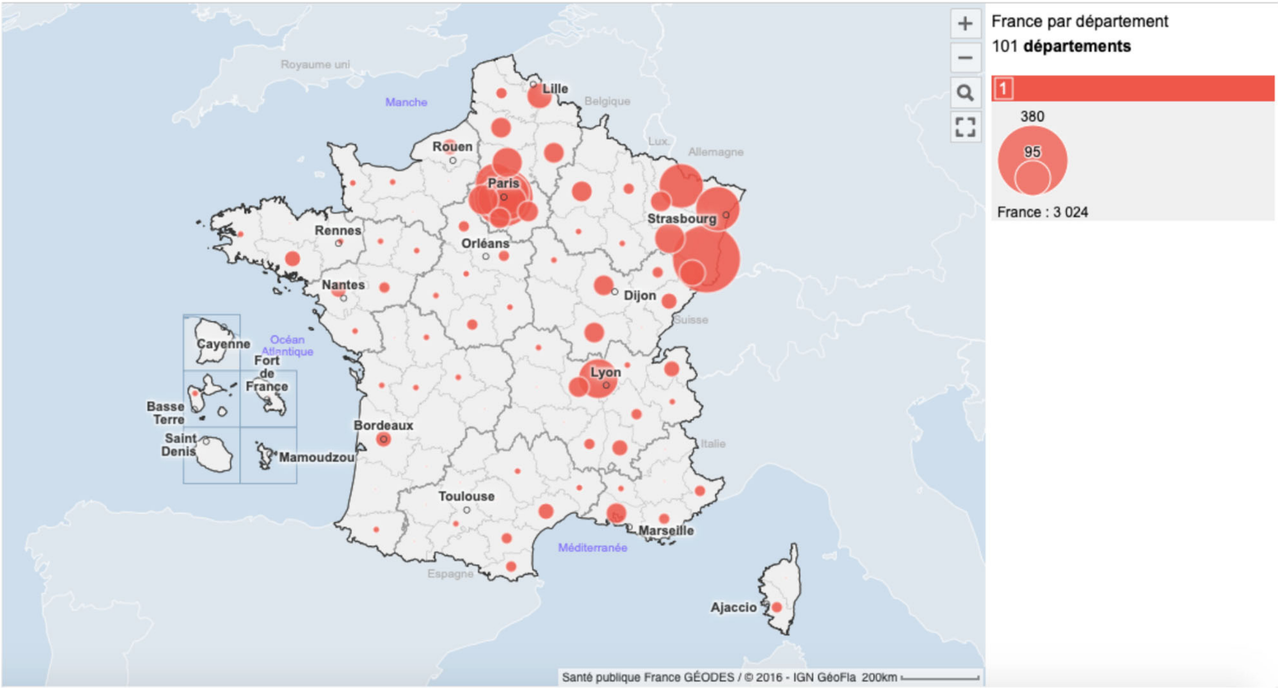

FIGURE 1 | Cumulative number of people who died of COVID-19 in France as of March 30, 2020. *Santé Publique France Géodes.* The circles correspond to the mortality rate per 100,000 inhabitants. The largest circle corresponds to a mortality rate of 380 deaths per 100,000 inhabitants, and the smallest circle corresponds to a mortality rate of 95 deaths per 100,000 inhabitants.

"COVID-19 patients and their families" component was a specific add-on to usual activities.

Indeed, we quickly identified families as particularly vulnerable due to highly restricted or prohibited visits and limited discussions with caregivers due to hospital staff's particular time constraints. Currently, available data are showing strong reactions of fear and panic and feelings of uncertainty among families (13), leading us to initiate a dedicated telephone relay with a double-entry system:

- a mental health support platform directly accessible to families,
- a direct telephone line for doctors in COVID-19 units to report families in need of specific support.

Intensive care clinicians mostly reported problematic situations concerning hospitalized patients or bereaved families.

Families warmly welcomed psychiatrists' supportive phone calls. This system branch was very beneficial to medical teams since it enabled them to feel supported in administrating care whenever they felt guilty for not having enough time to talk to families and address mental health issues. At the same time, they did their best to maintain contact with patients' families.

CoviPsyHUS Dedicated to Healthcare Professionals

Mental Health Support Hotline

The mental health support hotline allowed hospital staff to get in touch, anonymously if desired, with psychologists and psychiatrists providing live teleconsultations, thus identifying vulnerable caregivers and organizing follow-up. The response was graduated with the possibility of face-to-face consultations and referral to a psychiatrist if necessary (5% of cases, for drug prescription or need for medical leave from work).

Though we largely publicized the hotline, hospital workers remained reluctant to call, and the hotline was underused, as previously in China (14, 15). Between March 23 and May 7, 2020, the hotline received 170 (70% of women and 65% of frontline caregivers) calls for 13,000 agents. Despite the underuse of the hotline in our system, its existence was fundamental. It must be maintained in similar organizations as it allowed many hospital workers to identify CoviPsyHUS (16). Indeed, all calls were justified and commonly required specialized follow-up. In this context, accessibility over an extended hourly period (9 A.M.—10 P.M.) favored its use by isolated hospital staff (e.g., for those on temporary leave due to COVID-19).

We hypothesize that this underuse was the consequence of several issues: the reluctance of healthcare professionals to spontaneously call for personal mental suffering during such a sanitary crisis; healthcare professionals identified the telephone system as an additional measure of distancing in a global situation of confinement. In this context, it was necessary to identify a physical place of care in the hospital.

Relaxation Rooms

Relying on our Chinese colleagues' experience who reported the importance for healthcare professionals to have a place to rest, we quickly opened relaxation rooms for hospital staff.

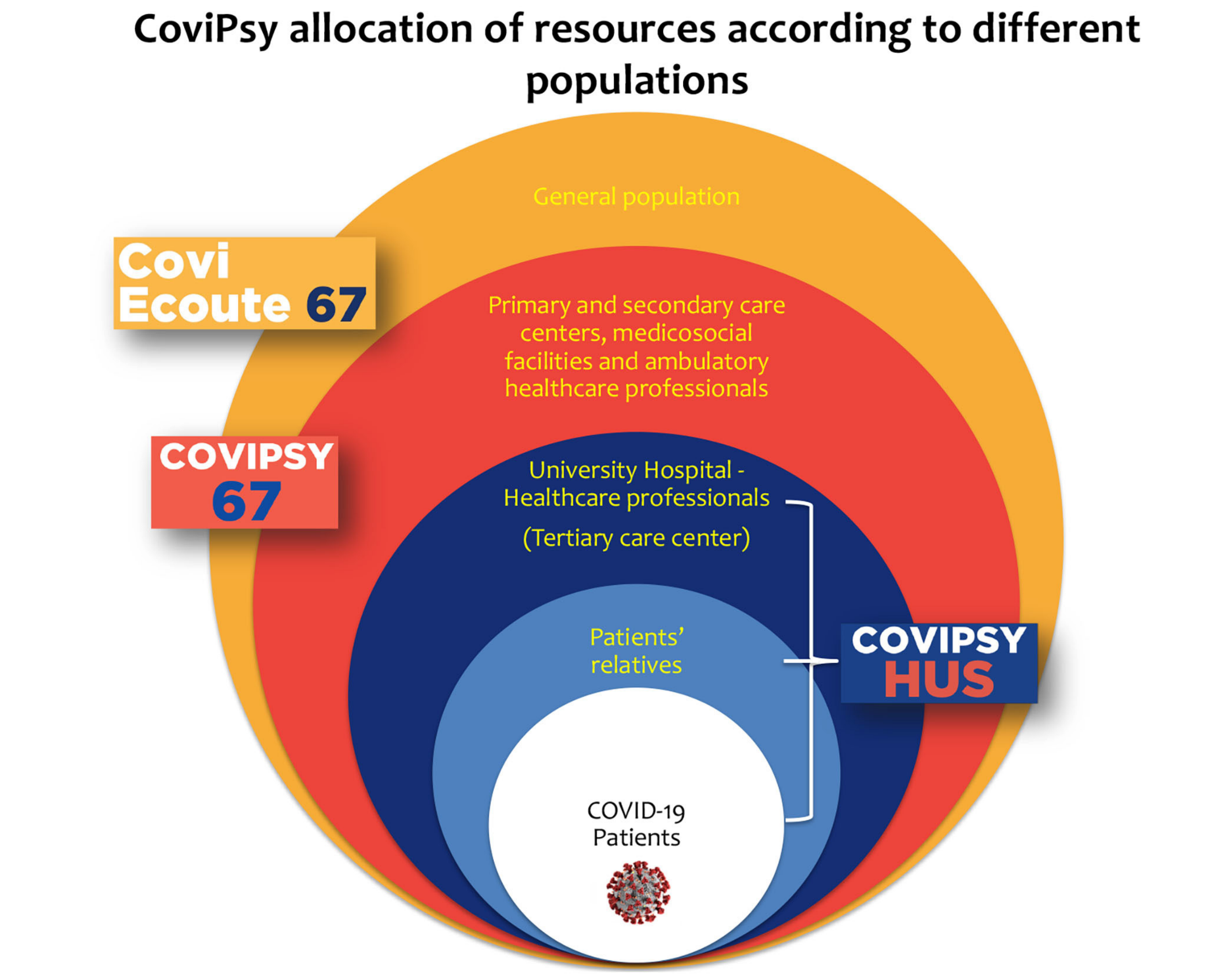

FIGURE 2 | CoviPsy organization of resources allocation according to different populations.

Although a risk of contagion existed in a relaxation room, we privileged direct social interaction but applied specific protective measures (15) (see **Figure 4**). We set up these rooms to create different spaces (reception, individual and collective space). In these rooms, caregivers had the opportunity to take a break (CoviPsyHUS team members offered coffee and cookies to promote conviviality) out of their daily stressful clinical context. A psychologist and mental health caregivers were present every day to welcome hospital professionals and offer individual consultations. The CoviPsyHUS team provided several workshops: mind-body techniques (mindfulness, yoga, sophrology, hypnosis), body-centered techniques (osteopathy and physiotherapy), and sleep workshops. In total, to date, 110 workshops were led by 30 different professionals and volunteers.

In particular, the sleep workshops were essential. They addressed one of the significant acute stress symptoms reported by most healthcare workers: sleep disorders, notably insomnia and nightmares (17), thus preventing a vicious circle of psychological stress and insomnia (18). Indeed, some staff described an increase in substance intake in the evening, notably alcohol, for anxiolytic and hypnotic purposes. Even though sleep deprivation persisted throughout, the state of exhaustion only appeared later-on, which illustrates the importance of activated stress mechanisms maintaining high vigilance levels over an extended period.

Healthcare professionals frequently presented with emotional and mood dysregulation: irritability, anger, hypomania, depressive mood. Moreover, they often reported hyperarousal and peri-traumatic dissociation: time perception changes, autopilot mode functioning ("We were like robots"). These elements might predict the manifestation of Posttraumatic Stress Disorder (PTSD) in the long run. We know from the literature that caregivers are more at risk of developing PTSD than the general population (3, 19). Studies following

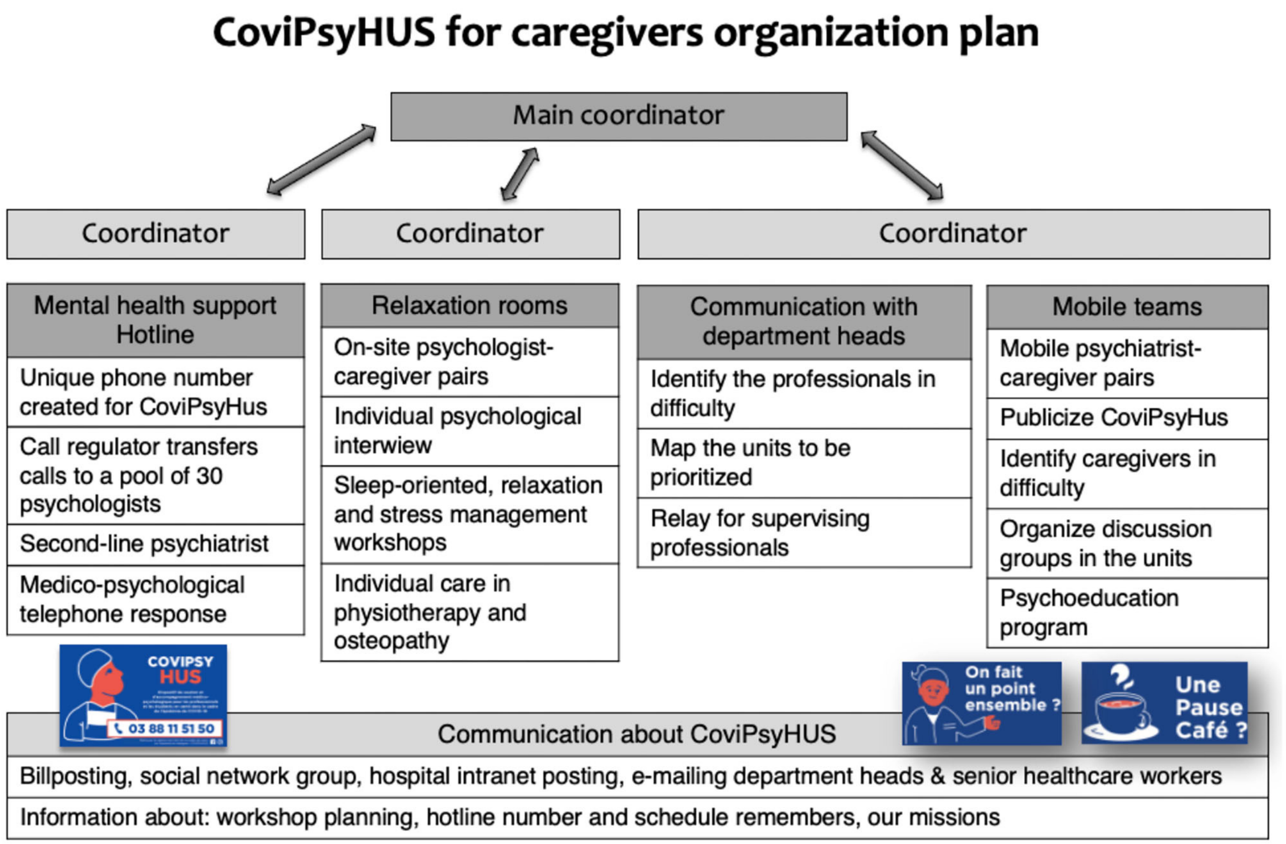

FIGURE 3 | CoviPsyHUS organizational plan dedicated to healthcare professionals.

exposure to SARS in caregivers show that infected caregivers have more psychic complications than other patients (6). So being a caregiver is associated with a risk factor of more severe and prolonged post-traumatic symptoms (6). However, as the COVID-19 outbreak consists of a long-lasting, ongoing and stressful event with an uncertain outcome, we consider that specific and rapid intervention in the heart of the critical event, mainly targeted on stress, sleep, and emotion regulation, is valuable to prevent future psychological disorders (19).

Body-centered therapies addressed a central need of hospital workers by removing muscular tensions. These workshops made it possible to take charge of the first manifestations of stress, which were very physical.

Until May 7, 2020, overall attendance was 2,120 visits for 13,000 agents, with 233 psychological interviews carried out (see **Figure 5**). The relaxation room has now become a benchmark as a resource place for caregivers. Children's drawings for teams or gifts from local traders dropped off in relaxation rooms also had a positive and supporting impact on healthcare professionals (see **Figure 4**). However, many caregivers did not allow themselves to visit relaxation rooms or know about their existence.

Proactive Mobile Teams

Therefore, CoviPsyHUS created mobile mental health care support teams. Their existence was vital as they enabled us to reach healthcare professionals who could not come to relaxation rooms. Indeed, due to heavy workloads, acute stress-related stupor, or the feeling of being illegitimate in taking care of themselves, many healthcare professionals would not allow themselves a pause. Indeed, stressed workers may shut themselves in and would not seek help, so it is up to mental health teams to be proactive and meet them. The *in-situ* contact in their units offered healthcare workers the opportunity to overcome psychological mechanisms secondary to stress.

In total, 12 proactive mobile teams reached about 1,200 healthcare professionals. We deployed these teams according to a precise map indexing priority units to visit. These mobile teams were composed of caregiver/psychiatrist pairs, thus facilitating interprofessional relationships. Each pair was in charge of a department, enabling a continuous, high-quality connection with specific teams.

Mobile teams distributed psychoeducational documents (including information about sleep disorders, stress management techniques, and advice on talking about the situation with children). Psychoeducation counseling has demonstrated

FIGURE 4 | Psychological interview in a relaxation room.

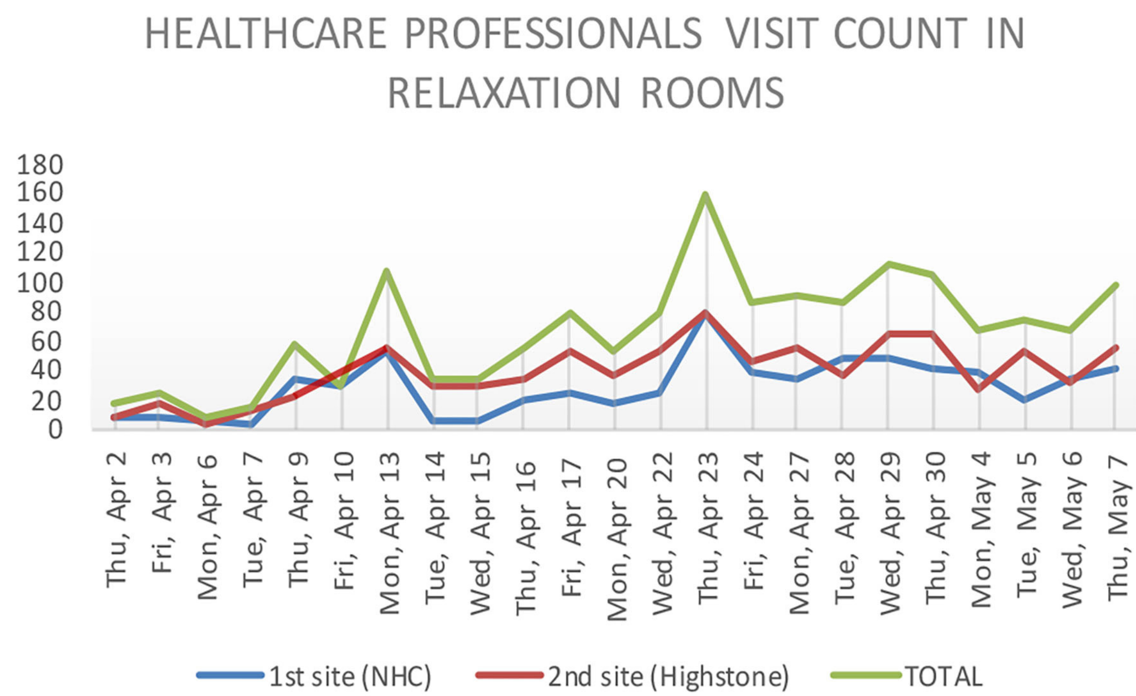

FIGURE 5 | Healthcare professionals' visits to relaxation rooms. Blue and red lines represent the relaxation rooms opened in the two main sites of our hospital. The green line represents the total visit count.

improved stress management with decreased stress levels after the intervention and retrieval of a sense of control over their mental health (20). Moreover, the mobile teams made it possible to reach out through the feeling of isolation, often encountered in highly stressful situations (healthcare workers on intense schedules preventing inter-team exchanges). Re-bonding after a critical experience is essential and recommended (20). Moreover, "Reaching out to caregivers" was seen as a gesture of recognition and taking into account their psychological needs.

Finally, mobile teams units proposed group and individual debriefings to talk about each individual's collective experience. This action was all the most useful for the newly created teams. Indeed, these teams were supposed to split after the crisis period. Individuals would meet their former colleagues, whose exposure to the COVID-19 was different, warranting the implementation of a congruent debriefing. Secondly, Balint groups were proposed (21).

We note that the set-up of mobile teams and a CoviPsyHUS group on social networks led to a significant increase in the use of relaxation rooms. Both these means fostered social connections between healthcare professionals, revealing the importance of substantial and non-stigmatizing mental health information dissemination during a crisis when stress mechanisms are active.

DISCUSSION AND PERSPECTIVES

Our first clinical observations (feeling of fear, acute stress, sleep disorders, anxiety, sense of rejection) are consistent with the results of previous studies on epidemics such as SARS (3–6) and with the first Chinese publications for COVID-19 (13–15).

Previous studies (8–10) confirmed the need to systematically integrate mental health support teams dedicated to healthcare professionals in exceptional sanitary situations' care plan to spot and prevent the effects of stress. Following international recommendations (8, 9), our system aimed to act immediately to avoid the progression toward psychiatric complications. Women and frontline health workers fighting against COVID-19 have mostly used CoviPsyHUS system (22). Lai et al. work shown that women and nurses are at high risk of developing mental health problems after exposure to COVID-19 (22). Thus, it made sense that this population noteworthily spent time in the different CoviPsyHUS components.

People under high stress levels could exhibit psychological stupor mechanisms. Therefore, among the critical points to integrate into a mental health care system designed to screen and treat highly exposed professionals (22, 23), we identified the actions promoting contact between healthcare professionals and a mental health system. For this purpose, it is essential to provide extensive and non-stigmatizing dissemination of mental health support information with multimodal communication and have a clear identification of the mental health support system with information on how to access it (3, 23). However, to be even more proactive in these highly stressful situations associated with a heavy workload, we innovated, created proactive mobile teams to identify healthcare professionals in trouble and map the hospital's psychological needs. Early detection by mobile teams could explain a different use of "relaxation rooms" compared to Chinese colleagues, who used them for rest (15). In our hospital, few healthcare professionals came to rest in our relaxation rooms. Stress mechanisms activation may explain this observation (17, 18), but also the benefit of our pro-active and rapid response and the stress management actions implemented. Indeed, "relaxation rooms" helped reducing stress levels and address essential needs. Mental health teams provided stress management techniques during previous epidemic setting, while to our knowledge, they did not provide group workshops (3, 23).

However, in an epidemic like COVID-19, exposure is collective. Respecting the protective measures, we, therefore, proposed group stress management workshops. We observed the positive effect of group learning. Firstly, it generated collective support. Secondly, it was easier for participants to apply the techniques they learned.

Precise health information and concrete infection management measures (social distancing, sufficient protective equipment, sufficient personnel) (3, 15) are associated with lower stress levels and less psychological impact [less anxiety and depression (13)] both for caregivers exposed to SARS (3, 5, 23) and for caregivers exposed to COVID-19 (15, 23) as well as for the general population (13). Like other psychiatric teams in other viral exposition such as SARS (3, 5) we disseminated this medical information to caregivers. However, we also integrated mental health information (23) (psychoeducation), considering different stress levels (COVID-19-related stress, work-related and social stress, personal stress). Moreover, implementing measures to relieve teams under pressure (e.g., relaying communication with families) was an additional element in reducing caregivers' incapacity feelings.

As for other psychological support systems, the mental health support hotline allowed to identify psychological troubles and disseminate stress management advices (3, 14–16). However, these phone consultations widely implemented during the COVID-19 in other hospitals have limitations. There is a lack of medical history data, psychometric psychiatric data, body data, and effective follow-up feedback (3, 14–16). The advantage of CoviPsyHUS compared to other mental healthcare support hotlines is the possibility of an immediate switch to face-to-face individual consultations or to benefit from one of the three other components of the system.

Different resilience and stress management systems emerged during this crisis, but they did not always fit collective and intra-hospital contexts (23). The strength of CoviPsyHUS is to constitute a modular system articulating complementary sub-parts that can be quickly deployed and redeployed when necessary. Its deployment may consider psychological needs and specific constraints (e.g., healthcare professionals agenda, anonymity, distance if work stoppage) at the appropriate time. The system offered various interventions, from early responses to immediate needs (body-centered techniques) to the possibility of complex elaboration of lived experiences (individual psychotherapy and debriefing groups). Moreover, CoviPsyHUS deployed step by step, integrating healthcare professionals' needs from the 1st day of the health crisis. For professionals enduring continuous stress, the system's existence facilitated stress level reduction and had a strong symbolic impact.

Lastly, this system associated the access to both individual (personal dimension) and collective (professional dimension) care within the same entity for healthcare workers' who are subject to double-sided (individual and collective) stress exposure. Indeed, in these situations, mental health care must integrate counseling for the individual and group workshops. It is also a way to recognize the essential involvement of caregivers. Also, work organization arrangements will improve mental health. Finally, this precise adjustment to healthcare professionals' needs seems to optimize health costs. Future studies might clarify the cost-benefit ratio of such interventions.

Though CoviPsyHUS professionals met numerous healthcare professionals in different settings, a limitation is that we did not precisely measure healthcare professionals' disorders (e.g., using surveys or scales). Nonetheless, we also created an online cognitive-behavioral therapy program that will be evaluated in a randomized controlled trial and offer a longitudinal assessment of healthcare professionals' mental health (24). Moreover, many teams conducted surveys worldwide to assess healthcare professionals' mental health during the COVID-19 pandemic (25–27).

Overall, CoviPsyHUS constitutes an innovative, reactive, and transposable mental health prevention and care system. This universal and modular device could serve as a model to deploy in other health (e.g., pandemics) or extra-health crises (e.g., nuclear or chemical risks situations), causing prolonged stress.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

AUTHOR CONTRIBUTIONS

JR: CoviPsyHus project co-responsible, mobile team supervisor, and sleep psychoeducation workshops manager. AM: CoviPsyHus project supervisor. CP: relaxation rooms supervisor. DM: CoviPsy67 supervisor. MF: doctor involved in CoviPsyHus and CoviPsy67. AG: doctor responsible for the part of the system dedicated to the families. J-JVH: doctor in charge of a covid unit who was a privileged contact for the feedback of clinical experience CS: local reviewer and sleep psychoeducation workshops supervisor. PV: CoviPsy project supervisor.

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MINI REVIEW
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The Sum of Fears in Cancer Patients Inside the Context of the COVID-19

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The pandemic resulting from COVID-19 has led to the collapse of the health system in dozens of countries. Parallel to clinical risk, the appearance or intensification of psychiatric symptoms has also been documented. The identification of groups at risk is essential for the establishment of preventive and therapeutic strategies. Cancer patients appear to be especially vulnerable both from a clinical and psychiatric perspective. Problems related to contamination and the cancer treatments themselves are intertwined, causing a sum of patients' fears to arise, which can cause mental effects. This study aims to review and investigate the impact of COVID-19 on the mental health of cancer patients and indicate possible support strategies.

Keywords: cancer, fear, mental health, COVID-19, pandemic (COVID-19)

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INTRODUCTION

The 2019 coronavirus (COVID-19) pandemic is an international public health emergency unprecedented in the 21st century (1). Despite the fact that most of the contaminated are asymptomatic, the disease can have a serious evolution, with the occurrence of respiratory failure and the need for support in intensive care units (ICU) (2). The severity of the disease is very heterogenous, and elderly people suffering from chronic diseases and those with immunosuppression are at the highest risk (3). In particular, cancer patients may be a vulnerable group to morbimortality by this infectious disease (4) and to higher levels of stress than the general population.

Infectious diseases can be a vital threat to cancer patients, so this relationship has been extensively investigated in recent decades (5, 6). During the H1N1 pandemic in 2009, for example, a study found a high incidence of hospitalization, severe pneumonia, admission to the ICU, mechanical ventilation, and mortality in cancer patients (7). Currently, during the COVID-19 pandemic, there is preliminary evidence that cancer patients may be particularly susceptible to contamination (8–12). In addition, recent systematic reviews have shown that cancer may be associated with the worsening of the disease (4, 13) and an increased risk of death (14, 15). This sum of factors can generate additional stress and intense suffering in a population that already has several mental health issues (16).

It is well-described that in cancer patients, the rates of problems related to mental health are higher than that evidenced in the general population (17). The implications of this can affect even the clinical prognosis. A recent meta-analysis reported that symptoms of depression and anxiety can affect prognosis, being related to reduced survival and increased mortality (18).

During the pandemic, cancer patients may be experiencing an intensification of psychological distress (19). There is evidence showing that the rate of cancer patients in need of mental health attention has increased in this period (20). Despite this, it is observed that access to psychological and psychiatric treatment in this population can be impaired during the pandemic (16, 19). The World Health Organization (WHO) estimates that despite the growing demand, the pandemic has disrupted mental health services in 93% of countries worldwide (1). On the one hand, it is observed that the reorganization of the health system to meet the demand of patients with COVID-19 may have compromised access to cancer services and drugs (21). On the other hand, fear of virus contamination may lead to avoidance of hospital environments (22–24). In both cases, this can cause a delay in treatment and worsen the prognosis. In addition to clinical issues, this may be associated with high levels of distress and mental suffering (22, 23, 25, 26). In this sense, risks and fears add up, generating a question: What is the impact of the sum of these fears on the mental health of cancer patients? To better understand this phenomenon and raise new insights on the subject, we conducted a short narrative review on the topic.

THE MENTAL BURDEN IN CANCER PATIENTS

Problems related to mental health in patients with cancer and greater psychological vulnerability are well-described in the literature (27). Going through a major life-stressing event, as in the case of discovering an oncological diagnosis, brings a series of emotional reactions increasing the perceived stress load (28). This increased burden often makes patients experience difficulties in returning to an emotional state prior to the discovery of the disease, impacting their quality of life (29).

Some mental disorders are more recurrent in the cancer population, as in the case of depression and anxiety, where their rates are higher than those observed in the general population (27, 28, 30–33). It is estimated that around 58% of cancer patients have some form of depression during treatment, ranging from mild depressive symptoms to the clinical diagnosis of major depressive disorder (34). To assess how common depressive symptoms may be during cancer treatment, a systematic review followed by a meta-analysis revealed that the presence of a major depressive disorder was described in 15% of studies and minor depression in 20% (31). The prevalence rates of depression in the oncology population may show some inconsistency and vary according to the method used for its assessment (35).

Concerning anxiety disorders, it is estimated that 19% of patients have clinical symptoms of anxiety, while 23% have subclinical symptoms once they do not fulfill all diagnostic criteria for some specific types of anxiety disorder (32). One of the phases during the continuum of cancer treatment that most arouses anxiety symptoms is the diagnosis (36). It is in the initial moments when the patient still needs to assimilate the information and adapt to different conditions that involve his treatment and make countless decisions that his anxiety is exacerbated (37, 38). Even after the treatment period, the symptoms of anxiety and depression can still be present for up to 10 years after the diagnosis of the disease (39).

Some factors contribute to the more significant presence of emotional problems in oncology patients, like the type of cancer (32). The highest prevalence of emotional distress appears to occur in patients with breast cancer, followed by patients with head and neck cancer (40, 41). Also noteworthy is the presence of depressive symptoms in patients with lung cancer, where the presence of guilt due to risky behaviors—such as constant use of tobacco—is shown to be an influential factor in altering mood (42, 43).

The stage of the disease during the diagnosis period was also one of the factors that influences the change in the patients' emotional state. People who discovered the disease at a very advanced stage have higher rates of distress (44), mainly because they have higher pain rates (45). The type of treatment performed also influences the prevalence rates of emotional problems. Treatments that require more invasive procedures, as in the case of surgeries, can contribute to the burden of distress and worsen the quality of life (46). The use of some chemotherapeutic drugs can have a deleterious effect on the cognitive functions of patients causing them to have problems involving memory and concentration (47, 48). In addition, the presence of side effects such as nausea and fatigue can lead to an increase in anxiety and depressive symptoms (49, 50).

After the treatment ends, the impact of cancer on the mental health of patients may persist, mainly due to the presence of fear that the disease may return. A previous study, for example, showed that the stress resulting from fear of death and recurrence affects between 22 and 87% of cancer patients, which can lead to neurobiological, emotional (51), and behavioral changes (52). Fear of disease recurrence can keep patients in a constant state of alert, mainly due to cognitive biases for stimuli considered threatening (for example, some pain in the body), impacting their quality of life (53). Thus, cancer patients are particularly vulnerable to emotional problems, in the face of the pandemic, and all these symptoms can be intensified.

THE IMPACT OF COVID-19 IN CANCER PATIENTS

Patients undergoing cancer treatment, especially in cases where the use of chemotherapy and/or immunotherapy is necessary, may be especially vulnerable to an increased risk of infection during the pandemic (54). Multiple risk factors, such as the existence of clinical comorbidities and poor functional status are frequently seen in patients with cancer. In addition, there is impairment of immunity due to the malignancy of the disease or to antineoplastic therapy (5). It is also noteworthy that different types of cancer produce immunological suppression in different extensions, as in the case of onco-hematological diseases (25). These risk factors often lead to frequent visits to hospitals to treat the disease or other concomitant medical conditions (or those resulting from the condition), which may increase the risk of contamination (5, 55). However, it is observed that the fear of exposure to the virus when attending hospital environments can also lead patients to interrupt treatment or neglect symptoms (22–24, 56). Still, it is necessary to consider that this group may be affected by the scarcity of essential medicines, and may suffer from the reduction of health activities, in the community, due to the implementation of the social distancing and lockdown guidelines (6, 9). In some cases, patients may encounter difficulties in carrying out important procedures for their treatments, such as in the case of surgery, due to the high demand for hospitalization due to the pandemic (57), which may further increase the fear of the progression of the oncological disease (26, 58). In addition, a systematic review recently demonstrated that during a pandemic, delay in surgery can reduce survival (59).

In this sense, fear of contamination, or the effects of the pandemic on health and treatment, can lead to additional potential stressors in the oncology population. Thus, in addition to the biological risk and the reduction in treatment offerings, it is necessary to take the influence of COVID-19 on the mental health of this population seriously. Moreover, this factor can be enhanced by the removal of family members and social support, which may be deficient, especially in the lower classes (6, 60, 61), who may also have difficulty accessing remote consultations (62). In the case of hospitalization, it is common for patients to be alone to reduce the risk of contagion, which can cause anxiety, sadness, feelings of abandonment, and the fear of dying alone (63). These manifestations can also appear in quarantined patients, whose psychological distress due to loneliness can be aggravated (64). Thus, it is observed that several factors influence the emotional aspects of patients during this period, resulting in the sum of the fear of different issues, further damaging the mental health of this population.

MENTAL BURDEN IN CANCER PATIENTS: THE SUM OF FEARS

During the pandemic, the fear of contamination, the difficulty of accessing treatment, and distance from family have added to the fear of death or a clinical condition worsening, which can intensify the feeling of stress even more. In risk groups, such as patients with serious or terminal illnesses, these symptoms interact with those of the current illness and can be even more intense. Depressive, anxiety (including panic attacks and posttraumatic stress), psychotic and paranoid disorders, or even suicidal behaviors can emerge (65, 66).

It should be noted that recent publications consider that, simultaneous with the COVID-19 pandemic, there seems to be a "fear pandemic" affecting the general population, becoming a trigger for the worsening of anxiety symptoms (67, 68). The fear of being contaminated and the drastic changes in daily routines can already be considered important stressors, but infected patients (or those with suspected infection) can manifest intense emotional and behavioral reactions (64, 69). One study found that the rates of fear and anxiety in cancer patients during the pandemic are high, and according to the literature, breast and lung cancer patients had the highest rates (70).

Undergoing cancer treatment alone generates numerous fears in patients, mainly involving fear of death (71). As mentioned earlier, during the COVID-19 pandemic, many patients may experience difficulties in accessing their treatments, causing the fear of cancer to progress even more (26, 58). In this sense, fear of being infected by the virus is added to the fear that their underlying diseases may become worse due to the lack of adequate treatment (72). The sum of these fears can cause a constant sensation of alertness (53) and that in cancer patients, this is potentially harmful, since stress hormones can activate oncogenic viruses and alter various aspects of the immune function (73). In addition, uncertainty about infection and death or about infecting family and friends can induce dysphoric mental states, including irritability and aggression under a sense of being experiencing something terrifying (66, 69, 74).

Fear is a natural reaction to threatening stimuli and triggers a series of biopsychological responses that prepare the individual for fight or flight reactions (75). This physiological response to stressful events involves the central nervous system (CNS) by activating the autonomic nervous system (ANS) and the hypothalamus–pituitary–adrenal axis (HPA) (76). In addition to preexisting vulnerability factors such as genetic, environmental, and gender differences, hyperactivation of the HPA axis can lead to an increase in cortisol, which can trigger a series of psychological problems, such as the onset of panic attacks and increased general anxiety levels (77–79). Some explanatory models for these outcomes such as the second wave hit model (80) and the bidirectional multi-system reactivity hypothesis (81) theorize that the interaction between a preexisting vulnerability with stressful events capable of triggering strong biopsychological reactions can lead to activation of complex systems and signaling pathways that can contribute to the onset of deleterious psychological symptoms, mainly due to responses to major stressful events, as in the case of COVID-19. In addition, the constant activation of HPA can result in the appearance of depressive symptoms, mainly due to responses to threatening events, as in the case of COVID-19 (74, 82, 83). It is clearly not possible to affirm the direct connection between the events, and neither would this be our proposal, but, nevertheless, it is necessary to reflect on the possibilities of the sum of factors leading to negative outcomes in this specific population. Thus, **Figure 1** presents an interactive model between the events, clarifying the possible psychological response to the sum of fears.

PERSPECTIVES OF MENTAL HEALTH CARE OF CANCER PATIENTS DURING THE PANDEMIC

Sadness and depressive symptoms can be recurrent and are associated with negative and catastrophic thoughts in cancer patients during the pandemic. They may occur with discouragement or despair that is related to a possible relapse or infection with the new coronavirus. This can make cancer patients even more vulnerable, with a greater tendency to develop physical problems (for example, impaired immunity)

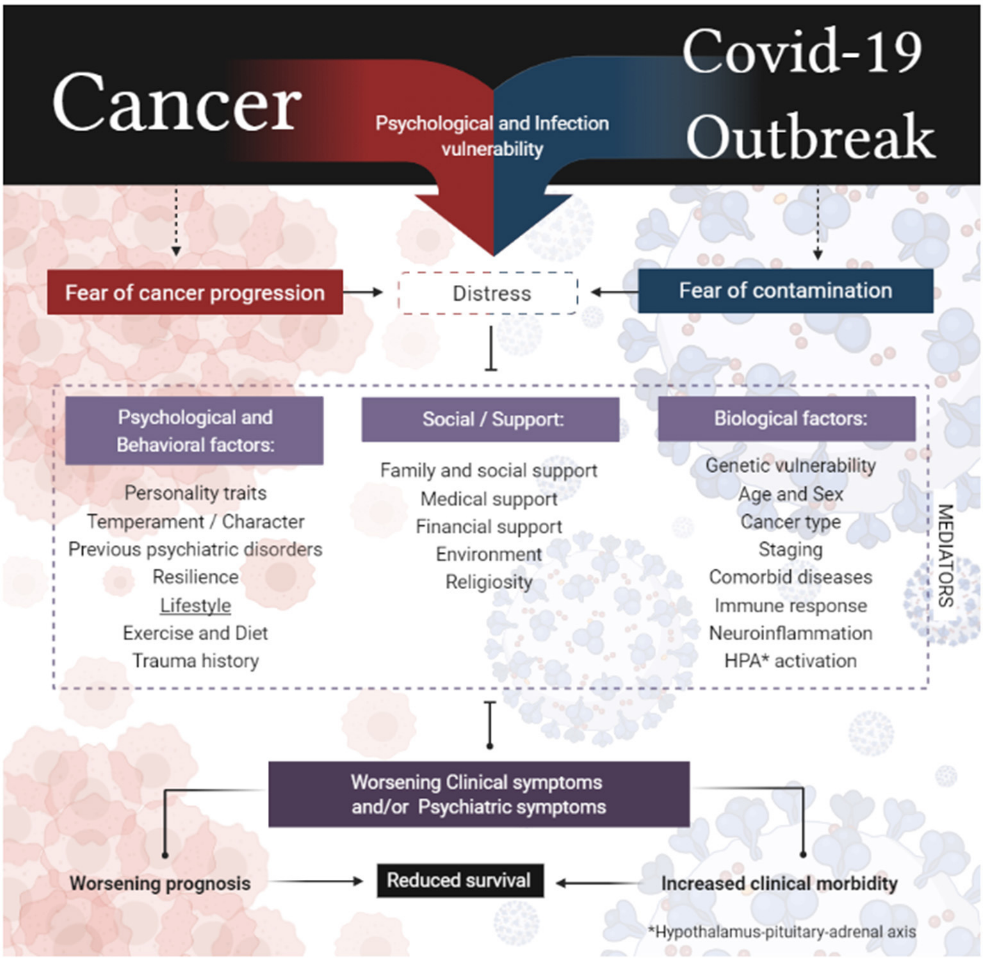

FIGURE 1 | Interactive model between the sum of fears in cancer patients.

or emotional problems (for example, high levels of anxiety and depression) (24, 58, 84).

Thus, it is essential that the institutions responsible for cancer treatments set up multidisciplinary crisis committees to develop and update the guidelines and strategies of mental health care for this population during the pandemic. In a recent study it was shown that despite the fact that we are aware that the crisis is having a significant impact on the mental health of cancer patients, few are being monitored or receiving specific mental health care (19). It is also essential that telephone or Internet service channels are urgently implemented (9).

Telemedicine is not exactly a novelty in oncology, and it has shown satisfactory results, especially for patients living in remote areas (85). In the context of mental health, the consolidation of remote care by professionals in the field during the pandemic has been observed (86). For patients in isolation, telephone and Internet calls are crucial alternatives to guarantee access to treatment and reduce the risk of COVID-19 transmission (87).

The application of screening protocols by telephone is a valid strategy for identifying cancer patients that are in severe mental distress. This can help to track patients at risk and direct support measures that reduce the intensity of symptoms and suffering (20). Recently, a panel of psychiatrists from 15 countries developed a protocol for providing mental health care during the pandemic. The protocol provides for an initial semistructured assessment and a series of interventions according to the degree of symptom intensity. All interventions follow evidence-based adequacy and efficacy criteria and may vary from psychoeducation to emergency care. This protocol can serve as a starting point for the development of strategies according to the region and the public served (88). Within this perspective, strategies need to contemplate four aspects: (1) dissemination of information (which involves communication and psychoeducational content), (2) counseling, (3) emergency support (psychological first aid), and (4) structured and more longitudinal interventions (68). However, as previously mentioned, not all patients have the possibility of having access to remote services, requiring care alternatives for this population to be considered (62). Thus, we take the opportunity to describe in **Table 1**

TABLE 1 | Recommendations for self-care in mental health for cancer patients.

Exhibited problem	What to do*
Anxiety	Use breathing techniques as the diaphragmatic breathing or any other of your preference to control some physical symptoms of anxiety (tachycardia, psychomotor agitation, shortness of breath, and accelerated breathing) (89).
	Try to separate the problems in two categories: the ones you can control and the ones that you cannot control. Focus on those problems which you have control over and search for strategies of problem resolution for them (90).
	Try to distract from news regarding COVID-19, restricting access to information (91).
Depressive mood	Try to listen to pleasant songs of your preference, which increase the feeling of pleasure and well-being (92).
	Do physical activities within your possibilities and reality of oncologic treatment: light walks, Yoga practice, and meditation (93).
	Keep in touch with friends and relatives even if it is a long distance. Remember that by talking to them, you do not necessarily need to speak about your treatment or the pandemic. Choose subjects that are convenient and bring you a feeling of joy (94).
Excessive Fear	Think about how experiences related to this feeling have brought you consequences, and try to identify triggers that bring you this sensation (95).
	Practice mindfulness techniques to focus on the here and now, without letting your thoughts regarding the future get in the way of the present moment (96).
	Determine which are your beliefs and thoughts related to fear, as for example: "I believe that my future is going to be horrible"; "I am not going to endure what will happen"; "I am certainly going to get contaminated by the coronavirus." After determining them, search and discuss with other people logical answers to those feelings, taking into account the probability of them actually happening and measuring how many of them are truly based on facts and not only on sensations (97).
	Remember all the situations in which you felt fear and were able to overcome it, analyzing what was the outcome of that situation and the emotional consequences you had.
	Make a chart with two columns: on the first write down all your worries, and in the second one write possible solutions for each (97).
	Talk to friends and close people in order to think together of all possible solutions for the problems you listed. In case you cannot find solutions, think about the impact that this problem is going to generate and about what resources you and other people may have to cope with it (97).
Sleep problems	Do sleep hygiene, searching for factors that may be contributing to this problem, such as heavy eating at night, excess intake of caffeinated drinks, room with too much luminosity and noise, etc. Determine the factor and search for solutions (98).
	If before going to sleep you keep thinking about your problems and cannot disconnect, try to postpone your thoughts. Make a deal with yourself and say you will only worry about your problems on the next day, when you wake up. Do not try to not think about your problems because this is going to make it worse, and bring your focus to the problem. Due to this reason, only say that you will postpone your worry (97).

**For more information, see the references below. In case of greater severity, consider referral to a health professional.*

some strategies that cancer patients can use to manage the emotional effects resulting from the pandemic, thinking about their self-care.

CONCLUSION

In cancer patients, the rates of mental disorders are higher than those seen in the general population. Previously, it was observed that anxiety and depression are related to the clinical prognosis, even increasing the morbimortality rate. During the pandemic, there may be an aggravation of mental suffering, resulting from the sum of the fear of being contaminated by the new virus plus the fear of the progression of the oncological disease resulting from the gaps related to clinical care, as well as distance from loved ones. The effects of this sum of fears in cancer patients can interact with complex systems involving hyperactivation of the HPA system, among other things, increasing the sense of threat and affecting the quality of life of patients. Given this scenario, it is relevant to recognize the challenges of caring for cancer patients during the pandemic. Thus, it is essential that psychiatric evaluation and psychological support measures are implemented, which may also involve telemedicine, which can be useful for tracking patients at risk, identifying the degree of severity of symptoms, and implementing support strategies considering the social context.

AUTHOR CONTRIBUTIONS

LB and FO conceptualized, designed, and drafted the manuscript. LvD and FK provided critical revisions of the manuscript. All authors contributed to the article and approved the submitted version.

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Rapid Review on the Associations of Social and Geographical Isolation and Intimate Partner Violence: Implications for the Ongoing COVID-19 Pandemic

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While the COVID-19 pandemic forced millions of people to stay home and minimize their social contacts, newspaper reports worldwide raised concerns as they reported an increasing rate of intimate partner violence (IPV). One link of the measures enforced to control the pandemic to IPV might be a possible side effect of those measures, namely social and geographical isolation. As there was no scientific data investigating the association of IPV and social and geographical isolation in the context of epidemics or pandemics at the time of conducting this rapid review, we aimed at investigating a broader range of contexts of social as well as geographical isolation and its association with IPV to draw conclusions regarding the COVID-19 pandemic. We searched Embase, PubMed, PsycINFO, and Web of Science (core collection). A research strategy was developed and observational studies were included if they considered men and/or women, estimates of social and geographical isolation, and IPV as a primary outcome. Of the 526 identified studies, 11 were included in this review. The included studies involved 15,695 women and were conducted in the USA, Sweden, Ethiopia, Egypt, Spain, and Turkey. Indicators of social isolation such as lack of social, emotional, or informational support or the frequency and quality of social contacts were narratively assessed. Geographical isolation was primarily assessed by physical distance to the next town or support service. Both social and geographic isolation were found to be associated with an increased risk of IPV. Recommendations made by the individual studies include the following: (a) improving access to social networks outside the victims' own group, (b) improving their economic circumstances, (c) asserting the responsibility for those in contact with the victims, and (d) increasing the focus on access to preventive services and programs need to be taken into account. Therefore, considering the particular infrastructure and legislation of the countries affected by the pandemic, policies need to ensure constant access to shelters and other help services and increase awareness for IPV in the society. In addition, future studies are warranted to assess prevalence rates and risk factors of IPV during the COVID-19 pandemic.

Keywords: intimate partner violence, social isolation, geographical isolation, association, COVID-19, pandemic, rapid review

INTRODUCTION

The COVID-19 outbreak, declared as a pandemic in March 2020 by the World Health organization [WHO] (1), forced several countries worldwide to impose strict measures to fight the outbreak of the virus. To contain infections, millions of people were forced to stay at home and minimize their social contacts. While physical and social distancing are effective measures to control the virus (2, 3), they showed negative impacts in other domains of public health. The resulting social isolation of such measures can be a major stressor that can contribute to widespread emotional distress, several psychological perturbations, and mood disturbances such as boredom, stress, depression, insomnia, irritability, anger, and frustration (4, 5). Possible distress within relationships with family and friends is also expected (6). Reports of newspapers and news agencies in several countries around the world reported an increasing rate of domestic violence among intimate partners (i.e., intimate partner violence (IPV) and against children, as well as an expected rise in femicide cases, child marriages, and genital mutilation in children since the implementation of the lockdown measures (7–11).

Social and Geographical Isolation and IPV

IPV refers to any behavior within an intimate relationship that causes physical, psychological, and/or sexual harm to those in former or current relationships (12). Types of behavior could include: (A) acts of physical violence, such as slapping, hitting, kicking, and beating; (B) sexual violence, including forced sexual intercourse and other forms of sexual coercion; (C) emotional (psychological) abuse, such as insults, belittling, constant humiliation, intimidation (e.g., destroying things), threats of harm, threats to take away children; (D) controlling behavior, including isolating a person from family and friends, monitoring their movements, and restricting access to financial resources, employment, education, or medical care (12). IPV can happen to anyone, regardless of any gender specifications, and in any form of intimate relations (13). However, it is the most common form of violence against women, and approximately one in three women worldwide has experienced violence by an intimate partner during her lifetime (14).

Among the many factors that could contribute and affect the experience of IPV, isolation is a key concept for understanding IPV in various contexts (15). There are different understandings of social isolation, but with regard to the present study we refer to social isolation as a "lack of contact or of sustained interaction with individuals and institutions that represent mainstream society" (16) (p. 60). Social isolation is often measured by the type and extent of social support (17). In the case of IPV, for example, social support from individuals outside the intimate relationship has been recognized as an important protective factor and moderator of the effect of IPV on many physical and mental health outcomes (18, 19). In fact, it was suggested that the likelihood of violence against women decreases as the amount of social support available to them increases (20) and vice versa (21). Women who have friends or family members available for support seem therefore less socially isolated and thus in turn better protected from victimization at the hands of their partner than women without such support systems (22, 23). In addition, social isolation plays a major role in creating the structural dislocation of minorities and marginalized populations and the differential distribution of resources (i.e., social capital), which in turn could directly increase the risk for IPV victimization for individuals who face overlapping social discriminations due to their race, gender, class, etc. (13, 24, 25). Furthermore, geographical isolation can be defined by distance to resources like neighbors, friends, police stations, hospitals, or the nearest village or town (26). Such remoteness, which for instance can be found in rural areas, may also imply sociocultural and psychological isolation (27), thereby accentuating social isolation. Hence, social as well as geographical isolation could have implications for intensifying the hidden nature of IPV itself and undermine efforts to both seek and provide help (15).

The global pandemic and its consequences like lockdowns of entire nations represent a novel situation in several countries. Reports show the urgency to take a closer look at associations of IPV and the measures to control the pandemic (28, 29). One possible link might be a side effect of the imposed physical and social distancing (30). These preventative restrictions foster isolation and may result in victims of IPV being trapped at home with the perpetrators (12, 30). Apart from that, availability of social support systems such as family and friends might be limited; in addition, closed shelters and limited accessibility of protection services could make it more difficult for survivors to escape from their perpetrator (11, 30). Studies investigating the prevalence and possible underlying factors of IPV like social and geographical isolation during the COVID-19 pandemic are still inconclusive (31), and drawing conclusions from comparable situations in the past is limited. We found it most appropriate to conduct this rapid review which aims at investigating a broader range of pre-pandemic contexts of social and geographical isolation and their associations with IPV, as well as providing reliable, preliminary knowledge of their potential impact during the COVID-19 pandemic[1]. When investigating the association of IPV and social or geographical isolation, the bidirectional nature should be taken into consideration. On the one hand, studies have found that isolation is one of several negative outcomes of IPV (32). This association can be found in terms of coercive control, which implicates that social isolation can be caused by IPV through controlling several aspects of the victim's everyday life, such as limiting social contacts or access to professional help (33). On the other hand, studies investigated IPV against women found that many victims experienced physical and emotional aspects of IPV as a consequence of being forced into isolation by the perpetrator, suggesting that IPV could be a possible outcome of social and geographical isolation (34).

MATERIALS AND METHODS

Considering the necessity of addressing the issue of IPV in the context of the ongoing pandemic and in order to present relevant knowledge in a timely manner, we conducted this rapid review following the Cochrane guidelines for rapid reviews (35–37).

Search Strategy

Research articles were primarily obtained through searches which were carried out in the following databases: Embase, PubMed, PsycINFO, and Web of Science (core collection). We used a combination of terms relating to IPV and social and geographical isolation, such as quarantine or social distancing as well as pandemics and epidemics. Separate searches for each primary database combined Medical Subject Subheadings (MeSH) terms and key text words with the Boolean operators (AND) and (OR), accordingly. The last date of the search considered for this review was on the 23rd of May, 2020 and was not restricted to any date range. The full list of search terms for PubMed can be found in the **Appendix**.

Eligibility Criteria

For studies to be included in this review, we rigorously followed our population, intervention, comparison, and outcomes (PICOS) scheme. The target population were men and/or women in intimate relationships. The intervention was limited to the exposure to social and geographical isolation, as well as epidemics/pandemics. No comparators were considered. We considered IPV to be the only primary outcome for this review. We excluded any studies, which did not clearly report perpetrators as intimate partners or victims (e.g., children) for two main reasons. One was to keep the definition of our outcome clear and consistent throughout our review. The second reason was to reduce the possibility of including studies, which did not utilize adequate statistical models to disentangle the results (e.g., subgroup analyses for perpetrators other than intimate partners). Only empirical quantitative studies such as cohort, case-control, and cross-sectional studies were included, with qualitative studies being excluded. We originally planned to include only articles published in English and German, but we diverged from the protocol and considered articles published in Spanish for inclusion as well, since these languages are spoken by the authors.

Data Collection Process

In order to conduct this rapid review, we used abbreviated systematic review methods and applied the following methodological shortcuts according to the Cochrane guidelines for rapid reviews: There was no dual abstract, dual full-text screening, dual data extraction, or dual assessment of risk of bias. All studies collected through the database searches were imported into the web-based, systematic review tool Rayyan QCRI (38). The identified titles and abstracts were then divided and screened; one reviewer (A. M.) screened titles and abstracts of studies identified by the search on PubMed, the other reviewer (H. H.) screened the ones identified by the search on Embase and PsycINFO. In case any of the reviewers were unsure whether titles and abstracts complied with the eligibility criteria, a second reviewer (S. B.) was consulted.

Full texts were then reviewed independently by the same reviewers (A. M.) and (H. H.) against the same inclusion and exclusion criteria as above. In case of uncertainties, a second reviewer (S. B.) was consulted. All studies that were accepted based on the full text screening were retained for data extraction. A data extraction form was developed where (S. B.) and (H. H.) then extracted data from each of the included studies. Extracted data included: author and year of publication, country, sample size, IPV prevalence estimates, type of isolation or its indicators, type of IPV (physical, sexual, psychological, and social), effect measures, as well as any recommendations made by the authors in the light of their findings.

Risk of Bias (Quality) Assessment

Originally, we decided that the use of quality assessment tools was not feasible, due to the time constraints in conducting a rapid review. However, we diverged from the protocol and assessed the risk of bias of the included studies. According to the Cochrane guidelines for rapid reviews (37), the risk of bias should be limited to be rated by one reviewer (A. M.), with full verification of all judgements by a second reviewer (H. H.). We evaluated the overall risk of bias for each included study as "low," "high," or "unclear." We followed the example used by Romero Starke et al. (39), and considering the criteria described by SIGN (40) and CASP (41). Items of the checklist were modified accordingly to suit the purpose of this review:

Recruitment Procedure

Adequate recruitment methods should be insured, such as randomized sampling. The response rate should be 50% or more, if not achieved, a non-participation analysis should take place. Studies that yielded high risk in this domain (i.e., studies that utilized convenience and clinical-populations) scored high risk in the overall assessment. For cohort studies, if the loss to follow-up was below 20% and there was no substantial difference between the comparison groups, this domain should be rated as low. Similarly, for a case-control study, both cases and control subjects should have a response of 50% or more, if this number was not achieved, non-participation analysis should be performed

[1]https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=185917.

where substantial differential selection of cases and controls should be excluded. For cross-sectional designs, adequacy of randomization and inclusion criteria for participation, and an acceptable response rate to be 50% or more should be presented for this domain to be considered as low risk.

Exposure Definition and Measurement

The exposure should be defined as social and/or geographical isolation. Both or any other terms, such as social support, living in rural areas, etc., which fall under social or geographical isolation should be accurately stated and measured for this domain to be considered as low risk.

Outcome

The outcome should be defined as intimate partner violence (IPV). Other terms used for violence among intimate partners, e.g., domestic/family violence were considered to be high risk, because it would mean that other members of the family (father, brother, mother in-law, etc.) may have been co-perpetrators, and that is not what we aimed to measure. Nevertheless, if these terms were used, other indications of spousal/intimate violence should have been reported. IPV should be assessed with standardized validated IPV victimization tools, including self-report questionnaires.

Confounding

A list of potential confounders had to be given, such as age, location, region, years of education, socioeconomic status.

Analysis Methods

Studies had to include one of the following effect measures to assess associations of social and/or geographical isolation and IPV: Odds ratios (OR), correlations (r), differences between groups (d), or regression coefficients (B or beta). Also, adequate statistical models had to be used to reduce bias and control for confounding (e.g., standardization, adjustment in multivariate model, stratification, etc.) for this domain to be considered as having a low risk of bias.

Funding

The sources of funding and the involvement of the funding body in the research were assessed in this domain. This domain should be rated as having low risk, if a study was funded by a non-profit organization(s) and it was not affected by sponsors. If there was any participation in the data analysis or the study was probably affected by the sponsoring organization, the domain should be considered as high risk.

Conflict of Interest

Authors should report not having a conflict of interest for this domain to be rated as having a low risk.

Overall Assessment of Risk of Bias

We considered the first five domains (i.e., Recruitment Procedure to Analysis Methods) as major domains, while Funding and Conflict of Interest were considered as minor domains. We defined the overall scoring rules for the assessment of risk of bias for each study as high risk if any of the major domains was rated as "high risk" or "unclear risk."

Data Synthesis

We synthesized results narratively and in tabular form. Because of the heterogeneity of available primary studies, we did not consider conducting any quantitative analyses for this review.

RESULTS

Description of Studies

The database search yielded 526 citations published between 1989 and 2020 (**Figure 1**). Articles were excluded based on information in the title and abstract. The full texts of potentially relevant articles were obtained for further assessment.

Characteristics of Included Studies

Our searches identified 11 relevant studies (15, 42–51) (**Table 1**). Of these, nine studies were cross-sectional (42, 43, 45–51), one was longitudinal (15), and one comprised comparative case studies (44). They were published in English ($n = 10$) and Spanish ($n = 1$). The included studies involved 15,695 women. Six of the included studies were conducted in the USA (15, 42, 44, 45, 47, 48), followed by one study in Sweden (46), Ethiopia (43), Egypt (50), Spain (49), and Turkey (51), respectively. All of the included studies investigated violence against women where the sole perpetrator was their current or former male intimate

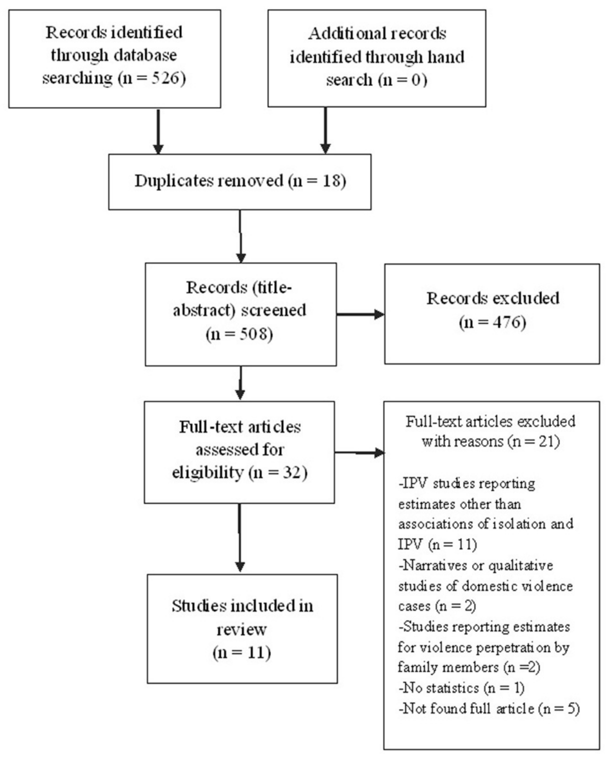

FIGURE 1 | PRISMA flow chart.

TABLE 1 | Characteristics of included studies.

	Study id country	Setting	Study design	Sample size prevalence of IPV	Population's characteristics
1	Fernbrant et al. (46) Sweden	Population-based	Cross-sectional	804 Lifetime: 22.1% (emotional: 15.9%, physical/sexual: 14.8%) By previous partner: 20.5 % (emotional: 14.3%, physical/sexual: 13.9%) By current partner: 6.7% (emotional: 6.1%, physical/sexual:2.4%)	Thai women residing in Sweden (since 2006) *Age*: range: 18–64 years *Marital status*: 85.4% married/cohabiting *Occupation*: 39.3% employed *Education*: 0–9 years: 52.1%, 10 or more years: 47.9% *Self-indicated social isolation*: 39.9% *Self-rated mental health*: poor: 19.2%, good: 80.2%
2	Lanier and Maume (15) USA	Population-based	Longitudinal	4,914 Count of the number of times the female partner was the victim of physical violence in the past year, ranging from 0 to 4 (where four indicates four or more incidents): Non-metro counties: M = 0.09 (SD = 0.48) Metro: M = 0.10 (SD = 0.48) *number of incidents in past year (one or more):* non-metro: 5.08%, metro: 5.87%	Men or women married or cohabiting with an opposite sex partner (couples) Part of the NSFH (National Survey of Families and Households), waves 1 and 2 Non-metro counties $N = 4{,}006$ / Metro counties $N = 4{,}636$ *Age*: M = 41.41 (SD = 16.66) / M = 39.53 (SD = 14.02) *Ethnicity*: Black: 11.42%, Hispanic: 3.86%, White: 84.72% / Black: 15.1%, Hispanic: 6.57%, White: 78.33% *Income-to-needs ratio*: M = 4.99 (SD = 4.95) / M = 3.82 (SD = 3.18) *number of kids <18*: M = 1.09 (SD = 1.25) / M = 1.07 (SD = 1.28) (Demographics refer to whole sample of $N = 8{,}642$)
3	Farris and Fenaughty (45) USA	Population-based	Cross-sectional	262 At least one incident of physical violence: 38.2%	Female drug users (most commonly used substance: smokable cocaine), part of a larger study, investigating HIV sexual risk behaviors, street-recruited *Age*: >18 years old/mean age: 37.6 y (SD = 6.8) *Ethnicity*: Caucasian: 41%, Alaska Natives/ American Indians: 32%, African American: 21% *Education*: Less than high school: 32.4%, high school graduation or GED: 36.3%, more than high school: 31.3% *Monthly income from all sources*: M = \$1144 (SD = \$2358) *Monthly legal income*: M = \$557 (SD = \$727) *Social class (self-reported):* Upper class: 3.5%, middle class: 22.4%, working class: 25.9%, lower class: 30.1%, truly needy: 18.1% *Number of children at home*: M = 0.6 (SD = 1.5)
4	Peek-Asa et al. (48) USA	Clinic-based	Cross- sectional	1,478 Overall: 16.1% (physical/sexual: 12.5%, battering: 9%) Urban towns: 15.5% Large rural towns: 13.5% Small rural towns: 22.5% Isolated rural areas: 17.9%	Women who attended for elective abortion at a clinic, Iowa residents No table for demographic information

(Continued)

TABLE 1 | Continued

	Study id country	Setting	Study design	Sample size prevalence of IPV	Population's characteristics
5	Bosch and Schumm (42) USA	Population-based	Cross-sectional	56 100%	Women who experienced an abusive relationship *Age*: M = 40.5 years (SD = 8.6), range: 22–63 years *Ethnicity*: Caucasian: 84%, Native-American: 14%, African American: 2% *Marital Status*: 80% married during abusive relationship (at time of interview, only one woman was still married to formerly abusive husband) *Education:* Less than high school: 5%, college degree: 14%, some college training: 40% additional vocational training: 9% *Occupation*: 49% working part-time, 38% working full-time during abusive relationship *Mean annual household income* (during abusive relationship): M = $34250, (SD = $29319) 36% receiving consistent monetary support 90% with minor children (average of 3.5 children, SD = 1.5)
6	Chernet and Cherie (43) Ethiopia	Population-based	Cross-sectional	4,714 30%	Ever-married women, survey of households *Age:* range 15–49 years (15–19: 22.7%, 20–24: 19.4%, 25–29: 20.0%, 30–34: 15.2%, 35–39: 10.8%, 40–44: 6.9%, 45–59: 5.0%) *Marital Status*: 71.3% married, 56.4% divorced, 73.5% widowed *Education*: Uneducated: 49.0%, primary: 34.2%, secondary: 11.4%, higher: 5.4% *Wealth index*: Poor: 44.7%, middle: 14.1%, rich: 41.2% 74.3% living in rural areas, 25.7% in urban areas
7	Seedhom (50) Egypt	Population-based	Cross-sectional	1,502 physical violence: 30.3% sexual violence: 7.5% sexual and physical violence: 31.6% emotional violence: 49.3% All forms of violence: 60.4%	Currently or formerly married women, systematic random sample from an Egyptian city *Age*: range 18–65 years (18–29: 21.6%, 30–44: 41.4%, 45–65: 37.0%) *Marital status*: 86% married, 14% divorced/ separated/ widowed *Education*: Illiterate: 40.2%, read and write: 35.3%, below University level: 14.9% University level or above: 9.6% *Occupation*: 77.3% housewife, 22.6% employed
8	Plazaola-Castaño et al. (49) Spain	Clinic-based	Cross-sectional	1,402 any type of violence during lifetime: 32.0% physical violence and sometimes psychological: 7.0% psychological violence: 14.0% psychological and sexual violence: 2.5% all three types of violence: 6.0%	Women who seeked help at a primary care center *Age*: M = 38.83 years (SD = 11.15), range: 18–65 *Marital status*: 62.9% married, 25.6% single, 11.5% separated/ divorced/ widowed *Education*: University degree: 34.7%, high school: 23.7%, middle school: 37.9%, no education: 3.7% *Occupation*: 35.3% housewives, 51.0% employed, 13.7% student/ unemployed *Monthly income*: > 1,200€: 36.0%, 900–1,200€: 23.5%, 600–900: 25.5%, <600: 15.0% *Number of children*: none: 29.7%, one: 20.5%, two: 33.3%, three or more: 16.4%
9	Coohey (44) USA (Iowa)	Recruited from parent groups in public schools, social service agencies, day care centers + libraries in Chicago	Comparative case studies	143 No prevalence estimates were provided	Mothers with a current partner (40 severely assaulted battered mothers, 46 battered but not severely assaulted mothers, 57 not battered mothers) *Age*: M = 30.56 years *Ethnicity*: 33.49% African American, 35.46% Latina American, 33.7% Anglo-American *Marital status*: 47.53% married *Education*: M = 11.23 years 86.03% lived below 120% of the poverty line *Number of children*: M = 2.99

(Continued)

TABLE 1 | Continued

Study id country	Setting	Study design	Sample size prevalence of IPV	Population's characteristics
10 Yanikkerem et al. (51) Turkey	Population-based	Cross- sectional	217 9.7% rural areas: 17.3% urban areas: 2.7%	Pregnant women living in certain areas (household survey) *Age*: 42.4% aged 25 years and younger, 57.6% older than 25 years *Marital status*: 82.5% married, 17.5% unmarried *Education*: elementary or less: 75.1%, more than elementary: 24.9% *Occupation*: 6.5% employed, 93.6% unemployed *Income status*: High to middle: 81.1%, low: 18.9% 52.1% attended clinic in urban areas, 47.9% in rural areas
11 Levendosky et al. (47) USA (Michigan)	Population-based	Cross-sectional	203 71.4%	Women in their last trimester of pregnancy *Age*: *M* = 25.3 years Ethnicity: 63% Caucasian, 25% African American, 5% Latina, 7% other ethnic *backgrounds* *Marital status*: 49% single + never married, 40% married, 11% separated/ divorced/ widowed *Education*: Less than high school: 16%, high school: 30%, post-high-school training: 41%, college: 13.5% *Monthly income*: Median = $1500, range: $0–$9500 *Number of children*: one or more: 57%

partner. No study with men as victims was identified. Two terms were used to describe the violence, i.e., IPV ($n = 8$), and Domestic Violence (DV) ($n = 3$).

Quality of Included Studies

Seven studies scored high risk of bias (42, 44, 45, 47–49, 51), while four studies scored low risk of bias (15, 43, 46, 50). **Table 2** summarizes the risk of bias assessment scores for the included studies.

Associations of Social and Geographical Isolation and IPV

Two studies reported associations of social isolation and IPV (45, 46). In Farris & Fenaughty (45), social isolation was strongly correlated with physical and sexual IPV among female drug users. In another study, social isolation was reported among immigrant women as a predictor for physical, sexual, and psychological IPV (46). Both social and geographical isolation were reported in two of the included studies (15, 42). Social isolation was assessed in terms of lack of emotional and informational support and found to be a predictor for an increased risk of IPV among women, who were also geographically isolated. They were found to be living approximately 6 miles away from the closest town, 12 miles away from closest mental health center, and 78 miles away from closest shelter service (42). In Lanier & Maume (15), social isolation was assessed in terms of lack of social support. Variables such as lack of help received, interaction through socializing, and church participation were measured and found to be significantly associated with increased risk of IPV. The geographical isolation aspect was assessed according to the counties classification into metropolitan countries, if they were located in a metropolitan area and contained an urban population of 20,000 or more, or non-metropolitan counties, which are an approximation of the rural context. It was also combined with the disadvantage index (i.e., sum of relative presence of Black residents, poverty households, female-headed households, and the unemployed in the county), as well as the Gini index (i.e., a standard measure of income inequality ranging from 0 to 100, where 100 indicates perfect inequality). The model for respondents in non-metro counties indicated the likelihood of women experiencing IPV in the past year was reduced significantly as levels of help received increased. Other findings indicating that respondents living in metro counties with higher levels of income inequality also reported a greater degree of IPV. This was also true for respondents in metro counties with more minor children in the household.

Four studies investigated lack of social support as indicator for social isolation (44, 47, 49, 50). Coohey (44) found that mothers who were severely assaulted, had fewer friends, fewer contacts with their friends, fewer long-term friendships, and fewer friends who really listened to them than did the non-battered mothers and the battered mothers who were not severely assaulted. In another study, social isolation was assessed by measuring the quality of support among a network of pregnant battered women (47). However, correlations between the average severity of violence and the practical, emotional, and critical support were not found to be statistically significant.

TABLE 2 | Risk of bias of included studies.

Study ID	Bosch and Schumm (42)	Chernet and Cherie (43)	Coohey (44)	Farris and Fenaughty (45)	Fernbrant et al. (46)	Lanier and Maume (15)	Levendosky et al. (47)	Peek-Asa et al. (48)	Plazaola-Castaño et al. (49)	Seedhom (50)	Yanikkerem et al. (51)
MAJOR DOMAINS											
Recruitment Procedure	High risk	Low risk	High risk	High risk	High risk	Low risk	Unclear risk	Unclear risk	High risk	Low risk	High risk
Exposure Definition and Measurement	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk
Outcome	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	High risk	Low risk	Low risk
Confounding	Low risk	Low risk	Low risk	Unclear risk	Low risk	Low risk	Low risk	Low risk	Unclear risk	Low risk	Low risk
Analysis Methods	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk	High risk	Low risk	High risk
MINOR DOMAINS											
Funding	Unclear risk	Low risk	Unclear risk	Unclear risk	Unclear risk	Low risk	Unclear risk	Unclear risk	Unclear risk	Unclear risk	Unclear risk
Conflict of Interest	Unclear risk	Low risk	Unclear risk	Unclear risk	Unclear risk	Low risk	Unclear risk	Low risk	Unclear risk	Low risk	Unclear risk
Overall Assessment	High risk	Low risk	High risk	High risk	Low risk	Low risk	High risk	High risk	High risk	Low risk	High risk

Yet, for battered women, the number of supporters in their network who were in an abusive relationship as well, was related to impaired emotional and critical support among these women. No further investigations were made regarding the association between this similarity of battered women and their supporters and IPV (47). In Plazaolo-Castaño et al. (49), women who reported having social support had a lowered probability of ever being abused than women who reported not having social support. Women who experienced abuse in the past and currently having social support had a lower probability of being abused again by a different partner than those who had no social support. Lack of social support was also investigated in Seedhom (50) and it was considered a predictor for physical, social, and emotional violence. Three studies investigated geographical isolation (43, 48, 51) and found it to be a risk factor for IPV. Chernet & Cherie (43), and Yanikkerem and colleagues (51) found that women living in rural areas were at significantly higher risk compared to women living in urban areas (**Table 3**).

Recommendations Made by Individual Studies

As a summary of the recommendations made by the individual studies, Coohey (44) pointed out that battered women were more likely to seek out support from family and friends than from professional helpers. Besides, interventions should aim at re-establishing social networks of women experiencing abuse (49). It was also emphasized that interventions for women living in rural areas should not be limited to formal networks, but should also include informal (social) networks within the community in order to provide information and advice, help women access resources and hold abusers accountable (15, 42). These studies expressed how imperative it is that abusers are held accountable for their abusive behaviors. In the case of socially isolated migrant women, this focus should be applied to the social structures as a whole to improve women's access to networks outside their own group (46). Moreover, improving the economic status of rural households could be an effective strategy to reduce IPV (43). Apart from that, as isolation is also likely to be tied closely to experiences of violence and drug use for the disadvantaged population of abused female drug users, people who have contact with victims ought to provide immediate support and resources (45). Finally, Peek-Asa et al. (48) recommended increasing the focus on access to preventive services in the case of rural women, including Domestic Violence Intervention programs (DVIP) resources.

DISCUSSION

The objective of our rapid review was to investigate the associations between social and geographical isolation and IPV and their possible implications for the ongoing COVID-19 pandemic. In this rapid review, the literature search did not reveal any studies associated with social or geographical isolation in the context of epidemics or pandemics. This means that the

TABLE 3 | Findings of individual studies.

	Study id/country	Type of isolation	Type of IPV	Effect measures	Recommendations by authors
1	Fernbrant et al. (46) Sweden	Social isolation	IPV (physical, sexual, psychological)	OR: 3.37 (1.82–6.24)	The role of social capital in increasing resilience against poor mental health for those living in abusive relationships indicates a need for supporting social structures that facilitate Thai women's' access to networks outside their own group.
2	Lanier and Maume (15) USA	Geographic isolation, social isolation (social support)	IPV (physical or sexual assault, threat of assault)	Non-metro counties/ metro counties ($N = 1,781/N = 3,133$): Help received: $\beta = -0.218/0.060$ ($p = 0.19/0.374$) Interaction—socializing: $\beta = 0.053/-0.004$ ($p = 0.20/0.919$) Interaction—church $\beta = -0.040/-0.022$ ($p = 0.518/0.617$) Interaction—participation $\beta = 0.004/-0.004$ ($p = 0.923/0.882$)	The study suggests that policies that work to increase the social networks of women living in rural areas may effectively decrease violence.
3	Farris and Fenaughty (45) USA	Social isolation	IPV (physical, sexual)	OR = 5.17 (2.62–10.19)	People who do have contact with this disadvantaged population have an added responsibility to provide immediate support and resources Intervention cannot be aimed singularly at social isolation, as isolation is likely to be tied closely to experiences of violence and drug use.
4	Peek-Asa et al. (48) USA	Geographic isolation	IPV (physical, sexual, psychological)	OR = 1.2 (0.7–2.1)	Increased focus on access to preventive services, including Domestic Violence Intervention Programs (DVIP) resources, is critically needed.
5	Bosch and Schumm (42) USA	Social and geographic isolation (~6 miles from closest town/grocery store, 12 miles from closest mental health center, 78 miles from closest shelter services)	IPV	***Previous/current abuse*** access to resources: $r = -0.381^{**}$ emotional non-support: $r = 0.355/0.360^{**}$ ***Abuse during relationship*** access to resources: $\beta = 0.515^{***}$ emotional support: $\beta = 0.423^{***}$ ***Abuse at time of interview*** informational support: $\beta = -0.577^{***}$ (** $p < 0.01$, $^{***}p < 0.001$)	It is imperative that persons in the informal and formal networks take individual responsibility in holding abusers accountable for their abusive behaviors. Women should not be held totally responsible for tackling this societal issue on their own. Practitioners must work with the informal and formal networks within communities to provide information and advice, help women access resources, and hold abusers accountable.
6	Chernet and Cherie (43) Ethiopia	Geographic isolation (living rural as a predictor)	IPV (physical, sexual, emotional)	Living in rural, being poor, being divorced and being 25–39 years old are found to be significant predictors if IPV Urban area: OR = 0.66 (0.5353–0.8127)	Improving economic status of household and awareness creation for rural residents can be effective strategies to reduce IPV.
7	Seedhom (50) Egypt	Lacking social support; being separated/ widow/ divorced	IPV (physical, sexual, emotional)	Lifetime prevalence of IPV lower for women with social support: 18.4 vs. 16.6% ($p < 0.002$) *logistic regression (social support as predictor):* physical and social violence: $\beta = 1.63$, OR = 7.8 (3.12–14.60) emotional violence: $\beta = 1.12$, OR = 9.6 (4.20–20.40)	-

(Continued)

TABLE 3 | Continued

	Study id/country	Type of isolation	Type of IPV	Effect measures	Recommendations by authors
8	Plazaola-Castaño et al. (49) Spain	Lack of social support	IPV (physical, psychological and sexual)	Social support and abuse: OR = 0.11 (0.06–0.20) Social support and recurring abuse: OR = 0.14 (0.05–0.37)	Interventions should aim at re-establishing social networks of women experiencing abuse.
9	Coohey (44) USA (Iowa)	Lack of social networks and received support (family and friends)	Domestic violence	Association between being severely assaulted and social network/ support characteristics: Size of friendship network: $r = -0.17$* Number of contacts with friends: $r = -0.17$* Number of long-term friends: $r = -0.23$* Number of friends who really listened: $r = -0.22$* (*$p < 0.05$)	As battered women were more likely to seek out support from family and friends than from professional helpers after a battering incident, interventions that include members of a woman's social network might be effective in keeping them and their children safe.
10	Yanikkerem et al. (51) Turkey	Geographic isolation (rural area)	Domestic violence against pregnant women	Women who lived rural area had experienced violence more than women who lived in urban areas ($p < 0.05$) Higher numbers of violence in women seeking prenatal clinics (139.3 vs. 199.8, $p = 0.000$)	–
11	Levendosky et al. (47) USA (Michigan)	Lack of social support (structural support, e.g., total number of supporters; functional support, e.g., emotional)	Domestic violence	Isolation assessed by measuring quality of support: correlation of average severity of violence and practical/emotional/ critical support: 0.08/ 0.00/−0.13 (not significant)	–

**p* < 0.05, ***p* < 0.01, ****p* < 0.001.*

applicability of our conclusions regarding the ongoing COVID-19 pandemic could be limited. However, as we already argued in the beginning, the ongoing pandemic represents a novel situation, it was therefore inevitable for us to consider pre-lockdown contexts as an approach to draw conclusions.

We found isolation, both social and geographical, was associated with IPV. Indicators of social isolation varied across studies. While two studies assessed social isolation directly (45, 46), there was a variety of approaches assessing social isolation indirectly among the other studies. Those approaches included assessing lack of social support (49, 50), lack of emotional or informational support (42), lack of practical, emotional, and critical support (47), number of friends or frequency of contacts (44), as well as membership in social networks and levels of social interaction (15). Having one of those indicators alone does not necessarily indicate being socially isolated, but when combined with other factors, such as unemployment, poverty, or drug use, they may provide an adequate indicator of social isolation (34). These findings are consistent with most recent studies which suggest that increasing feelings of isolation during the COVID-19 lockdown measures may cause abuse of alcohol, drugs, as well as increased anger and aggression, which may also lead to violence toward the self or others (52), such as one's intimate partner (53). Combined with isolation, experiencing economic problems caused by an ongoing lockdown can significantly contribute to the increase of stress in an already strenuous relationship, precipitating IPV episodes (54). Indeed, initial studies and reports indicate changes in the prevalence of IPV and the extent of injuries. For instance, latest figures imply either a decline or an increase in IPV cases in various countries. However, where there has been a reported decrease, it was in stark contrast to the severity of the injuries that have been presented (55). Thus, the current research evidence remains inconclusive, since there are few representative surveys and figures available. In any case, IPV interventions and the care of affected individuals and their children must be guaranteed even in times of an ongoing pandemic, where urgent adaptation of intervention and protection measures of IPV to these special conditions, as well as the timely announcement of corresponding help offers are of central importance.

Implications for the Ongoing COVID-19 Pandemic

Many of the included studies have emphasized social support through the recommendations that they made in order to enhance the interventions and prevention of IPV in the context of isolation. Of these studies, some have expressed living in rural areas (i.e., being geographically isolated) could correlate with social isolation, which in turn could increase the risk of IPV victimization (15, 42). Such isolation could be very similar to our context of the COVID-19 pandemic, where physical entrapment of potential victims is seen due to the enforced quarantine and physical and social distancing rules. Furthermore, this remoteness or entrapment with emergency resources being limited, such as the closure of women's shelters and ambulatory and community referral sites during the pandemic, could render victims more vulnerable to IPV (56, 57). Even without isolation, access to information and support could be a difficult task for women in violent relationships. In times where personal freedom is restrained even more, digital means of communication such as m-health, social media, or telemedicine could play an important role in reducing the sense of isolation and entrapment the victims may suffer, and could facilitate better access to key workers (e.g., helplines, legal aid) and foster better support (11). The generalizability of how isolation and IPV are associated is limited due to the heterogeneous characteristics of the included study populations, like the fact that some studies were conducted in low and middle income countries such as Ethiopia (43), while others were conducted in high-income countries like Sweden (46). Some studies included very specific populations such as female drug users (45), women who attended for elective abortion (48), pregnant women (47, 51), and migrant women (46). Nevertheless, our results shed light on the possible increased likelihood for these populations to experience IPV under the COVID-19 pandemic circumstances. Therefore, the recommendations of those studies, such as improving access to social networks outside the victims' own group, improving their economic circumstances, asserting the responsibility for those in contact with the victims, and increasing the focus on access to preventive services and programs need to be taken into account. It is also very important for the governments around the globe to develop innovative strategies in order to ensure access to all the relevant information and the infrastructure in place, along with the required services, during this crisis situation. This is especially important for those being at most danger (i.e., women, children, elderly) (58). Moreover, the cross-sectional design of some of the included studies does not allow us to determine whether IPV consequently leads to isolation, especially social isolation, or whether isolation rather serves as cause of IPV. Nevertheless, findings in our review show that isolation is strongly associated with an increased risk of IPV. This could be applied to the context of this rapid review since isolation could be seen as a consequence of the physical and social distancing, as well as quarantine during this pandemic.

Limitations

We conducted a rapid review due to the urgency of the topic and its implications for the ongoing COVID-19 pandemic. As a result, time constraints asked for an abbreviation of certain methodological steps of the review process. Since neither dual titles-abstract nor dual full-text screening were performed, relevant studies might have been missed and a certain selection bias might have been introduced. Only published studies with language restriction (i.e., English, German, and Spanish) were used, this could mean that some eligible studies may be missed, resulting in a selection bias. Upon our risk of bias assessment, seven studies were found to be of high risk. This could influence the quality of the rapid review in general, causing mainly reporting bias. Nevertheless, the present rapid review contains clear eligibility criteria. Our procedures, which were based on the guidance and training materials produced by Cochrane for rapid reviews make us assume that the overall conclusion was not affected by those limitations.

CONCLUSIONS AND IMPLICATIONS FOR FUTURE RESEARCH

In this review, we aimed at identifying possible associations between social and geographical isolation and IPV to assess their potential impact during the ongoing COVID-19 pandemic. Overall, our narrative synthesis of the pre-pandemic data emphasized that isolation could be associated with experiencing IPV in the context of the current pandemic. Associated factors like limited access to formal and informal services as well as disruptions of social networks has affected millions of people during the pandemic due to quarantine, and physical and social distancing measures. Therefore, isolation circumstances should be seriously considered as an important factor regarding recommendations made by the individual studies for interventions and prevention of IPV. Policies need to make sure that alternative help services (e.g., messenger services, telemedicine) are accessible and dependable by victims of IPV who are affected by isolation with particular attention to reaching survivors safely while perpetrators are present and in ways that cannot be detected or traced. In addition, increasing awareness for IPV is essential so that people working in the informal or formal sector as well as family and friends in the immediate social network of IPV victims are sensitized to signs of violence.

Additionally, help systems in the countries included in the review differ widely. Therefore, conclusions of this review have to be adopted to fit the particular help systems, infrastructure, and legislation. Measures such as pharmacies establishing code words for victims to get help were established in Belgium, France, Spain, the Netherlands, and Germany. For example, in Germany, the national coalition of pharmacist organizations (Bundesvereinigung Deutscher Apothekerverbände e.V.), the national coalition of women's counseling services (Bundesverband Frauenberatungsstellen und Frauennotrufe [bff]), and the national helpline against violence against women (Hilfetelefon Gewalt gegen Frauen) started a national campaign. Nineteen thousand pharmacies are providing information about the national helpline since pharmacies belong to the very few places where women can access low threshold information regarding health and well-being during the pandemic. This campaign raises awareness for the possibility of 24/7 free and anonymous counseling. The national helpline is of key importance. It is free, available at all times, and it offers counseling for female victims, translation, information, and redirection to a local counseling service and/or shelter. While face-to-face counseling and admission to shelters has proven problematic during the pandemic, the website and phone service remain of vital importance and safe options during isolation. Also, the Fed, the Ministry for Family Affairs, Senior Citizen, Women and Youth in Germany started a cooperation with supermarkets, displaying information regarding help hotlines or services on posters and the back of receipts. To establish more conclusive evidence, a systematic review with meta-analysis is currently being performed by one of this study's co-authors (J. L[2].)

DATA AVAILABILITY STATEMENT

The original contributions generated for this study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

AM, SG-N, SB, and HH designed and conceptualized the present study. AM, SB, and HH conducted manuscript screening and data extraction. AM wrote the first draft of the manuscript. SG-N supervised data extraction and drafting of the manuscript. AM, SB, HH, BG, CH, JL, and SG-N contributed to the analysis and interpretation. AM, HH, and SG-N contributed to the manuscript revision. All authors read and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2021.578150/full#supplementary-material

[2]https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42020186517.

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An Overview of Commercially Available Apps in the Initial Months of the COVID-19 Pandemic

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Introduction: It has been 4 months since the discovery of COVID-19, and there have been many measures introduced to curb movements of individuals to stem the spread. There has been an increase in the utilization of web-based technologies for counseling, and for supervision and training, and this has been carefully described in China. Several telehealth initiatives have been highlighted for Australian residents. Smartphone applications have previously been shown to be helpful in times of a crisis. Whilst there have been some examples of how web-based technologies have been used to support individuals who are concerned about or living with COVID-19, we know of no studies or review that have specifically looked at how M-Health technologies have been utilized for COVID-19.

Objectives: There might be existing commercially available applications on the commercial stores, or in the published literature. There remains a lack of understanding of the resources that are available, the functionality of these applications, and the evidence base of these applications. Given this, the objective of this content analytical review is in identifying the commercial applications that are available currently for COVID-19, and in exploring their functionalities.

Methods: A mobile application search application was used. The search terminologies used were "COVID" and "COVID-19." Keyword search was performed based on the titles of the commercial applications. The search through the database was conducted from the 27th March through to the 18th of April 2020 by two independent authors.

Results: A total of 103 applications were identified from the Apple iTunes and Google Play store, respectively; 32 were available on both Apple and Google Play stores. The majority appeared on the commercial stores between March and April 2020, more than 2 months after the first discovery of COVID-19. Some of the common functionalities include the provision of news and information, contact tracking, and self-assessment or diagnosis.

Conclusions: This is the first review that has characterized the smartphone applications 4 months after the first discovery of COVID-19.

Keywords: COVID-19, smartphone apps, M-health, technology, review

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INTRODUCTION

On the 31st of December 2019, the World Health Organization (WHO) was alerted by authorities in China of a case of pneumonia of unknown origin (1). Within weeks of the detection of the index case, large number of individuals were afflicted, and the total number of cases and mortality exceeded that of the Severe Acute Respiratory Syndrome (SARS) outbreak in 2003. On the 30th of January 2020, the WHO declared the outbreak as a public health emergency (1). The rapid increase in the number of cases and the increasing rates of mortality resulted in the WHO's declaration of the outbreak as a pandemic (COVID-19) on the 11th March 2020 (1). To date, as of the 21st of April 2020, a total of 2,314,621 cases have been confirmed globally, along with a total of 157,847 deaths (2). Throughout the world, countries are trying their best to contain this pandemic, with some countries, like Italy, Spain and Malaysia, locking down their cities; whilst others have adopted stringent measures such an increased social distancing in their attempt to stem the community spread of COVID-19 (3, 4).

Many of the measures introduced to stem the rapid community spread of COVID-19 involve individuals being confined to their homes, with only limited movement. In parallel there has been an increase in the utilization of web-based technologies for counseling, and for supervision and training, and this has been carefully described in China (5). The Chinese government has also tapped upon social media technologies, such as that of WeChat and Tencent QQ, to provide psychoeducation, which is much needed in times of crisis (5). Telehealth technologies have also been used to support frontline healthcare workers and patients who are diagnosed with COVID-19, and there is evidence demonstrating the feasibility and acceptability of such technologies (5). Most recently, Zhou et al. (6) have identified tele-mental health services available in Australia, that could potentially be used to meet the unprecedented need for mental health care and treatment. The existing tele-health initiatives in Australia are mostly delivered on online platforms, but there are also apps, such as that by Black Dog Institute to help individuals with mood and anxiety disorders (6).

Smartphone applications have previously been shown to be helpful in times of a crisis to assess the impact on psychological well-being. Zhang et al. (7) used social media and an accompanying smartphone application to assess for psychological distress amongst the general public during the 2013 Southeast Asia Haze Crisis. Algahtani et al. (8) described the use of the iPhone in delivering a questionnaire to assess public response to MERS-COV. Mobile applications, such as "Flu-Report" have been helpful in the acquisition of real-time information about the spread of influenza using self-reported information. Fujibayashi et al. (9). All these examples illustrate the great potential of mobile technologies during times of a crisis, including epidemics. Whilst there have been some examples of how web-based technologies have been used to support individuals who are concerned about or living with COVID-19, we know of no studies or review that have specifically looked at how M-Health technologies have been utilized for COVID-19, especially so in the initial months of the pandemic. There might be existing commercially available applications on the commercial stores, or in the published literature. There remains a lack of understanding of the resources that are available, the functionality of these applications, and the evidence base of these applications. It is of importance for there to be an understanding of the immediate tools that were made available to the public, as with the lockdowns and restrictions in movements, individuals could only obtain information digitally; and receive interventions digitally. Four months since the first index case of COVID-19 was detected in China, it is now timely to review the applications that have been designed to help reduce and alleviate the distress associated this global pandemic. Given this, the objective of this content analytical review is in identifying the commercial applications that are available currently for COVID-19, and in exploring their functionalities.

METHODS

Identification of COVID-19 Applications on the Commercial Stores

The methodology we adopted for this review was based on that used previously to identify attention and cognitive bias modification applications (10). The previous review involved a manual cross-sectional search on the apps store iTunes (Apple Inc, Cupertino, CA, USA) and Google Play (Google LLC, Mountain View, CA, USA). On this occasion we dispensed with a manual search as we anticipated the yield would be low, given that manual searches are only able to identify applications from a particular country or locality (due to the restrictions on the app store in searching for apps that are available in other countries). Instead we used a mobile application search application, App Annie (11), this is a mobile application search engine that is freely available and equivalent to 42 matters (AG, Zurich, Switzerland), which we have used previously. App Annie is a database that collates commercial applications in various application stores, and provides analytics into the performance of these applications (i.e., uptake rates). The search terms used were "COVID" and "COVID-19." Keyword search was performed based on the titles of the commercial applications. We did not limit the search of the applications by means of the language of the applications but included all applications that provided information of how they were used for COVID-19.

The search through the database was conducted from the 27th March through to the 18th of April 2020 by two independent authors (MZ and AC). We have decided to search for commercial applications during the acute/initial phase of the COVID-19 pandemic, in order to better understand how commercially available COVID-19 applications have helped in the initial stage of the pandemic. We concluded the search when there had been 3 consecutive days with no new countries or areas infected with COVID-19.Both reviewers independently identified the applications and compiled a list of those relevant. Applications were deemed to be relevant if they described how they provided some means of intervention for the COVID-19 pandemic.

In the event of any disagreement between the two reviewers this was resolved with discussion with the third researcher. An electronic spreadsheet was used in the collation of the following information from the identified applications, that of (a) Name of app, (b) App store notes (if the description were not in English, Google translate was used), (c) Functionality (based on the app store notes description), (d) country, (e) Category, (f) Release date, (g) Last updated date, (h) Version, (i) Seller, (j) App support link, (k) Privacy policy, (l) Displayed average ratings, and (m) Total displayed ratings.

As some of the identified applications were designed for use in non-English speaking countries Google translate was used for us to understand the description of the applications. We were not able to download the identified applications for a full assessment of their functionalities, given that we were unable to access applications published outside of Singapore.

RESULTS

There were 623 applications identified from the Apple iTunes store and 626 applications from the Google Play store. After further screening, as described above by two independent reviewers, there remained a total of 103 applications were identified from the Apple iTunes and Google Play store, respectively; 32 were available on both Apple and Google Play stores. Thus, in terms of unique applications per store, there were a total of 28 from the Apple Store and 43 from the Google Play store. **Figure 1** provides an overview of the selection process of the applications. **Supplementary Table 1** provides a summary of the core characteristics of the applications from both the commercial app stores. Of the identified applications, 26 applications are from the United States, Canada and Mexico; 29 applications are from the United Kingdom and rest of Europe; 1 application is from Australia and 18 applications are from India and Pakistan. Of the identified applications, at least 13 applications have had inherent contact tracing capabilities; 27 apps have had the main functionality of information provision and 12 apps have had functionalities relating to self-tracking of symptoms. Thirty-eight applications are classified under the "Health and Fitness" category and 39 applications are under the "medical category."

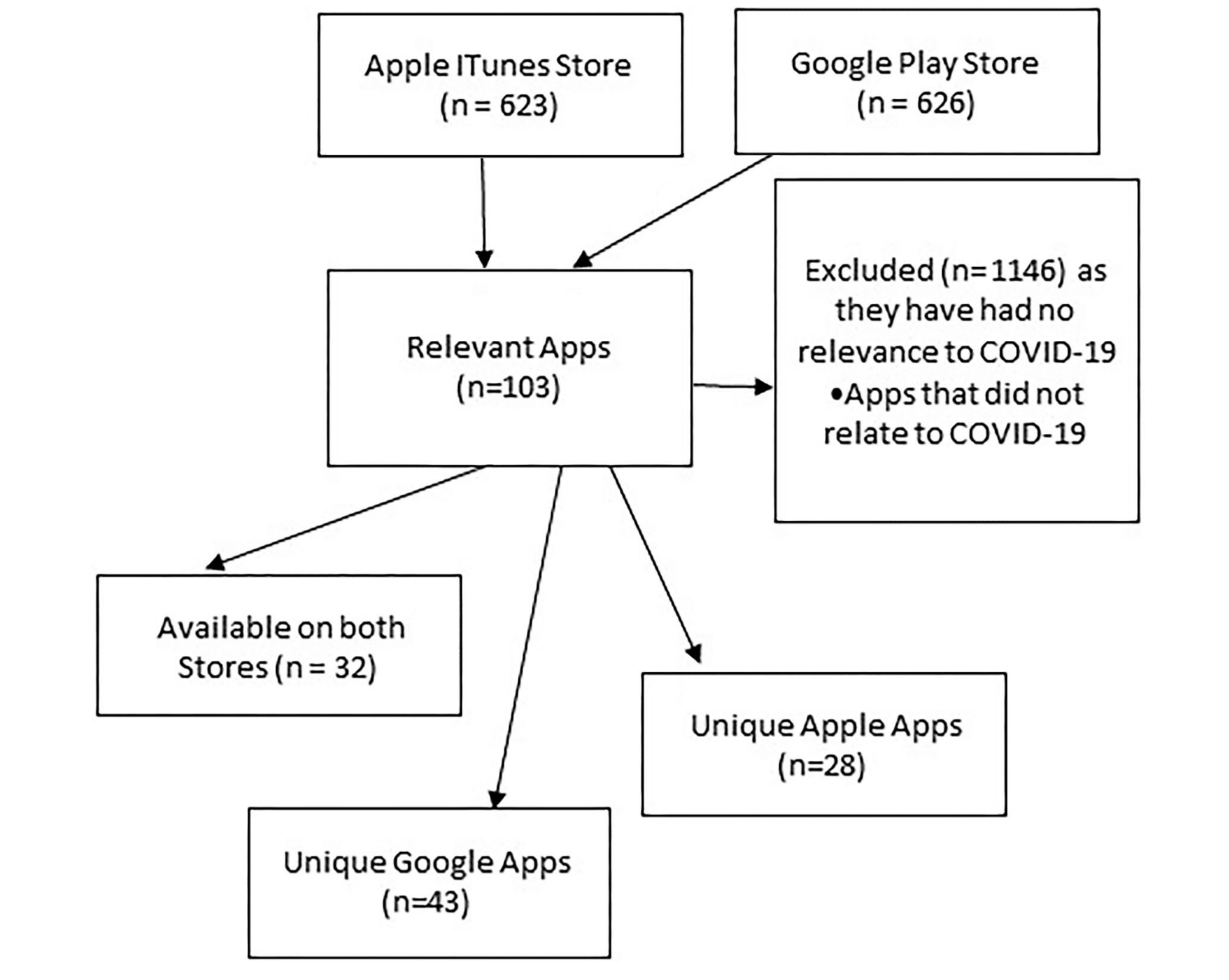


FIGURE 1 | Flowchart demonstrating how applications were identified.

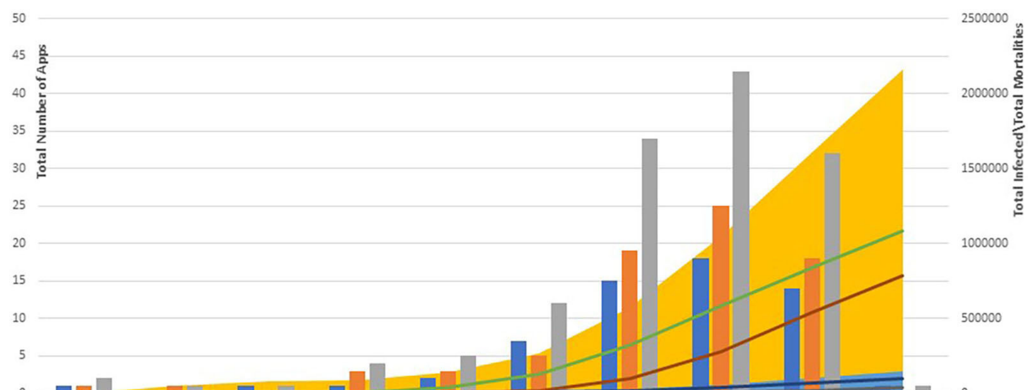
Figure 2 provides an overview of the numbers of new application available on the stores per week, along with an overview of the total numbers of individuals infected and the total number of mortalities.

As evident from **Figure 2**, there was a steady increase in the total number of applications made available, with most applications being available in the 3rd week of March through to the 2nd week of April. This corresponds to the period on which there is an exponential increase in the numbers of individual infected and the total number of mortalities. A total of 11 applications were made available for individuals living in the United States in March 2020 and at least 22 applications were made available for individuals living in Europe in this time period. Of these applications, at least six of these applications allowed for some form of self-assessment or screening, 11 for the provision of information pertaining to COVID-19 and two with features that enables for contact tracing. Some applications also reported functionalities that allows healthcare professionals to remotely monitor individuals who were discharged from a medical facility following treatment for COVID-19. Amongst the applications made available in the months of April 2020, at least five were made available for individuals living in the United States, and six were available for individuals living in the Europe. Of these applications, at least seven provided tools that allowed individuals to self-assess for symptoms related to COVID-19. Amongst all the identified applications, almost all, but 13 did not include any mention or links to a privacy policy. Almost all of the identified applications have stated the developer or the governmental organizations that were involved in the creation of the applications.

DISCUSSION

From our knowledge, this is perhaps the first review that has systematically characterized all the applications on COVID-19 from the commercial stores. We found 103 applications that are commercially available for individuals who are concerned about COVID-19. The majority appeared on the commercial stores between March and April 2020, more than 2 months after the first discovery of COVID-19. Most of the applications that were created in these 2 months catered to individuals who were living in countries that were severely affected by COVID-19, that of Europe and the United States. Some of the common functionalities include the provision of news and information, contact tracking and self-assessment or diagnosis. Most of these applications have been jointly conceptualized with governmental organizations, and with the majority having been recently updated.

As evident from our results, there has been a proliferation of applications in the months of March through to April, and this corresponds to the increasing numbers of individuals infected and the mortalities globally. We found there to be an increasing number of applications ($n = 22$ in March for Europe; $n = 11$ in March for United States, $n = 6$ in April for Europe, and $n = 5$ in



	2019	2nd week of February 2020 (15 Feb 2020 - 21 Feb 2020)	3rd week of February 2020 (22 Feb 2020 - 28 Feb 2020)	4th week of February 2020 (29 Feb 2020 - 06 Mar 2020)	1st week of March 2020 (07 Mar 2020 - 14 Mar 2020)	2nd week of March 2020 (15 Mar 2020 - 21 Mar 2020)	3rd week of March 2020 (22 Mar 2020 - 28 Mar 2020)	4th week of March 2020 (29 Mar 2020 - 04 Apr 2020)	1st week of April 2020 (05 Apr 2020 - 11 Apr 2020)	2nd week of April 2020 (12 Apr 2020 - 18 Apr 2020)
Total Cases (Global)	0	50580	77794	85403	142534	266073	571659	1051697	1610909	2160207
Total Mortality (Global)	0	1526	2359	2924	5392	11183	26493	56986	99690	146088
Total number of new apps on Apple Store	1	0	1	1	2	7	15	18	14	1
Total number of new apps on Google Store	1	1	0	3	3	5	19	25	18	0
Total number of apps	2	1	1	4	5	12	34	43	32	1
Total Cases (European)	0	46	54	1119	36233	128541	324343	583141	839257	1086889
Total Mortality (European)	0	0	1	23	1510	5999	18740	42334	70565	97201
Total Cases (Americas)	0	22	43	79	2209	18887	100314	279543	536664	784272
Total Mortality (Americas)	0	0	0	0	46	235	1485	6802	19294	35742

Time (Weeks)

FIGURE 2 | Availability of commercial apps by total numbers of infected/mortalities. Sunday is taken as the 1st day of the week for the computation of the number of new applications that are available on the stores. The numbers of individuals infected, and the total moralities figures have been extracted from the World Health Organization's COVID-19 Situation Reports. There were no available figures for 2019 as the first WHO Situation Report was published on 21 Jan 2020. The line graphs present the overall total number of infections and mortalities in Europe and the United States.

April for United States) in catering to the needs of the individuals from Europe and the United States, and this corresponds to the rapidly raising numbers in these two regions. As of the 21st of April 2020, the World Health Organization reported the European Region to have the greatest number of cases (1,149,071), and deaths (103,5886) (2) and within these figures, Spain and Italy are ranked the 1st and 2nd (2). As of 21st of April 2020, there were a total of 178,972 cases in Italy, with 23,660 deaths, whereas for Spain, there were a total of 195,944 cases and 20,453 deaths (2). In America, as of the 21st of April 2020, there has been a total of 893,119 infections with a total mortality that of 42,385. The proliferation of these applications might be due to the measures introduced by the different governments, such as a lockdown of the major cities, and these applications thus are integral in the provision of news and information. These applications might also help in the self-assessment of individuals for symptoms of COVID-19, so that individuals would know when and where to seek help. Additionally, as highlighted in the results, some of these applications allow for contact tracking, which is crucial in an epidemic to stem the increasing rates of infection.

Our results show that there is an increase in the numbers of applications only 2 months since the first discovery of COVID-19. Applications have been made available on the commercial stores since the start of the pandemic, but there were concerns pertaining to the information quality and the accuracy of the information within these applications, and this led to both Apple and Google announcing a ban on commercial applications from 5th March 2020 (12). This ban was to reduce the possibility of applications disseminating inaccurate information or fake news, recognizing that there was already a significant degree of anxiety amongst the general public, which has been reported formally in studies (5, 13, 14). Therefore, the applications we identified have attributions to a governmental organization, as this was necessary for it to be featured in a commercial app store. To date, the ban on applications have since been lifted.

From our review, the most common functionality of applications was in the provision of information about the nature of the disease outbreaks. Some applications incorporated novel functionalities, such as the ability to integrate with medical records, or link up with physical equipment like pulse oximeters, or harness the geo-location services in the smartphone for contact tracing. The provision of accurate information in times of a pandemic is crucial, to keep the general public well-informed of the changes in the situation and allay public's anxieties. The importance of accurate information has been echoed by the Centers for Disease Control and Prevention (CDC); they recommended guidelines to help public health authorities work with news media agencies, to ensure that the information disseminated is accurate (15). The fact that these applications allow for integration with physical sensors makes it possible to track patients remotely, such as those who have recently recovered. This helps to ensure that these patients could still be monitoring for residual symptoms despite them not being in a medical facility. A recent evaluation of a COVID-19 remote patient monitoring applications [Annis et al. (16)] (GetWellLoop) tested amongst 2,255 participants found that it was effective in enabling patients to manage their COVID-19 symptoms at home. Lastly, the functionality that allows for tracking of the users ought to be replicated for other countries, as it might be an inexpensive method for contract tracking.

At the time of the conclusion of our search, we found no applications that could assist in the delivery of psychological intervention, or counseling support are non-existent. These applications could be beneficial for patients afflicted with COVID-19 and members of the general public, who might require support given their high levels of psychological distress. Several recent studies have documented high levels of psychological distress amongst the general public. For example, Wang et al. (17) investigated, using the IES-R and the Depression, Anxiety and Stress Scale (DASS-21), the mental health status of 1,120 members of the general public living in China. Notably, 53.8% reported the psychological impact to be moderate to severe, with 16.5% having moderate to severe depressive symptoms, 28.8% moderate to severe anxiety symptoms and 8.1% moderate to severe stress. Liu et al. (5) have highlighted the high levels of psychological distress and the way in which apps have been used in China to help support these individuals together with social media networks, such as WeChat, to deliver of psychological interventions (5). It is thus crucial for clinicians to work with software developers in joint conceptualization of the next generation of apps for COVID-19 that could cater to the psychological needs of the end users. It is important to include clinicians, as they might be able to provide resources for the evidence-base of these apps. It might also be ideal to have patient participants to share ideas and offer their perspectives as to what they need from an application, to ensure that the apps meet the specific needs of users. By the time of revision of this manuscript in December 2020, we are now made aware that there have been applications, such as Corona Health (18), that attempts to investigate the impact that COVID-19 has on the mental health of adolescents and adults. Unfortunately, this application was only created several months into the pandemic. Such tools might be extremely helpful for the examination of the acute psychological distress of the public during the initial periods of the pandemic.

One of the major strengths of this study is that we have identified all the commercial COVID-19 applications featured on the two most common application stores. These commercial applications are likely to be resources that the general public would turn to, in such times. By using a global search engine, we were able to identify applications across the regions, instead of a manual search, which would confine our results to a particular locality, and would not have provided an overview of the nature of the COVID-19 app landscape. However, our study is not without its limitations. We have searched for COVID-19 applications using a search engine by means of keywords search and will have had missed out any applications that do not use the term COVID-19 in their application names, unfortunately this is a limitation that we were unable to overcome with the existing search tools that used. Our comprehensive searched of the two largest commercial stores did not identify any applications developed in China, and yet we know from Liu et al.'s (5) review that such apps exist. This is possibly because China-developed applications are not routinely hosted on these two commercial application stores, and are hosted on China application stores, which are not searchable outside of China. We have not tested the functionalities of the apps identified, as we were limited by resource and linguistic skills, also some applications require the users to register with credentials from that country. In addition, we are also aware that there have been tools that allow for the analysis of user reviews of applications. Such tools might provide a better perspective into the usefulness of each of the identified application and the challenges that individuals face in using them. We have not considered the use of such tools in our current work, as our intents were in characterizing the type and functionalities of applications that were made available in the early days of the pandemic. This is a dynamic field and we have summarized the state of play within 3 weeks, it will be interesting to observe whether new apps are launched with the same frequency and the focus of their content. Nevertheless, understanding the landscape of commercial applications available can inform the preparation of health promoting materials and highlight to developers where need still remains.

CONCLUSION

This is the first review to characterize the smartphone applications which are currently available, 4 months after the first discovery of COVID-19. Whilst there are several diverse applications mainly for the provision of information and tracking of health status, there remains a need for applications that could address the psychological well-being of the general public. The information generated by this review will also inform health professionals and the general public about the applications they can recommend or use for emotional support during the COVID-19 outbreak and it is also of importance for governmental policy and planning, as some of these technologies, if scientifically validated to be effective, could be shared amongst countries.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

AUTHOR CONTRIBUTIONS

MZ, AC, RH, and HS jointly conceptualized the study. MZ and AC were involved in data extraction, verification of the extracted data, and amended the second draft of the manuscript. MZ worked on the first draft of the manuscript, which HS provided guidance and further amends. RH provided critical updates to the final manuscript. All authors read and approved the manuscript prior to submission.

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SUPPLEMENTARY MATERIAL

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Impact of Coronavirus Disease 2019 (COVID-19) Outbreak Quarantine, Isolation, and Lockdown Policies on Mental Health and Suicide

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The novel coronavirus disease (COVID-19) pandemic has made a huge impact on people's physical and mental health, and it remains a cause of death for many all over the world. To prevent the spread of coronavirus infection, different types of public health measures (social isolation, quarantine, lockdowns, and curfews) have been imposed by governments. However, mental health experts warn that the prolonged lockdown, quarantine, or isolation will create a "second pandemic" with severe mental health issues and suicides. The quarantined or isolated people may suffer from various issues such as physical inactivity, mental health, economic and social problems. As with the SARS outbreak in 2003, many suicide cases have been reported in connection with this current COVID-19 pandemic lockdown due to various factors such as social stigma, alcohol withdrawal syndrome, fear of COVID infection, loneliness, and other mental health issues. This paper provides an overview of risk factors that can cause suicide and outlines possible solutions to prevent suicide in this current COVID-19 pandemic.

Keywords: COVID-19, mental health, suicide, quarantine, lockdown, social distancing, isolation

INTRODUCTION

The novel coronavirus disease (COVID-19) is a recently discovered infectious disease that is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). COVID-19 was first identified in Wuhan, China in December 2019 (1), and it has since spread rapidly to the entire world. On January 30, 2020, the World Health Organization (WHO) declared it a Public Health Emergency of International Concern (PHEIC) based on the International Health Regulations (2005), and they declared it a pandemic on March 11, 2020 (2). The following clinical symptoms present in COVID-19 patients: fever, cough, fatigue, muscle soreness, headache, diarrhea, and dyspnea. However, on April 1, 2020, China's National Health Commission (NHC) reported that 78% of cases were asymptomatic (3). COVID-19 mainly spreads through the respiratory droplets. Besides, people can also be infected by touching contaminated surfaces where the is virus present and then touching their own mouth, eyes, and nose (4). As of May 20, 2020, 4,761,559 confirmed cases and 317,529 confirmed deaths have been reported from 216 countries (WHO, 2020). The United States of America (USA) is in the number one place among a list of countries most affected by coronavirus. For example, according to a report from the WHO Coronavirus Disease (COVID-19) Dashboard, as of May 20, 2020, 1,477,459 confirmed cases and 89,271 deaths were reported in the USA. In India, the second-most populated country in the world, as of May 20, 2020, a total of 101,139 confirmed cases and 3,163 deaths were reported by the WHO (5). At present, there is no vaccination or any other therapeutic method for COVID-19. Therefore, a number of preventive measures have been taken around the world to prevent the spread of infection, such as quarantine, social isolation, lockdowns, and curfews. In this COVID-19 pandemic, ~2.6 billion people have been quarantined or are in under lockdown around the world (6). Although public health preventive measures have been taken to control the spread of COVID-19 infection, it has still had a huge impact on mental health around the world due to various psychological, social, and economical factors, such as loneliness, social isolation, anxiety, stress, depression, fear of COVID-19 infection, loss of loved ones, alcohol withdrawal syndrome or substance misuse, and loss of employment (7–9). Several studies reported that these above-mentioned factors will or have already increased suicide rates during COVID-19 (8, 10–12). A nationwide survey study reported that 34.1% of the quarantined or isolated people had experienced at least one of the following mental health issues: acute stress, anxiety, depression, and sleep disorders (13), and their study also stated that this likelihood was higher in frontline workers, people with pre-existing mental health issues, and people with chronic physical health disorders. Specifically, a previous study found that suicidal ideation behavior was significantly higher among people with pre-existing mental health disorders than in healthy controls in the COVID-19 pandemic (14). Furthermore, previous literature has stated that COVID-19 pandemic-related suicide rates will in the future range from 1 to 145% based on various prediction modeling studies (12). However, limited studies have been carried out on COVID-19 infection prevention measures (isolation, social isolation, locking, and curfew order) and their impact on mental health. Likewise, as soon as these lockdown policies are implemented, there is no updated and functional suicide monitoring system data on the effect of COVID-19 lockdown and other social distancing measures on mental health and suicide. Therefore, in this study, we briefly reviewed the different types of infectious-preventive measures for better understanding and the psychological impact of infection-preventive measures and risk factors for COVID-19-related suicides (up to May 2020). This study also tried to suggest possible solutions to prevent risk factors for the psychological effects of quarantine or lockdown procedures.

TYPES OF COVID-19 PREVENTIVE MEASURES

These kinds of preventive measures are not unfamiliar; for example, 40 days of quarantine were imposed in Italy during the 14th century to prevent plague epidemics (15, 16), and, more recently, a quarantine was put in place for severe acute respiratory syndrome (SARS) in 2003 (17). Quarantine is one of the oldest and most effective methods to reduce the spread of communicable diseases, and it separates and restricts people who have been exposed to a contagious disease or who have traveled to an affected region; people may not, however, be infected or might be asymptomatic. For instance, more than 150,000 persons were quarantined at their homes in Taiwan to control the SARS outbreak in 2003. Out of 150,000 quarantined people, only 24 people were infected by SARS-coronavirus (SARS-CoV) infection (18). In the COVID-19 outbreak, most of the countries in the world enforced a compulsory 14 days home quarantine or in a designated place (hotel) for people who have traveled to other countries. Under the policies of quarantine, people are not allowed to move from their home or designated place to meet others or invite visitors to their place of residence. If quarantine measures are implemented by the governments, people need to strictly follow the guidelines of the governments or public health authorities. It can be either voluntary or mandatory and implemented at individual groups or community level (19).

On the other hand, isolation has been imposed on the infected people to protect the non-infected people from those people with a confirmed diagnosis of contagious disease. Isolation and quarantine have been considered extreme forms of social distancing. The infected persons will usually be admitted and isolated in the hospital settings under medical supervision (20). In case of infection with mild symptoms, the infected person will be isolated at home.

Another form of public health measure to prevent the spread of infectious disease from person to person is "social distancing." The "social distancing" measures are implemented to reduce people's physical interactions with other people in the community. Since COVID-19 transfers from human to human (21), the following guidelines are practiced in the social distancing methods: wearing face masks, maintaining at least 6 feet distance from the other persons, avoiding social gatherings, avoiding handshakes, avoiding crowds at the parks, beaches, restaurants, shops, or any other public or private places, and work from home if possible.

The most extreme type of public health measure is "lockdown." Lockdown restricts the moment of people from one place to another place, and it can be imposed when enough people have fallen sick due to contagious diseases in specific regions or countries (22, 23). The government may order the shut down of schools, universities, public transports, taxis, railways, domestic and international flights, restaurants, temples, churches, mosques, and movie theatres, but hospitals remain an exception (24, 25).

IMPACT OF ISOLATION, QUARANTINE, AND LOCKDOWN ON MENTAL HEALTH AND RISK OF SUICIDE

Around the world, the COVID-19 pandemic and lockdown have brought a huge burden to the public, governments, and the

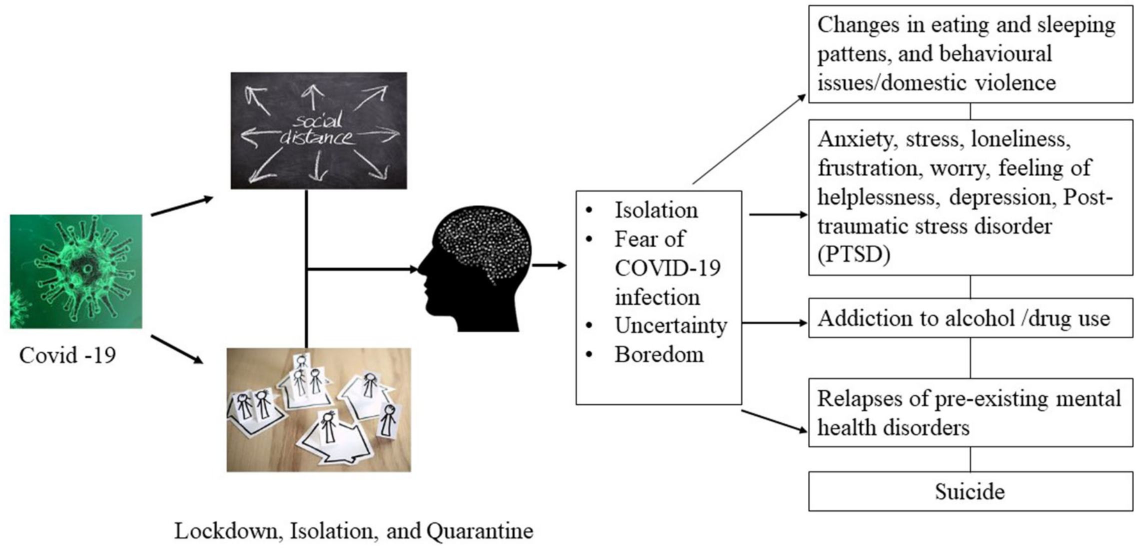

FIGURE 1 | Overview of COVID-19 impact on mental health.

economy of the countries. Although quarantines or lockdowns are implemented for a good reason, to prevent the spread of COVID-19, they may cause various adverse effects in the form of physical, psychological, social, and economic consequences. In particular, with social distancing, isolation, and lockdown, people may suffer from very serious psychological issues, such as anxiety, stress, fear, fear-induced overreactive behavior, frustration, guilt, anger, boredom, sadness, worry, nervousness, helplessness, loneliness, insomnia, and depression (26, 27) (**Figure 1**). A previous study investigated the psychological effects of SARS-quarantined persons in Toronto, Canada, and it was reported that 28.9% of people had a symptom of posttraumatic stress disorder (PTSD), and 31.2% suffered from depressive disorder (28). In extreme cases, social distancing or social isolation may increase the risk of suicide (29), and the following risk factors may trigger suicidal thoughts and ideas: social isolation due to prolonged lockdown, stress, fears of contracting the infection from others, isolated or quarantined individuals with pre-existing mental health issues, loss of employment, financial instability (7, 30, 31), fear of staying in the isolation ward in the hospital, loss of a loved one or missing family members, and feelings of insecurity for the future. At the SARS outbreak in 2003, a higher suicide rate (18.6 per 100,000) was recorded in Hong Kong (32) and most of them were older adults aged 65 or above (37.46/100,000) (33). Loneliness, isolation, anxiety, fear of contracting the virus, and fear of being a burden to their families were thought to be associated with higher suicide rates among older adults during the time of the SARS epidemic in Hong Kong (32, 34). Like the SARS outbreak in 2003, COVID-19 has instilled an uncertainty in people throughout the world, and it has led people to commit suicide, especially, more cases of suicide have been reported in developing countries than in other parts of the world in the early days of lockdown, isolation, and social distance practices (**Table 1**).

COVID-19 and Alcohol Addiction

Alcohol dependence is a significant risk factor for suicide. It also has high comorbidity with a variety of psychiatric issues such as depression, violent behavior, mood, and anxiety disorders (36). A previous study reported that people with alcohol addiction are 60–120 times more likely to commit suicide than people with no alcohol use disorders (37). On the other hand, after the announcement of a lockdown in India, there have been a number of suicide cases that have reportedly been due to the current unavailability of alcohol in the market. People with alcohol addictions suffer from alcohol withdrawal syndrome when they suddenly stop drinking or significantly reduce their alcohol intake (38). Alcohol withdrawal syndrome is characterized by tremors, insomnia, anxiety, and other physical and mental symptoms (alcohol hallucinosis, alcohol withdrawal seizures, and delirium tremens). According to the India Today newspaper (March 2020), two alcohol-related suicides were reported in the state of Karnataka, India. The first instance was of a 50-year-old man who desperately moved around for few days to acquire liquor before he ended his life due to frustration and alcohol withdrawal syndrome (39). Another person, a 70-year-old man, committed suicide by hanging himself in a tree in the same district of Karnataka due to the non-availability of alcohol. According to News18, seven people committed suicide due to alcohol withdrawal syndromes in the districts of Thrissur, Kochi, Kannur, Kollam, and Thiruvananthapuram, Kerala, India (40, 41), and most of them were younger than 40 years old (42). In contrast, some people with alcohol addiction took to after-shave lotion or paint and varnish as alternative drinks to liquor after liquor shops closed due to lockdown in Tamilnadu, India. Furthermore, it has been reported that three people died by drinking paint and varnish (43), and two people died after consuming after-shave lotion (44).

TABLE 1 | Impact of Covid 19 and suicides (up to May 2020).

Case study/No.	Age	Place	Occupation/ Remarks/Name	Gender	Risk factors for suicides	References
1	37	Kerala, India	-	M	Alcohol addict/Feeling depressed due to unavailability of liquor	https://news.abplive.com/news/india/coronavirus-lockdown-kerala-man-commits-suicide-after-govt-shuts-liquor-shops-1183618
2	50	Dakshina Kannada, Karnataka district, India	Rubber tapping labourer/ Name: Thomas	M	Alcohol addict/Feeling depressed due to unavailability of liquor	https://www.indiatoday.in/india/story/frustrated-at-not-being-able-to-get-liquor-during-lockdown-2-commit-suicide-in-karnataka-1661060-2020-03-29#
3	70	Karnataka, India	Rubber tapping labourer/Name: Tommy	M	Alcohol addict/Feeling depressed and frustrated due to unavailability of liquor	https://www.indiatoday.in/india/story/frustrated-at-not-being-able-to-get-liquor-during-lockdown-2-commit-suicide-in-karnataka-1661060-2020-03-29#
4	37	Pakistan	Fawad Abbasi	M	Drug Addict/he was suspected for Covid−19 infection and admitted in the Jinnah Postgraduate Medical Centre, Pakistan. But he jumped from the third-floor isolation ward and committed suicide. But his Covid-19 test result showed that he was not infected with the coronavirus	https://www.dawn.com/news/1552729/addict-with-covid-19-symptoms-commits-suicide-at-jpmc
5	-	Chengalpat District, Tamilnadu, India	3 persons: Shivasankar Pradeep and Sivaraman	M	Alcohol addicts: Habitual drinkers/Consumed paint and varnish as an alternative for liquor due to unavailability of liquor	https://www.indiatoday.in/india/story/unable-to-get-liquor-3-men-die-in-tamil-nadu-after-drinking-paint-and-varnish-1663775-2020-04-06
6	27	Tamilnadu, India	Fisherman/Arunpandian	M	Consumed aftershave lotion mixed with soda as a substitute for alcohol	https://www.newindianexpress.com/states/tamil-nadu/2020/apr/04/craving-alcohol-amid-lockdown-two-tn-men-die-after-drinking-aftershave-mixed-with-soda-2125733.html
7	35	Tamilnadu, India	Fisherman/Hasan Mydeen, 35	M	Consumed aftershave with soda as a substitute for alcohol	https://timesofindia.indiatimes.com/city/chennai/three-alcoholics-in-tn-consume-after-shave-lotion-laced-soft-drinks-two-die/articleshow/74981848.cms
8	28	Kerala, India	Name: KC Vigil		Restlessness due to unavailability of liquor to drink	https://bangaloremirror.indiatimes.com/news/india/frustrated-over-not-getting-alcohol-one-more-man-commits-suicide-in-kerala/articleshow/74866273.cms
MIGRANT WORKER						
9	22	Kerala, India	Migrant worker/Asif Iqbal Mondal	M	He committed suicide as he did not have money to book the ticket to return to his hometown in Kolkata	https://www.deccanchronicle.com/nation/current-affairs/100520/unable-to-return-home-migrant-labourer-from-bengal-ends-life-in-keral.html
FEAR & ANXIETY OVER COVID-19						
10	53	Gurgaon, India	Businessman	M	He committed suicide after his wife tested positive for Covid-19	https://indianexpress.com/article/cities/delhi/gurgaon-54-year-old-commits-suicide-hours-after-wife-tests-positive-for-covid-19-6386371/
11	64	Punjab, India	Name: Santosh Kaur	F	She had a common cold, but she feared it was a corona virus. Then she committed suicide by consuming celphos	http://timesofindia.indiatimes.com/articleshow/75000691.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst
12	40	Shamli district Uttar Pradesh, India	-	M	He was admitted to the isolation ward on suspicion of having a Covid-19 infection. He committed suicide in the isolation ward, but his Covid-19 test result was negative	https://www.indiatoday.in/india/story/coronavirus-india-suspected-covid-19-patient-committed-suicide-up-hospital-tests-negative-1662942-2020-04-03
13	30	Sidhi district Madhya Pradesh	labourer	M	He committed suicide after being quarantined in Madhya Pradesh, India	https://www.indiatvnews.com/news/india/covid-19-man-commits-suicide-after-being-quarantined-in-mp-610879

(Continued)

TABLE 1 | Continued

Case study/No.	Age	Place	Occupation/ Remarks/Name	Gender	Risk factors for suicides	References
14	35	Safdarajung Hospital, NewDelhi in India	Name: Tanveer Singh	M	Covid-19 screening was conducted for all passengers at the Indira Gandhi International Airport, India. During the screening process, Mr. Singh reported that he had headache. Therefore, he was admitted in the isolation ward at the Safdarajung Hospital, New Delhi on suspicion of being infected with coronavirus. Soon after admission in the isolation ward, he jumped from the hospital and committed suicide	https://www.hindustantimes.com/india-news/covid-19-suspected-coronavirus-patient-jumps-to-death-from-hospital-building-soon-after-admission/story-gO78nJO3ClEWAudRtJLRaL.html
15	27	Kenya	-	F	She was sent to 14 days mandatory quarantine at the Kenya Industrial Training Institute (KITI) in Nakuru. According the media report, she committed suicide because she did not like about the conditions of the facility where she was held with other three persons	https://face2faceafrica.com/article/covid-19-south-african-woman-quarantined-in-kenya-commits-suicide
16	36	Mathura, India	Former/Name: Mahendra Singh	M	Due to fear of coronavirus infection, he committed suicide without undergoing any medical test. Because, he assumed himself that he had already been affected by the corona virus infection, so he feared it would affect his family members and villagers	https://newsable.asianetnews.com/uttar-pradesh/cough-and-cold-patient-commit-suicide-in-mathura-up-kpt-q82aun
17	19		Waitress/Name: Emily Owen	F	She committed suicide due to coronavirus fears. In addition, she was previously diagnosed with having high-functioning autism	https://nypost.com/2020/03/25/british-teen-dies-after-suicide-attempt-due-to-coronavirus-fears/
18	60	Ariyalur district, Tamilnadu, India	Name: Narayanasamy (35)	M	Fear of infection/isolation. Mr. Narayanaswamy's village people had informed to the government officials after he got the symptoms of fever. On April 6, he was taken to the Ariyalur government hospital and admitted in the isolation ward. On April 10 (2020), he ended his life himself in the isolation ward. But his COVID-19 infection test results were negative	https://www.newindianexpress.com/states/tamil-nadu/2020/apr/10/elderly-man-in-coronavirus-isolation-ward-commits-suicide-in-ariyalur-general-hospital-2128486.html
STIGMA OVER CORONAVIRUS						
19	35	Bibikulam, Madurai, India	Labourer/Name: Mustaffa	M	Mr. Mustaffa was taken to the hospital for Covid-19 testing and test results were negative. Some of his village people took a video when he was taken to the hospital in a small van, then they circulated that video on social media. Moreover, his neighborhoods insisted him to go back to the hospital again. The hospital authority reaffirmed that he was not infected with the corona virus. Unfortunately, he committed suicide on the same day	http://timesofindia.indiatimes.com/articleshow/74939681.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst
SUICIDE DUE TO MISSING OF FAMILY MEMBERS						
20	32	Uttar Pradesh, India	Name: Rakesh Soni	M	According to the media report, Mr. Rakesh Soni committed suicide due to missing his wife as she had gone to her parents' place. Because his wife was stuck at her parents' house due to the implementation of lockdown measures in India	https://www.indiatoday.in/india/story/man-commits-suicide-as-he-missed-wife-in-lockdown-1665050-20
COVID-19 CASES						
21	50	Bangalore, India	Autorickshaw driver/Name: Syed Babu	M	Mr. Syed Babu committed suicide by jumping from the coronavirus-ICU ward, due to depression, anxiety, and fear. He was admitted for Covid-19 treatment. He was also diagnosed with hepatitis C infection	https://www.thehindu.com/news/cities/bangalore/bengaluru-patient-ends-life-in-covid-19-ward/article31441997.ece

(Continued)

TABLE 1 | Continued

Case study/No.	Age	Place	Occupation/ Remarks/Name	Gender	Risk factors for suicides	References
22	30	Government Medical College and Hospital in Akola, Maharashtra, India	-	M	On April 7, 2020, he was admitted in the isolation ward at the Government Medical College and Hospital in Akola, Maharashtra, India and was tested positive for COVID-19 infection on 10 April, 2020. However, he committed suicide attempt in the isolation ward-bathroom on 11th April 2020 and later he died in the hospital	https://indianexpress.com/article/coronavirus/coronavirus-patient-assam-resident-suicide-akola-maharashtra-hospital-6357770/
HEATH CARE PROFESSIONALS						
23	22	Kilpauk Medical College (KMC) hostel, Chennai, India	House surgeon	F	She was found dead at KMC hostel. Hospital authorities confirmed that she was not infected from COVID-19. Police suspected that she may have committed suicide due to stress after being involved in treating covid-19 patients	https://www.indiatoday.in/india/story/medical-student-serving-covid-19-cases-found-dead-in-chennai-hostel-1673188-2020-05-01
24	49	New York City, USA	Emergency Room (ER) Doctor/Name: Dr. Lorna Breen	F	An ER doctor, Dr. Lorna Breen, contracted from Covid-19 during the time of treating the patients. After she recovered from the corona-virus infection, she continued her duty to treat the Covid-infected patients (12-h shift). However, she was sent back her home again by hospital officials and soon later she was again admitted in the University of Virginia hospital for exhaustion. About a week later, she committed suicide after returning home from the hospital	https://www.ndtv.com/world-news/coronavirus-new-york-doctor-lorna-breen-who-treated-covid-19-patients-commits-suicide-2220035 https://missoulian.com/news/national/an-er-doctor-who-treated-patients-after-she-recovered-from-covid-19-has-died-by/article_975c2e8f-1597-5a67-9241-79dff309c73f.html
ECONOMIC ISSUES						
25	52	Uttar Pradesh	Framer/Name: Rambhavan Shukla	M	Mr. Rambhavan Shukla committed suicide due to non-availability of farmworkers to harvest his wheat crop	https://www.businessinsider.in/india/news/covid-19-lockdown-farmer-commits-suicide-after-no-labourers-to-harvest-crop/articleshow/75106144.cms

COVID- 19 and Social Stigma

Social stigma in the context of health is the extreme social disapproval of a person or group based on a specific disease and its characteristics. Likewise, the COVID-19 outbreak has not only spread fear and anxiety worldwide, it has also fostered various kinds of social stigma, such as discrimination, and racism, and judgmental attitudes toward quarantined or isolated people and people who have traveled to the virus-affected regions or countries. In addition, stigmatized people may be experiencing social rejection or avoidance by others, physical violence, and denial of healthcare services, housing, education, and employment opportunities (45). These types of social stigma not only affect those with the disease, but it also affects their family members, friends, and communities. It can make people afraid to get screened for COVID-19 or any other contagious diseases, and some even take extreme steps, such as suicide or displaying anti-social behavioral issues.

COVID- 19 and Unemployment: An Economic Issue

Although we save thousands of people from the COVID-19 infection by implementing prolonged lockdown measures, there will be a huge micro-, meso-, and macroeconomic loss to individuals, organizations, and countries. The prolonged lockdown can cause an increasing unemployment rate, and it may drive stress, mental health issues, family issues, intake of more alcohol or substance use, an increase in crime or suicide rates. A recent report from the United Nation Labor Agency stated that this COVID-19 pandemic will have a worse effect on the labor market and may lead to a risk of a 50% loss of the global workforce (46). Furthermore, UN news reported that the lockdown measures will affect almost 2.7 billion workers globally (47). Currently, there are millions of workers who suffer from uncertainties related to food, security, and future life. According to the press release of the International Labor Organization (ILO), on April 29, 2020, the second quarter (Q2/2020) of the global showed that working hours from this year (2020) are expected to be 10.5% lower than the last quarter of 2019 (Q4/2019) due to pandemic lockdown measures. This global working hours damage is estimated to be equivalent to 305 million full-time jobs (48). Specifically, in developing countries such as in India, about 27 million people (age group 20–30 years) lost their jobs in April 2020 (49), and the Centre for Monitoring Indian Economy (CMIE) reported that 84% of the household will be affected by decreased monthly income. Similarly, ∼1 million people lost their jobs in Australia (50) and 5.5 million in Canada, which was an increase in the unemployment rate of up to 13%, putting it closer to the unemployment rate in the USA (14%) (51).

A recent report predicts that the worldwide unemployment rate is estimated to be at a maximum of 5.6%, and it will increase the suicide rate to 9,570 per year (52). For example, more than 1,500 were made to the Los Angeles suicide crisis hotline crisis in March 2020 after few weeks of lockdown, and one in five calls were related to suicide (53). All over the world, government officials are also stressed over dealing with the economic fallout of the coronavirus. For example, Mr. Thomas Schaefer, Minister of Finance of Hesse, Germany, recently committed suicide on March 28, 2020, due the COVID-19 crisis (54). Likewise, according to Aman et al. (2020) until now, more than 300 deaths have been reported as non-COVID-19 infection-related deaths following the lockdown in India. Among those deaths, 34 deaths were recorded due to financial hardship and starvation (55), however, these reports have not confirmed how many deaths were suicide related.

COVID-19 Non-pharmaceutical Interventions and Psychopathological Factors

It is important to identify which factors modulate the mechanism and changes in psychopathology symptoms among the public in the period of the COVID-19 pandemic. A recent Norwegian population-based study reported that people with pre-existing mental health disorders and those who were living alone are affected by loneliness in the period of implementation of social distancing measures, and loneliness was very closely associated with depression and anxiety (56). Another study found that people with pre-existing anxiety-related and mood disorders had more negative impact than those with no mental disorders; anxiety-related disorder groups, in particular, expressed more fears of the socioeconomic impact, xenophobia, fear of danger and contamination, and traumatic stress-related symptoms (57) based on COVID Stress Scales (58). In addition, a psychopathological cross-sectional study found that some specific fear factors (neuroticism, corona phobia, and hypochondriasis) played a role to elevate pandemic-related psychopathology, such as depressive symptoms and generalized anxiety, in the period of lockdown/other preventive measures (59). These prolonged lockdown/other preventive measure factors and the uncertainty of when the COVID-19 crisis is over would also increase the prevalence of post-traumatic stress disorder (PTSD). Recent literature reported that the prevalence of post-traumatic stress disorder (PTSD) during the COVID-19 in Saudi Arabia was 22.63% (PTSD cut-off score), 24.8% (criteria), and 19.6% (combined). In addition, their study reported that the PTSD prevalence was similar or higher to USA (31.8%), Spain (15.8%,), and Italy (29.5%) than China (2.7–12.8%) (60).

On the other hand, a recent study reported that 37 adolescents and youths, including 14 school-age students, committed suicide in the period of lockdown, based on the report of media news between February 15 to July 6, 2020 (35). The COVID-19 prevention strategies related distress, online class/remote schooling, and examination-related stress to tendencies toward depression, loneliness, and psychological distress. Also, a suicide pact (son and mother) was reported in Bangladesh due to an argument between family members regarding online class (61). Likewise, the elderly population has been the most affected age group due to COVID-19 lockdown in terms of isolation or difficulty in obtaining medical and rehabilitation services for aging-related complications. In this COVID-19 pandemic, older adults have a high risk of infection and death (62). Therefore, the elderly population is more prone to fear, stress, depression, loneliness, and other mental issues.

The COVID-19 social restrictive preventive measures related psychopathological factors, such as stress and anxiety, to an increase in alcohol consumption as a coping mechanism. Regarding the COVID-19 and use of substance or alcohol consumption, previous literature estimated that 75,000 "deaths of despair" may result from COVID-19 pandemic related (stress, isolation, and unemployment) drug and alcohol addiction, and suicide (63, 64).

SUICIDE PREVENTION DURING AND AFTER THE COVID-19 OUTBREAK

Across the globe, there is a huge uncertainty is seen among the public due to the coronavirus pandemic. People are facing difficulties in accessing their basic needs (e.g., food and medical services) as well as employment, their futures, and well-being due to the current scenario of the prolonged restrictions on movement, social distancing, and isolation. Besides, social isolation and loneliness can cause serious public health issues among people whether young, middle-aged, or old, and there is a strong association between these and the development of neurocognitive and mental health disorders as well as heart and autoimmune diseases (65); social isolation and loneliness could create negative health outcomes, such as high blood pressure, heart diseases, disability, a decline of cognitive function, and depression (66).

For example, the National Public Health Group-Well Being Trust and Robert Graham Center for Policy Studies in Family Medicine and Primary Care (US) have estimated that around 75,000 Americans could die because of suicide, alcohol and drug misuse, and as a result of the COVID-19 pandemic (67). Another report from the Brain and Mind Centre at Sydney University, Australia, predicted that the suicide rates will double due to the social and economic consequences of the national lockdown measures, and about 1,500 extra deaths will occur in Australia (68). Therefore, worldwide, mental health and suicide experts warn governments to take immediate action to intervene in mental health issues among the public in the COVID-19 pandemic to avoid suicide-related deaths (69). In this paper, the following possible solutions and public health awareness methods have been discussed to prevent suicide among the public and healthcare workers, and **Table 2** shows the impact of quarantine, isolation, lockdown, and social distancing (SWOT analysis).

TABLE 2 | SWOT: COVID-19 preventive measures (quarantine, isolation, lockdown, and social distancing) and mental health.

STRENGTH	WEAKNESSES
Governments • Helping to prevent the COVID-19 infection • Using more online technological services including health care sector services • Can use public authorities to serve and control the spread of infection • Can use national Media & TV channel to create the awareness • Using social media for spreading awareness	**Governments policies/orders** • Insufficient hospital facilities and medical equipments, including for general and mental health services • Uncertainty of Economy due to various reasons such as, Disturbed in providing essential services to public due to the closure of public and private transports, Closure of schools, universities, Partially or fully shutdown of factories and industries
Individuals • Regular exercise/yoga at home • Learn new skills such as learning new language, arts, painting, cooking, take care of family members • Working from home • Spending more time with family • Learning new online courses	**Individuals** • Poor social interaction and Isolation • Difficult to attend social life such as meeting friends, relatives, or going to bars and social clubs • Reduced monthly income
OPPORTUNITIES	**THREATS**
Governments and public health authorities • Implementing to control the spreading of COVID-19 infection • Can create more awareness through local and national leaders, social influential people, and religious people • Allotting appropriate funding for health care sectors • Allotting appropriate welfare funding for their citizens to manage the lockdown period • Arranging more mental health screening programs • Using media to create awareness among public to avoid the social stigma	**Governments and public health authorities** • Damage to economy of the country • Political threat by other countries • Shortage of medical equipments and devices • Challenging to save the frontline workers from COVID-19
Individuals • Can do regular exercise to improve physical and mental health • Can create awareness to support the frontline workers and discourage the stigma • Being as a responsible citizen and family member to the society • Being a role model to children by stopping to drink alcohol and smoking • Learning new courses	**Individuals** • Difficult to do regular health checkup/follow up for those with pre-existing mental health issues such as schizophrenia, bipolar disorder, and other mental health disorders • Students - No face-to-face classroom experiences and prolonged stay at home • Affected by various psychological issues as anxiety, feeling stressed, fear, fear-induced overreactive behaviour, frustration, guilt, anger, boredom, sadness, worry, nervousness, helplessness, loneliness, insomnia, and depression • Obesity and diabetes • Suicidal thoughts • Domestic violence • Unemployment, Poverty

Recommendations and Suggestions for Social Stigma

Governments, media, the public, and individuals have an essential role to play to prevent the COVID-19-social stigma against ethnicities, religions, and specific countries. Media in particular should carefully select their topics when covering COVID-19 topics. Topics must be factual and respectful to avoid stigmatization, fear, and anxiety among the public. For example, certain words can be replaced by other words "people who have COVID-19" instead of "COVID-19 cases" and "people who may have COVID-19" instead of "COVID-19 suspects" and "suspected cases" (70). In addition, governments and public authority officials can request that celebrities, religious leaders, and leaders of specific regions spread facts about COVID-19 through social media platforms and TV channels. It would be helpful to reach out to the greatest number of people to reduce stress and anxiety among the public. Unfortunately, most healthcare workers have experienced social stigmatization from working with patients with COVID-19. To prevent the social stigmatization of healthcare professionals, showing support and making statements of gratitude on social media aimed at doctors and healthcare workers would increase recognition of their vital role in the community and reduce stigma.

Recommendations and Suggestions for Social Distancing, Quarantine, and Isolation

Prolonged social distancing and isolation, can impact both the physical and mental well-being of individuals, including healthy people. To avoid the stress, anxiety, depression, and other serious mental health issues, including suicidal ideas, individuals can attempt activity scheduling, such as reading, listening to music, learning, watching interesting TV programs, regular exercise (e.g., stretching and yoga), and learning a new language, instead of continuously watching live coverage of coronavirus-related news. For example, One World: Together At Home is a special broadcast curated by Lady Gaga in support of healthcare workers on the frontlines of the COVID-19 crisis, and this event also raised \$128 million to support vaccine development and local and regional charities (71). Although social distancing requires the maintenance of physical space between people, people can contact their family members and friends by using various social apps like WhatsApp, FaceTime, Viber, Skype, Zoom, and Facebook messenger. In addition, this study suggests providing more online telehealth counseling services to the quarantined and isolated people as well as people who are recovering from coronavirus infection.

Recommendations for Preventing Alcohol-Addiction-Related Suicides

In this study, we have discussed the number of alcohol-dependence-related deaths during the lockdown period. Most individuals try to consume more alcohol to overcome social isolation, assuming that alcohol consumption will reduce their anxiety and stress during the lockdown period. However, alcohol consumption leads to many physical and mental health problems, including liver- and lung-related diseases, depression, anxiety, suicidal thoughts, and social and behavioral problems. In India, most alcohol-related deaths were associated with substance withdrawal syndrome. Therefore, not only quarantined people but also the individuals who have been admitted for COVID-19 care need to be screened for substance use withdrawal syndrome along with COVID-19 care. Also, there are a number of myths about consuming alcohol and COVID-19. Therefore, we suggest educating individuals and raise their awareness of the effect of alcohol consumption and circulate guidelines for avoiding suicide. We list the following topics as suggestions for content for governments policymakers and media to raise awareness among the public:

a. Drinking alcohol will not kill the virus and it will not help you develop immunity/resistance to coronavirus
b. Drinking alcohol will not help you cope with stress; in fact, it is likely to cause anxiety, depression, and other mental health disorders and vulnerable behaviors
c. Contact the local or national mental health counseling hotlines if you have any signs of alcohol use withdrawal syndrome
d. Local governments can support the individuals by providing food, medicine, subsidies, and more telehealth-hotline-based psychological intervention services to protect people from alcohol-related suicide deaths
e. Local governments should advertise telehealth-hotline-based psychological intervention services phone numbers through social media, television programs, and social influencers
f. Local governments should encourage individuals and family members to do regular yoga and exercises at home in this lockdown period
g. Avoid drinking alcohol in front of children to be a role model for the child
h. Provide more online telehealth services for alcohol-dependent people with pre-existing mental health issues

Recommendations and Suggestions for Unemployment, Economic Issues, and Suicide

Current worldwide suicide rates high compared to the previous economic recession of 2008. Recession triggers various kinds of stress and mental health issues among individuals due to unemployment, job loss, loan defaults, and government cuts to welfare and healthcare budgets. These financial difficulties will cause more recession-related mental health issues and suicide. To prevent pandemic-recession-related suicide, mental health experts and researchers have to raise awareness toward the governments and societies about an increasing unemployment rate being a risk factor for suicide. The pandemic is expected to bring about miserable outcomes; therefore, governments should implement programs to secure the basic needs of living for their citizens, waiving or extending loan payments, the healthcare and educational costs, and providing more online mental health services, including for inpatients in hospitals. In addition, the provision of more funding for mental health services and setting up more mental telehealth services in every hospital is necessary to control pandemic-related suicides. A previous study reported that two-thirds of suicides occurred among people who have lost their job within the year, and 50% of people committed suicide while they were employed (72). Therefore, early mental health intervention is essential to prevent suicide among both the working and non-working population now and in the future.

Recommendations and Suggestions for Supporting Healthcare Professionals

In this pandemic, healthcare professionals are more prone to stress and trauma due to dealing with COVID-19. There are a number of factors that cause this: long working hours, less sleep, isolatiton from one's family for long periods of time and worry about one's family's safety, lack of protective equipment, lack of testing kits, less-experienced new staffs, and facing discrimination and harassment from the public from fears due to working with COVID-19. Therefore, the national and local governments should ensure the safety of their healthcare workers by providing enough personal protective equipment and medical testing kits, issuing ordinances for harassment and discrimination, creating awareness among the public about the COVID-19 infection and the importance of healthcare workers, ensuring appropriate working hours with enough resting hours, and providing mental health services to the healthcare workers. Moreover, governments can ensure adequate compensation and healthcare services for healthcare professionals if they contracted COVID-19.

Physical Activity for Overall Physical and Mental Health

Physical activities will not only improve physical health but will also improve the psychological well-being of individuals (73–75). Previously, several studies have reported that physical activity can reduce sadness and suicidal intention (76, 77). The World Health Organization has recommended a required amount of physical activity per day or week for all age groups for people to stay healthy at home during the time of COVID-19. For example, adults aged over 18 years should do at least 150 min of physical activity per week (moderate intensity), and at least 60 min of moderate to vigorous physical activities per day has been recommended for children/adolescents between the age of 5 and 17 years. For children aged 1–5 years, should do at least 180 min/day of various types of physical activity (any intensity) (78). Therefore, we suggest that doing regular exercise or yoga at home is essential during this lockdown period to overcome mental health diseases, including suicide, depression, and anxiety disorders, and other chronic physical diseases, such as cerebrovascular diseases, obesity, and diabetes.

Prevention of Psychopathology During and After Lockdown

Early identification and prevention of causative factors for psychopathology is very essential to avoiding "second-pandemic"-related deaths. COVID-19 pandemic lockdown has been a psychopathological burden and has had a negative impact on the quality of life of the public, including school students and children, various kinds of frontline workers, people with pre-existing mental health issues, and the elderly population. Based on the previous literature, fear of COVID-19 is associated with anxiety, stress, and depression (79, 80). In a severe condition, psychopathological factors can lead to suicidal thoughts and attempts among those with pre-existing mental disorders.

The management of coronavirus fear and other factors is essential to prevent mental health issues, including suicide. The prevention strategies for fear are not only related to infection of COVID-19, the mental health intervention strategies and government policies should also be focused on various other factors, such as fear of contamination or loss of employment, pre-existing mental health issues, awareness of COVID-19 infection, awareness of social distancing and lockdown policies, social media news about the COVID-19, arrangement of online counseling sessions for students through their schools, telepsychiatry for isolated patients to alleviate their fear, anxiety, stress, and depression. In addition, government and mental health officers/hospital/service providers should closely work and monitor the services for people with pre-existing mental health issues. Otherwise, recurrence is more likely to occur in people with bipolar disorder and schizophrenia.

STRENGTHS AND LIMITATIONS

In our paper, we provide an overview of risk factors causing suicide and possible solutions to prevent suicide in this current COVID-19 pandemic. However, our study has several limitations. Firstly, our review study was conducted during the period of lockdown, i.e., up to May 2020. Secondly, there was no updated and functional suicide monitoring system data on the subject of implementing the lockdown, quarantine, and other social distancing procedures and their impact on mental health and suicide. Therefore, this study mostly used the search engine "Google" as an electronic database to search and analyze relevant information from the online and other media news.

CONCLUSION

The COVID-19 pandemic has traumatized the entire world physically, psychologically, emotionally, socially, and economically following the implementation of forced lockdown measures to prevent the spread of infection. Therefore, the local, regional, and national governments need to act quickly along with mental health providers to make new mental health policies and improve the availability of mental health services for everyone (people with COVID-19 infection, frontline workers, those in quarantine/isolation, people with preexisting mental health issues, students, and older adults) to prevent suicide due to the COVID-19 pandemic.

AUTHOR CONTRIBUTIONS

BG and RT conceptualized and designed the study. BG, RT, AA-J, KF, PP, and SM analyzed the literature and wrote, revised, and approved the manuscript.

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The Psychological Impact of COVID-19 Among Pakistani Adults in Lahore

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Background: In the wake of the worldwide spread of the novel coronavirus and the resultant restrictive measures, mental health has become a crucial issue. Physical health is not the only aspect of humans that is at risk. Globally, the rates and severity of mental illness are being significantly impacted by this pandemic. Two scales have been validated to measure the impact of coronavirus disease 2019 (COVID-19) on the levels of anxiety and obsessional thinking in clinical and non-clinical populations. The present study was designed to investigate the levels of anxiety and obsessions related to COVID-19 in the general public of Lahore, Pakistan.

Materials and Methods: Data were collected *via* snowball sampling from May 9 to May 19. An online survey consisting of a demographic profile and two scales, Coronavirus Anxiety Scale (CAS) and Obsession with COVID-19 Scale (OCS), was sent through email, WhatsApp, and Facebook groups to adults (18 years and above) of Lahore, Pakistan.

Results: A total of 240 individuals (20% men and 80% women) recorded their responses. The majority belonged to a nuclear family system (60%), and their education level ranged from high school to Ph.D. The cut-off score for probable dysfunctional coronavirus anxiety and obsession levels was not met within this sample (CAS, $M = 3.24$, $SD = 4.21$; OCS, $M = 4.14$, $SD = 3.15$), suggesting that the general population of Lahore, Pakistan is not suffering from dysfunctional anxiety or obsessions related to COVID-19. Forty-seven participants' score on OCS and 35 participants' scores on CAS were above the cut-off, i.e., ≥ 7 and ≥ 9, respectively. The results of the correlation analysis showed a significant positive relationship ($^{**}p < 0.619$) between anxiety and obsessions related to COVID-19.

Conclusion: One important, yet surprising, conclusion of this study is that the average adult in Lahore does not show much anxiety or obsessions related to COVID-19. Other studies around the world using these measurement tools have indicated significantly high levels of both anxiety and obsessions related to COVID-19. These findings may demonstrate the resilience of Pakistanis or perhaps the lack of understanding of the seriousness of the situation.

Keywords: psychological impacts, COVID-19, corona virus anxiety, obsessions related to COVID 19, Pakistan

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INTRODUCTION

Viral epidemics continue to emerge and pose serious threats to public health. Even in the past 20 years, the breakdown of many viral epidemics including severe acute respiratory syndrome coronavirus (SARS-CoV) in 2002 and 2003, H1N1 influenza in 2009, and Middle East respiratory syndrome coronavirus (MERS-CoV) in 2012 has been recorded (1). The outbreak of coronavirus disease 2019 (COVID-19) in China in December 2019 has rapidly proliferated in more than 200 countries around the globe, not only paralyzing daily lives but also creating insurmountable challenges for mankind (2). Historically, the large-scale epidemics and pandemics had generally left long-standing social and psychological impacts on mankind (3). The novel coronavirus (COVID-19) pandemic has not only emerged as a major health threat throughout the world but also brought many social, financial (4), and psychological (5) challenges with it (2). This large-scale pandemic has adversely impacted the lives of a significantly large population of the world (6), particularly leaving more pressure on those living in underdeveloped and developing countries, such as Pakistan.

Pakistan reported its first case of coronavirus in February 2020 and implemented a nationwide lockdown in the third week of March 2020 to contain the situation by flattening the curve of the spread of the disease. In compliance to lockdown measures, all educational institutes, all significant public places including shopping malls, religious worship places, and restaurants, and many industries were closed. The lockdown led to many problems that were likely to increase the psychological burden of the population even in developed countries (3).

Pakistani society significantly values socialization and social activities, and people give lots of importance to social interaction. The implementation of lockdown and social distancing created disruption in many routine activities, consequently increasing the emotional pressure on people. Financial constraints and pressures also contributed to the psychological difficulties as a large segment of the Pakistani population works in the private sector or belongs to the daily wage workforce with 24% of the total population reported to be living below the poverty line and 38.8% of the population reported to be poor (7). As a result of the complete lockdown, the country has faced a serious halt to economic activities (8); many workers have either lost their jobs or faced significant cut in their salaries, contributing more to the already existing financial difficulties, resulting in increased cases of suicide (9). Since the emergence of COVID-19, many conspiracy theories and myths about the condition have been spreading in Pakistan, which also resulted in developing fears and anxiety among the general public (10). Moreover, these lead to more uncertainty and increased unrest among the public. All these factors stress the need to explore the psychological influences of the coronavirus pandemic in the general population.

There are many researchers studying different medical (11), social, and psychological influences (12) of coronavirus in different countries, and they reported contradictory findings. In China, Tian et al. (13) concluded that more than 70% of their sample had moderate to severe levels of different psychological symptoms. They also observed that females and younger participants had higher levels of psychological disturbance. Varshney et al. (14) studied the psychological effects of coronavirus in the general population of India. They reported that one-third of their sample was psychologically affected by the coronavirus pandemic and females and younger participants and those with an existing physical illness were significantly more affected than others. Salman et al. (10) studied the impact of coronavirus in Pakistani university students and observed that 34% of their sample had moderate to severe levels of anxiety and 45% had moderate to severe levels of depression. Female respondents and those below 30 years old were more depressed, whereas participants with a friend or relative diagnosed with coronavirus reported more anxiety. In light of the literature review, the present study was designed to explore the psychological impact of the COVID-19 pandemic on the Pakistani population. We hope that the findings will contribute to understand the requirements of the population and to design effective strategies to help people cope with the psychological burden of the current pandemic.

MATERIALS AND METHODS

The present study followed the survey method for data collection. Through convenient and snowball sampling technique, data were collected from the adult population (18 years and above) of Lahore, Pakistan from May 9 to May 19, 2020. A Google form was prepared and sent through email, WhatsApp, and Facebook groups to the contact list of the authors. Then, these groups were further requested to send the form into their own contact list. The snowball sampling technique was used to get a quicker sample that allowed the study to take place at the perfect time; with the restrictions placed during the lockdown, it was the best way to reach participants. This method was cost effective and simple as data were collected by the primary source and the research had no external funding. Moreover, this sampling technique needed less planning and workforce than other sampling techniques. The online survey was composed of the demographic information sheet, Coronavirus Anxiety Scale [CAS; (15)], and Obsession with COVID-19 Scale [OCS; (16)]. CAS is a 5-item scale, rated across a 5-point scale from 0 (not at all) to 4 (nearly every day). It measures an individual's experience of anxiety related to coronavirus during the past 2 weeks. The score range is 0–20, and higher scores indicate higher anxiety. The cut-off score has been established, and scores equal to or above 9 are considered to be problematic and the individual has to be referred for further assessment and treatment (15). The author reports that it is a reliable and valid scale with a Cronbach's alpha value of 0.93. The scale also has high diagnostic properties, with 90% sensitivity and 85% specificity, when compared with other instruments, such as Generalized Anxiety Disorder-7. OCS is a self-report 4-item scale in which each item is rated across a 5-point scale ranging from 0 (not at all) to 4 (nearly every day). The scale measures an individual's experience of persistent and disturbed

TABLE 1 | Mean, standard deviation, and minimum and maximum ranges along with the Cronbach's alpha of CAS and OCS ($N = 240$).

Variables	*k*	*M*	*SD*	Cut-off	Range		a
					Minimum	Maximum	
CAS	5	3.24	4.21	≥9	0	17	0.90
OCS	4	4.14	3.15	≥7	0	13	0.75

k, no of items; M, mean; SD, standard deviation; a, Cronbach's alpha.

TABLE 2 | Frequencies and percentages of responses for Coronavirus Anxiety Scale ($N = 240$).

Variables/responses	CAS 1 *f* (%)	CAS 2 *f* (%)	CAS 3 *f* (%)	CAS 4 *f* (%)	CAS 5 *f* (%)
Not at all	121 (50.4)	162 (67.5)	151 (62.9)	152 (63.3)	171 (71.3)
Rarely/less than a week	54 (22.5)	23 (9.6)	50 (20.8)	52 (21.7)	33 (13.8)
Mild/several days	30 (12.5)	23 (9.6)	21 (8.8)	21 (8.8)	21 (8.8)
Moderate/half of the days	25 (10.4)	17 (7.1)	16 (6.7)	14 (5.8)	12 (5.0)
Severe/nearly every day	10 (4.2)	1 (0.4)	2 (0.8)	1 (0.4)	2 (1.3)

TABLE 3 | Frequencies and percentages of responses for Obsession with COVID-19 Scale ($N = 240$).

Variables/responses	OCS 1 *f* (%)	OCS 2 *f* (%)	OCS 3 *f* (%)	OCS 4 *f* (%)
Not at all	79 (32.9)	69 (28.2)	67 (27.9)	181 (75.4)
Rarely/less than a week	75 (31.3)	87 (36.3)	74 (30.8)	30 (12.5)
Mild/several days	63 (26.3)	55 (22.9)	57 (23.8)	14 (5.8)
Moderate/half of the days	20 (8.3)	22 (9.2)	28 (11.7)	10 (4.2)
Severe/nearly every day	3 (1.3)	7 (2.9)	14 (5.8)	5 (2.1)

thinking related to COVID-19 over the past 2 weeks. The score range is 0–16, and higher scores indicate higher rate of obsessive thinking. A score equal to or above 7 indicates a problematic and dysfunctional thinking, and the individual needs to be referred for further assessment or treatment. It is a reliable ($\alpha s > 0.83$) and valid instrument. The author reports high diagnostic properties (81–93% sensitivity and 73–76% specificity) of the scale with related instruments, such as General Health Questionnaire (GHQ). According to Lee (16), researchers are using the CAS and OCS internationally across various cultures to assess both anxiety about COVID-19 and obsessional thinking about COVID-19.

In the present study, general information regarding the survey and process of data collection was conveyed to the participants. The inclusion criteria were that participants were above the age of 18 and could read English. The exclusion criteria were that the participants had no history of any diagnosed psychological illness and were not on any related medications. This allowed the researchers to rule out the confounding factor of the mental health of the participants. Participants were also told that their participation was voluntary and without any monetary gains. The confidentiality of their information was also an important priority of the researchers. Data were collected without their names mentioned or asked, and file was also encrypted and could be seen or used for research purpose only.

TABLE 4 | Relationship between anxiety and obsessions related to COVID-19.

Variables	Anxiety	Obsessions
Anxiety		0.617**
Obsessions		

**$p > 0.01$.

Statistical Analysis

Both descriptive and inferential statistics were executed with the help of Statistical Package for Social Sciences version 21 (SPSS). Frequencies and percentages were calculated to determine the demographic characteristics of the sample as well as the response categories of anxiety and obsessions related to COVID-19. Pearson Product Moment Correlation analysis was also carried out to examine the relationship between anxiety and obsessions related to COVID-19. Independent samples *t*-tests were computed to compare men and women on the levels of anxiety and obsessions related to COVID-19.

RESULTS

Two hundred forty adults participated in the survey. Among them, 80% women and 20% men recorded their responses during the said period. Most of them belonged to a nuclear family system (60%). The range of their educational level was high school to PhD, but most of them were undergraduates and above (96%). The age range was 18–70 years ($M = 28.15$, $SD = 8.85$). Among them, 47.5% were students, 23% were working in the private sector, 16.7% were employed in the public sector, and 7.1% were self-employed. Two housewives and 11 unemployed individuals also participated in the survey, whereas only 1 participant was retired. Participants were South Asian, specifically from the Punjab region of Pakistan. They did not have any specific race as Pakistan is largely mono-ethnic and not many foreigners reside here.

The results in **Table 1** showed that the mean scores of both anxiety and obsessions scales were below the cut-off. Specifically, 35 (14.6%) participants reached the cut-off for clinically significant levels of anxiety, and 47 (19.6%) reported obsessional thoughts about COVID-19 that were above the cut-off.

The results in **Table 2** illustrated that approximately half of the population opted for the not at all response category and the rest of them chose other severity levels of anxiety responses ranging from mild to severe.

The results in **Table 3** indicated that more than half of the participants marked the more severe options for obsessions related to COVID-19.

The results in **Table 4** showed a significant positive relationship between anxiety and obsessions related to COVID-19.

The results in **Table 5** depicted significant gender differences regarding both anxiety and obsessions related to COVID-19. Men scored higher on both the scales than women.

DISCUSSION

All over the world, rates of mental illness–particularly related to coronavirus–have increased since the advent of the pandemic. Other studies have found a significant psychological impact of the coronavirus in India (17) and Pakistan (10); however, in this sample, the average level of anxiety and obsessional thoughts due to COVID-19 is below the cut-off scores. A large majority of the sample reported little to no anxiety or obsessions about coronavirus, with 14.6% reporting clinically significant dysfunctional anxiety about coronavirus and 19.6% reporting problematic obsessions about COVID-19. This is in contrast to rates of depression, anxiety, and stress in Pakistani undergraduate students (10). Possible explanations for this discrepancy could be multifactorial. The study by Salman et al. (10) was conducted on undergraduate students, and one of the findings of the study was that age was a factor in the levels of mental illness. Those above 31 years old had lower levels of depression than those below 30 years old. The current study's sample had an average age of 28.15 years, thus presenting a possible reason for lower rates of reported distress. Additionally, the current study did not evaluate the diagnosis of COVID-19 among family members, which is a strong correlation of anxiety.

There are several other possible explanations for this low level of clinical distress on average among this group. When this study was conducted, the lockdown was in effect, and the number of cases was still quite low. The study by Salman et al. (10) was conducted prior to the lockdown, when there was greater uncertainty. Moreover, it is possible now that the cases are rising rapidly, the full psychological impact of the COVID-19 pandemic will be more apparent. Further research should be conducted to continue to monitor the levels of psychological distress and ascertain the needs of the country.

Another possible explanation is that Pakistan is a developing nation, where diseases, such as malaria and dengue fever, are seasonal realities, where polio is still not eradicated, and where massive political upheaval is historically recent. Conceivably, in such an environment, COVID-19 is just another change to adjust to or risk to manage as people go about their day-to-day lives. Pakistan is also a collectivistic society. In such societies, reporting of mental illness is often lower, due to many factors (17). Perhaps, these rates of psychological distress are in fact higher than reported or expressed in a different way. Future research should consider this factor.

Several studies have indicated that the two measures used in this study are correlated with general distress (15). The present study also found a strong correlation between the two measures, suggesting that they are indeed closely related and indicative of clinical distress. Future studies could further validate these measures in the Pakistani population by evaluating psychological distress *via* another measurement tool. This could provide further evidence for the validity of these measurement tools in this context.

Most research into psychological illness and distress indicates that women report higher rates of mental illness. Indeed, this is the case of the recent survey of the levels of depression in undergraduate students in Pakistan in response to coronavirus (10). The unusual finding in this study that men have higher rates of anxiety about and obsessions related to coronavirus can be possibly explained by several factors. In Pakistan, men are more likely to be required to enter society and interact outside of the home. This could increase anxiety and obsessional thoughts in two ways. First, the likelihood of infection through exposure is higher for those going out and interacting within the society. Second, the need to go outside the home brings reminders of the situation; it is not possible to "pretend" that everything is normal. Furthermore, importantly, research indicates that men are more likely to have severe symptoms and have a higher mortality rate than women (18).

STRENGTHS AND LIMITATIONS

There are several important strengths and also limitations of the present study. Strengths include that the study was completed during the lockdown period, when the pandemic had first begun. This provided important insights into the early stages of the pandemic, when people were first adjusting to the news of

TABLE 5 | Independent samples *t*-test for gender differences for anxiety and obsessions related to COVID-19 ($N = 240$).

Variables	Men ($n = 49$)		Women ($n = 191$)		$t_{(238)}$	p	95% CI	
	M	SD	M	SD			UL	LL
CAS	4.59	5.03	2.89	3.91	2.54	0.01**	0.38182	3.01128
OCS	5.18	3.69	3.88	2.69	2.58	0.01**	0.31034	2.29503

**$p < 0.01$; M, mean; SD, standard deviation; CI, confidence interval; LL, lower limit; UL, upper limit.

COVID-19. Being able to measure the levels of anxiety and obsessions regarding COVID-19 during this period provided a rare opportunity to examine the initial impact of the pandemic. Moreover, the size of the sample provided enough power to test the study hypotheses with confidence.

Limitations include the sampling method and the sample characteristics. Convenience sampling, particularly snowball sampling, is not the ideal method of obtaining a sample; however, given the circumstances, it was important to abide by the rules of the country that did not allow for in-person data collection or random sampling. Moreover, this sample is more highly educated than the general population of Pakistan. Though this study provides an accurate picture of the average educated person in Lahore, it cannot be generalized to other areas of Pakistan, particularly regions with fewer resources and a less educated population on average, especially given the known influence of education levels on stress.

CONCLUSION

The COVID-19 pandemic is a rapidly changing situation with impacts on all areas of life. Recent studies show that mental health has been particularly negatively impacted by both the direct effects of the virus, as well as the secondary effects of such measures as lockdowns and the resultant economic tolls on the population. However, in this sample, rates of mental illness related to COVID-19 were found to be much lower than expected. Furthermore, importantly, in an unusual result, men were found to have higher rates of both anxiety and obsessional thinking related to COVID-19. These findings are intriguing and could be due to multiple factors, including lack of understanding about COVID-19, resilience, and culture. Future research should seek to replicate and further understand the psychological impact of COVID-19 on the general population of this developing nation as the pandemic continues to spread. Cultural factors as well as understanding of the situation and the impact of resilience should be considered.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Punjab Institute of Mental Health. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

SM conceived the idea of the study and developed the study protocol. All authors contributed to the data collection and analyses. All authors contributed to the writing and review of the manuscript for publication.

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The Impact of COVID-19 on Psychiatric Emergency and Inpatient Services in the First Month of the Pandemic in a Large Urban Mental Health Hospital in Ontario, Canada

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The World Health Organization characterized COVID-19 (coronavirus disease 2019) as a pandemic on March 11, 2020 (WHO). Within a couple of days, all Canadian provinces announced the implementation of social distancing measures. We evaluated the immediate effect of COVID-19 on psychiatric emergency and inpatient services in Canada's largest psychiatric hospital in the first month of the pandemic. We extracted data from the electronic medical records of the Center for Addiction and Mental Health in Toronto, Canada. We compared emergency department visits, inpatient occupancy rates, and length of stay in March 2019 and March 2020, and during the first and second half of March 2020. There was a decrease in the number of emergency department visits and inpatient occupancy rates in March 2020 compared to March 2019. There was also a significant decrease in the number of emergency department visits and inpatient occupancy rates in the second half of March 2020 compared to the first half. Our findings suggest that the pandemic was followed by a rapid decrease in the usage of psychiatric emergency and inpatient services in a large mental health hospital. Future studies will need to assess whether this decrease will be followed by a return to baseline or an increase in need for these services.

Keywords: COVID-19, psychiatry, Canada, pandemic, emergency, inpatient, hospital

INTRODUCTION

COVID-19 (Coronavirus disease 2019) is a disease caused by the SARS-CoV2 (1) virus identified in Wuhan, China in December 2019. It was declared a pandemic on March 11th. Within 2 months, over 316,000 deaths have been confirmed globally (WHO). Several recent papers have hypothesized that patients with psychiatric and/or substance use disorders may be particularly vulnerable to being infected with COVID-19 and to experience adverse outcomes, emphasizing the importance of studying the effect of this pandemic in this vulnerable population (2–6).

Several studies have examined the effect of disasters on mental health. After natural disasters, psychotropic prescription fills or supply decreased (7–9). By contrast, terrorist attacks increased mental health service use (10–12). Similarly, some studies have reported an increase in the use of psychiatric services among the survivors of the 2003 severe acute respiratory syndrome (SARS) pandemic (13, 14). However, during the SARS pandemic itself, there was a significant shift from hospitals to community clinics for anxiety disorders that was attributed to the perception that the risk of being infected if one was hospitalized outweighed the potential benefit of a psychiatric hospitalization (15). A recent review examining the effects of quarantine in light of self-isolation of individuals who are potentially exposed to COVID-19 noted negative psychological consequences of quarantine, including post-traumatic stress symptoms, some of which can be long-lasting (16). It has also been speculated that social distancing associated with the current COVID-19 pandemic may both directly and indirectly increase the risk of suicide (17). Together, these studies show that the potential impact of disasters on the need for, and use of, psychiatric services is complex.

On March 16, 2020, provinces of Canada declared the COVID-19 pandemic a state of emergency, ordering closures of non-essential services and prohibiting large public gatherings. The Center for Addiction and Mental Health (CAMH) in Toronto, Ontario is the largest mental health hospital in Canada. It provides care to more than 34,000 patients each year and is in the metropolitan Toronto, which is the most populous metropolitan area in Canada (statscan.gc.ca). After March 16, we noticed a decrease in the number of both visits in the psychiatric emergency department (ED) and admissions at CAMH, suggesting that COVID-19 was possibly affecting the way in which patients access and use psychiatric services. To test this hypothesis, we examined the number of ED visits and the occupancy rates on acute inpatient units in the month of March 2020. To our knowledge, this paper is the first consideration of the impact of COVID on mental health utilization in a psychiatric hospital in Canada. While we only examined one hospital, due to the size of CAMH and the acuity of the COVID-19 outbreak in metropolitan Toronto (https://www.toronto.ca/home/covid-19), we hope that the findings of this study will contribute to increasing our currently limited body of knowledge on how pandemics affect psychiatric care utilization in hospitals in urban settings.

MATERIALS AND METHODS

In this natural study, we used a pre-post study design (18) to test the hypothesis that the usage of both ED and inpatient psychiatric services in March 2020 was lower than in March 2019 and that the decrease would be attributable to a decrease from the first to the second half of March 2020. We chose March because the COVID-19 pandemic was declared an emergency on March 16 in Canada. In comparing 2 weeks prior to and after the closure of non-essential services, we hoped to identify the immediate effect of the pandemic in psychiatric service utilization within the same month. In doing so, we hoped to compare two short time frames that would have similar weather conditions and other sociopolitical factors influencing service utilization outside of acute changes produced by the pandemic.

Study Sites

Data from this study were extracted from electronic medical records (EMR) of the CAMH ED and its 10 acute inpatient units: Acute Care Unit A (ACU A), Concurrent Addictions Inpatient Treatment Service (CAITS), Emergency Assessment Unit (EAU), Early Psychosis Unit (EPU), General Psychiatric Unit (GPU) A and B, Mood and Anxiety Inpatient Unit (MAUI), Medical Withdrawal Services (MWS), Psychiatric Intensive Care Unit (PICU), and Women's Inpatient Unit (WIU). CAITS and MWS are inpatient units for concurrent addiction services. ACU and PICU are inpatient units for patients of higher acuity.

Data Collection

For March 2020, we extracted the number of daily ED visits for March and the daily bed occupancy rates for March for all 10 inpatient units combined and for each of the individual inpatient units listed above. We also extracted: the median time between registering in the CAMH ED and completing triage (triage), the median time between registering in the ED and either be admitted for those who were admitted (arrival to admission) or leaving the ED (arrival to leave ED), the median length of stay (LOS) on inpatient units, and the number of inpatient discharges from all inpatient units. We compared these variables during two different time periods: from March 1 to 15 and from March 16 to 31. These two periods were chosen as March 16 was when quarantine and social distancing measures were first announced in Canada.

For March 2019, we extracted the total number of ED visits, the acute inpatient monthly occupancy rate, which is the combined inpatient occupancy rate of all 10 acute inpatient units mentioned above, and the monthly occupancy rate for each of the individual inpatient units.

Statistical Analysis

Statistical analysis was performed to compare the daily number of ED visits, daily occupancy rates for all acute inpatient units combined, and daily occupancy rates for each individual inpatient unit between March 1–15, 2020 and March 16–31, 2020. Data from each day was treated as an independent observation. Kolmogorov-Smirnov test was used to examine if the data was normally distributed. Mann-Whitney (MW) U test was used to compare the two time periods. Data is presented as median $\pm$ interquartile range (IQR). IBM SPSS Statistics 26 was used for statistical analysis.

Descriptive Comparisons

Monthly occupancy rate for all acute inpatient units combined was calculated by dividing the total number of days spent by all the patients on all inpatient units during March by the number of days in March (31) and the total number of beds in all acute inpatient units (148). Monthly occupancy rates for the individual inpatient units were calculated similarly using the number of days spent on each inpatient unit and the number of beds on each unit.

TABLE 1 | Comparison of ED visit data, length of stay (LOS) and total number of discharges in acute inpatient units between March 1–15 and March 16–31, 2020.

	March 1th−15th	March 16th−31st	Percent change
Number of total ED visits	545	404	−25%
Triage (hours)	1.7	1.0	−41%
Arrival to admission (hours)	9.2	6.5	−29%
Arrival to leaving the ED (hours)	4.6	2.8	−39%
LOS on inpatient units (days)	5	8	+60%
Number of inpatient discharges	176	177	0%

**All numbers presented are medians, except for numbers of ED visits and number of inpatient discharges. Triage represent the amount of time between when patients register in the ED and when they are assessed by a psychiatrist or an allied health staff at the ED. Arrival to admission represent the time between when patients register in the ED and when they are admitted the ED for those who are admitted.*

We calculated the percent change between March 2019 and March 2020 for total number of ED visits and inpatient monthly occupancy rates.

The extracted data for triage duration, arrival to admission, arrival to leave ED, and inpatient LOS were median values for the following two time periods: March 1–15, 2020 and March 16–31, 2020. We did not have their interquartile ranges or daily values, allowing for a descriptive comparison between the two extracted medians but not a statistical comparison. Therefore, we calculated the percent change between March 1–15, 2020 and March 16–31, 2020 for the following: total ED visits, triage duration, ED arrival to admission, ED arrival to leave, inpatient LOS, and number of inpatient discharges.

RESULTS

Number of ED Visits

Descriptive Comparisons

The number of ED visits decreased 27% from 1,305 visits in March 2019 to 949 in March 2020.

The descriptive comparison of the ED visit between the first and second half of March 2020 are presented in **Table 1**: a 25% decrease in total ED visits, 41% decrease in triage duration, 29% decrease in the time from arrival to admission, and 39% decrease in the time from arrival to leaving the ED was found.

Statistical Comparisons Between the First and Second Half of March, 2020

The median number of ED visits per day was significantly lower in the second half (27 ± 6) compared to the first half (37 ± 15, MW $U = 44.5$, $p = 0.003$). **Figure 1** presents the line graph for daily ED visits in the month of March, and a bar graph comparing the first and second half of March for the median number of daily ED visits.

Inpatient Occupancy Rates

Descriptive Comparisons

Descriptive comparisons of occupancy rates between March 2019 and 2020 are presented in **Table 2**. There was a 10% decrease in the combined occupancy rate of acute inpatient units. The two high acuity units (ACUA and PICU) had an increase in occupancy rate, while the other eight units (CAITS, EAU, EPU, GPU A, GPU B, MAUI, MWS, and WIU) had a decrease in occupancy rate.

Descriptive comparisons for inpatient LOS and number of inpatient discharges between the first and second half of March are also presented in **Table 1**. The median LOS increased from 5 days to 8 days, while the number of discharges did not change.

Statistical Comparisons Between the First and Second Half of March, 2020

Figure 1 presents the line graph for the daily occupancy rate for all inpatient units combined and the bar graph representing between-group differences for the two time periods. **Table 3** presents the statistical comparison of median daily occupancy rates in the acute inpatient units. There was a significant decrease in the combined occupancy rates of all acute inpatient units. The median daily occupancy rates did not change in the ACUA, MAUI, and PICU, while it decreased significantly in the CAITS, EAU, EPU, GPU A, GPU B, MWS, and WIU (see Figures in supplementary material).

DISCUSSION

The COVID-19 pandemic is an international public health crisis (WHO) with potentially significant implications for patients with psychiatric disorders (3–6). We compared ED visits and inpatient occupancy rates between March 2019 and March 2020 and between the first and second half of March 2020 in the largest mental health hospital in Canada. Our study focused on the 2 weeks before and after the announcement of social distancing measures to allow for the examination of immediate changes produced by the implementation of these measures compared to the same time frame that would presumably have the same weather conditions and sociopolitical factors influencing service utilization. We found a significant decrease in the number of ED visits and occupancy rates overall and on all the units except for three, two of which have the highest level of acuity. These findings demonstrate the immediate impact of pandemic-related social distancing measures on emergency and inpatient psychiatric care utilization in the largest mental health hospital in Canada.

Psychiatry ED visits decreased by 27% in March 2020 compared to March 2019. There was a similar decrease (25%) between the first and second half of March 2020, suggesting an acute change in service utilization within the same month. It is important to note that our findings are limited in its generalizability as it was derived from one hospital. However, similar changes were observed in a metropolitan hospital in Portugal, showing a rapid decrease in psychiatric ED visits within two weeks of the emergency state period in Portugal (19) and within a month in a large tertiary hospital in Connecticut (20). Furthermore, a cross-sectional study of 24 EDs in five States

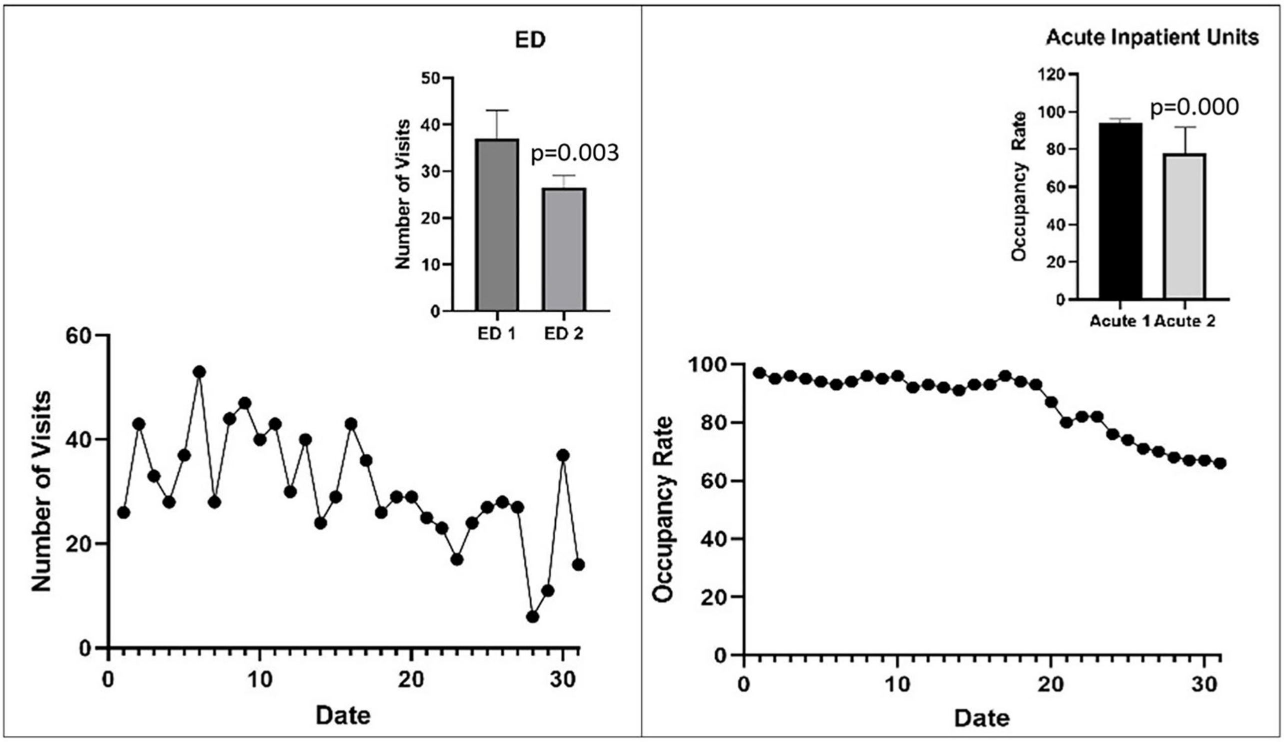

FIGURE 1 | Line graphs represent the number of ED visits and the overall occupancy rates in 10 acute inpatient units each day in March, 2020. The bar graphs represent the median number of ED visits or median daily occupancy rate in the first half of March 2020 (labeled ED 1 and Acute 1, respectively) and the second half of March 2020 (labeled ED 2 and Acute 2, respectively). Error bars represent interquartile range. Statistical significance was determined with the Mann-Whitney *U* test (see text).

TABLE 2 | Monthly occupancy rates for March 2019 and March 2020.

	Number of beds	Occupancy rate for March 2019	Occupancy rate for March 2020	Percent change
Combined	148	95.8%	86.4%	−10%
ACU A	6	97.5%	98.3%	+1%
CAITS	20	94.2%	88.1%	−7%
EAU	12	81.3%	63.8%	−22%
EPU	20	95.8%	86.0%	−10%
GPU A	22	97.7%	87.5%	−10%
GPU B	20	99.1%	85.7%	−14%
MAUI	13	99.4%	95.0%	−4%
MWS	12	96.3%	86.3%	−10%
PICU	3	82.8%	98.4%	+19%
WIU	20	99.5%	87.2%	−12%

**Monthly occupancy rate was calculated by dividing the total number of days spent by all the inpatients by the multiple of number of days in March (31) and the total number of beds (148). The retrospective nature of data collection only allowed for the extraction of a single value for occupancy rate for the entire month of March 2019. This was the same for March 2020. Because these two values could not be compared using a statistical test, we used percent change to provide a descriptive measure of change between the 2 years.*

ACU A, acute care unit A; CAITS, concurrent addictions inpatient treatment service residential treatment unit; EAU, emergency assessment unit; EPU, early psychosis unit; GPU, general psychiatric unit; MAUI, mood and anxiety inpatient unit; MWS, medical withdrawal service; MW U, Mann-Whitney U; PICU, psychiatric intensive care unit; WIU, women's inpatient unit.

observed a steep decline in the number of ED visits after the rise in COVID-19 cases, with the first week of mid-March being the most significant (21). Interestingly, Goncalves-Pinho and colleagues also reported that ED visits steadily increased after the first 2 weeks (19), suggesting that the impact of pandemic-related social restrictions on service utilization may be most acute in the beginning. These findings together suggest that in future waves or pandemics, clear public messaging regarding

TABLE 3 | Median daily occupancy rates on acute inpatient units during the first and second half of March 2020.

	Occupancy rate in 1st half	Occupancy rate in 2nd half	MW U, *p*
Combined	94 ± 3%	80 ± 23%	MW U = 28.5, $p = 0.000$
ACU A	100 ± 0%	100 ± 7%	MW U = 84.0, $p = 0.086$
CAITS	99 ± 8%	88 ± 23%	MW U = 14.0, $p = 0.000$
EAU	76 ± 13%	38 ± 30%	MW U = 24.0, $p = 0.000$
EPU	93 ± 12%	87 ± 33%	MW U = 62.5, $p = 0.023$
GPU A	96 ± 6%	86 ± 27%	MW U = 41.5, $p = 0.002$
GPU B	94 ± 3%	73 ± 27%	MW U = 51.0, $p = 0.006$
MAUI	99 ± 8%	98 ± 15%	MW U = 103.0, $p = 0.491$
MWS	92 ± 6%	83 ± 17%	MW U = 58.0, $p = 0.014$
PICU	100 ± 0%	100 ± 3%	MW U = 103.0, $p = 0.329$
WIU	100 ± 2%	67 ± 35%	MW U = 55.5, $p = 0.009$

**All data are median ± interquartile range.*

ACU A, acute care unit A; CAITS, concurrent addictions inpatient treatment service residential treatment unit; EAU, emergency assessment unit; EPU, early psychosis unit; GPU, general psychiatric unit; MAUI, mood and anxiety inpatient unit; MWS, medical withdrawal service; MW U, Mann-Whitney U; PICU, psychiatric intensive care unit; WIU, women's inpatient unit.

the need for patients to continue to seek psychiatric care as appropriate may be important prior to the implementation of social distancing measures. This is also congruent with the shift away from psychiatric admissions observed during the SARS pandemic (15).

The decreases in the triage time in the ED, time from arrival to admission, or time from arrival to leaving the ED reflect the lower number of patients. It is also possible that patients were assessed more quickly by the staff who wished to minimize the risk of virus transmission in the ED.

In March 2020, there was an overall decrease in the monthly occupancy rate for all acute inpatient units combined, compared to March 2019. This overall decrease reflects a decrease on all the inpatient units except for the 2 that cater to patients with the highest acuity. The same pattern was observed when comparing daily occupancy rates during the first and second half of March. These decreases in the number of occupancy rates may be due to the observed decrease in the number of ED visits or a higher threshold applied when deciding to admit a patient to minimize the risk of a COVID-19 infection.

By contrast, the total number of discharges did not differ between the first and second half of March, suggesting that decisions to discharge a patient were not affected by COVID-19. Similarly, the absence of a decrease in occupancy rates on the two units for patients of higher acuity (ACU and PICU), suggests that the admission and discharge of these patients is not affected by COVID-19. The median LOS in inpatient units was 3 days longer in the second half of March 2020 compared to the first half. This could be because patients who were admitted were more ill and require longer admissions; alternatively, it could be because fewer beds were occupied and the need to discharge patients were lower.

Also, patients at CAMH ED or EAU who are suitable for ACU or PICU are often admitted to general wards due to the small number of beds in the acute units. These patients may now be more readily admitted to the acute units due to the lower number of patients from the ED awaiting transfer to inpatient units. Furthermore, COVID-19 related changes may be interfering with discharge planning (i.e., housing, arranging follow-up social and medical care), causing psychiatrists to have a higher threshold in discharging a patient.

The findings of this study should be interpreted in light of some limitations. First, as this was a retrospective study, the data we could extract from the health records were limited and allowed only for descriptive comparisons. That is, apart from daily occupancy rates and ED visits, the majority of the extracted data were median values for a specified time frame, allowing only for descriptive comparisons. More importantly, our findings are limited in that it examines a short time frame in one hospital. This limits the generalizability of these findings to other settings. Future studies should examine longer timeframes in multiple hospitals to characterize the delayed impact of the pandemic on psychiatric care utilization across the country.

In conclusion, our findings suggest that the COVID-19 pandemic led to a rapid decrease in ED and inpatient services in a large mental health hospital. This may reflect a complex interplay among patients (e.g., a higher threshold to come to the ED and seek admission) and providers (e.g., a higher threshold to admit). Many of these pandemic-related changes in both patient and provider behavior can be interpreted as rational responses to the rebalancing of risk-benefit calculations for seeking or providing psychiatric care during a pandemic. Previous studies and some expert opinion (13, 14, 17, 22) suggest that this decrease in utilization of psychiatric services may have long-term consequences. Future studies should examine potential confounding clinical and demographic factors and a wider range of clinical settings, geographical area, and timeline, which may add important insights. Increasing our knowledge in how pandemics affect psychiatric care utilization may contribute to preparing for similar crises in the future to provide better care for this vulnerable population.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

HK and ZD contributed to data collection, data analysis, and manuscript writing. AC, DG, AW, MH, BM, and VS contributed to data analysis and manuscript writing. SG contributed to data collection and manuscript writing. All authors approved the final version of the manuscript.

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Symptoms of Depression and Anxiety During the Early Phase of the COVID-19 Pandemic in Sweden

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In this cross-sectional study we aimed to assess symptoms of depression and anxiety at an early stage of the COVID-19 pandemic, and to explore factors predictive of these mental health outcomes. A sample of 1,503 participants, recruited from the general Swedish population, completed an online survey distributed through social media. In this sample, 22.2% reported clinically significant levels of depressive symptoms (PHQ-9 $\geq$ 10) and 10.9% indicated possible major depression using the PHQ-9 algorithm. Moreover, 28.3% reported clinically significant levels of anxiety (GAD-7 $\geq$ 8) and 9.7% severe anxiety and possible GAD (GAD-7 $\geq$ 15). Multiple linear regression analyses identified some common predictors for both outcomes. Age, having a stable income, and sufficient social stimulation, sleep, and recovery showed negative associations, whereas worry about the economy and overall burden showed positive associations. These results suggest an impact on mental health already at an early stage of the COVID-19 pandemic.

Keywords: COVID-19, pandemic consequences, mental health, depression, anxiety, risk factors

INTRODUCTION

On December 31, 2019, the World Health Organization (WHO) was informed about pneumonia cases of unknown cause, occurring in the city of Wuhan, China. On January 7, 2020, the cause of the pneumonia was identified as a new type of corona virus, the SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2), and as of January 30, the WHO stated that the virus constituted a public health emergency of international concerns. On March 11, the WHO declared the new coronavirus disease, COVID-19, a pandemic. By then, it had spread to 114 countries, there were more than 120,000 confirmed cases in the world, and about 4,000 people were reported to have died from the disease (1). In Sweden, the first case of COVID-19 was detected in the end of January, and on March 10, the public health agency stated that there were signs of community transmission in Sweden. When this manuscript was first finalized, May 7, 2020, Sweden has almost 25, 000 confirmed cases (applying restricted testing) and over 3 000 fatalities due to COVID-19. This rapid spread of the SARS-CoV-2 and its effects on societies throughout the world, was unprecedented. Although mental health consequences were expected, the timing, extent, and predictors of any such consequences were unknown at the time.

Early on, preliminary results from China, the first country affected by COVID-19, pointed to an increased mental health burden associated with the outbreak of the virus (2–6). However, one study also pointed to positive effects, showing that even though participants experienced a mild increase in stress, they also relaxed and exercised more than usually, received increased social support, and experienced increased feelings of sharing with family members (7).

Since research about the pandemic situation was sparse when this study was conducted, findings from previous epidemics were used to guide ideas about the current situation. For example, when studying the impact of the Ebola outbreak, Jalloh et al. (8) found a high prevalence of any anxiety-depression symptoms and symptoms of posttraumatic stress in the general population of Sierra Leone. Factors associated with higher levels of symptoms included knowing someone quarantined for Ebola and perceiving Ebola as a threat. In a study from the less affected US, Thompson et al. (9) found Ebola-related worry to be positively associated with for example prior mental health diagnoses and high Ebola-related media exposure. However, not all studies pointed to increased levels of mental health symptoms. Studies assessing the psychological impact of the 2002–2004 outbreak of SARS (SARS-CoV-1;10), and H1N1 [or the swine flu; (10)] did not find increased levels of distress, although Ko et al. (11) showed that groups directly affected had more symptoms than non-affected groups.

A review, rapidly conducted in order to better understand effects of being quarantined (published online in late February 2020), showed that most studies on the effects of having been in quarantine reported negative psychological effects, such as trauma and stress-related disorders, anxiety, low mood, irritability, and anger (12). Factors associated with adverse psychological outcomes included both peri-quarantine factors, such as duration of quarantine, fear of infection, frustration and boredom, inadequate supplies and information, and post-quarantine factors, such as stigma and financial loss.

At the time the study was performed, it could only be assume that the new pandemic would lead to financial consequences for many individuals. In Sweden, we started to see increasing rates of unemployment, and many people had been temporarily laid off. Looking back to the financial crisis that started in 2007, research reports suggested that mental health was generally not affected in most European countries (13), but that there was a substantial increase of mental health problems in more affected countries, such as Spain (14). Sweden was more affected by the economic crisis in the nineties, during which a national decrease in psychological well-being also could be seen (15). Thus, any financial consequences of the COVID-19 pandemic were expected to mediate negative effects on mental health.

When this study was performed, the WHO stated that "the overarching goal for all countries is to control the pandemic by slowing down the transmission and reducing mortality associated with COVID-19" [(16); p. 5]. Even though mental health issues, for good reasons, were less prioritized at that time, it is important to understand how psychological well-being is affected by a pandemic situation. With this cross-sectional study, we aimed to assess symptoms of depression and anxiety in the Swedish general population at an early stage of the COVID-19 pandemic. We furthermore aimed to explore factors predictive of these mental health outcomes.

MATERIALS AND METHODS

Design and Setting

This cross-sectional study was conducted at an early stage of the COVID-19 pandemic in Sweden. During a period of 11 days, from March 26 to April 5, 2020, we collected anonymous data online, using the online survey software Qualtrics (Qualtrics; Provo, UT). During this time, the number of confirmed cases in the world went from 531,865 to 1,201,483 and in Sweden from 2,840 to 6,443 (17). At this time, Sweden had no formal movement restrictions, but the public was advised to practice social distancing. Universities and high schools/colleges had closed and applied online teaching, but younger children went to school as usual. On March 13, larger gatherings were restricted to 500 people, and by March 27 this number dropped to a maximum of 50 individuals. People aged 70 or above were recommended to avoid all social contacts. The public health agency also recommended people to avoid traveling within Sweden.

Sample Size Calculation

Sample size calculations were based on prepandemic data, suggesting a 10.8% prevalence of clinically significant symptoms of depression and a 14.7% prevalence of clinically significant symptoms of anxiety in the general Swedish population (18). With a 2% precision and a 95% confidence interval, a power calculation using http://sampsize.sourceforge.net/ suggested a sample size of 926–1,205. In order to allow the prevalence to raise to ∼20%, the sample size was preferred to approach 1,500 participants.

Procedure

A convenience sampling procedure was used. The study was presented in social media (Facebook, Instagram, and LinkedIn), with a direct link to the survey. We also used an open press release and local radio to spread information about the study. Following the link to the survey, visitors could first read detailed information about the study and their rights as participants. Before entering the questionnaire, participants had to verify being at least 18 years of age (which was our only criteria for eligibility) and give a digital consent to participate in the study. Hence, participants were self-recruited.

The questionnaire was presented in two sections, of which the first covered questions relating to demographics, life style, and COVID-19, and the second focused on issues related to quality of life and mental health. For ethical reasons, any question could be left unanswered.

Participants

In all, 1,695 eligible individuals gave their consent to participate in the study. Of these, 1,504 (89%) completed the full questionnaire. One participant had taken the questionnaire without giving a single response and was therefore excluded, rendering a final sample of 1,503 participants.

Variables

Outcomes

Two mental health outcomes, symptoms of depression and symptoms of anxiety, were analyzed.

Depression

To measure symptoms of depression we used the Patient Health Questionnaire-9, PHQ-9 (19), a self-report instrument used to detect, diagnose, monitor or measure severity of depression. The scale consists of nine items with four labeled response alternatives scored from 0 to 3. The sum of score is used, yielding a maximum score of 27 where higher scores indicate more depressive symptoms. Diagnostic validity has been established, with high sensitivity and specificity in identifying major depressive disorder using a cut-off score of 10 (19, 20). The PHQ-9 is widely used in both clinical and research settings (21), and has previously been used to assess prevalence of depression in the Swedish general population (18). In this study we used the cut point of 10 to indicate clinically significant depressive symptoms, alongside a diagnostic algorithm previously used by Johansson et al. (18), to indicate probable cases of major depressive disorder. In the present sample, Cronbach's α showed a good internal consistency ($\alpha = 0.88$, $N = 1{,}502$).

Anxiety

We used the General Anxiety Disorder 7, GAD-7 (21) to measure symptoms of anxiety. The GAD-7 was developed as a brief assessment tool for generalized anxiety disorder (GAD) covering several aspects of anxiety and worry. It has the same response system as PHQ-9, and the scale ranges from 0 to 21. Cut-offs for mild (5), moderate (11) and severe (15) anxiety symptoms have been identified, and for diagnosing general anxiety disorder a cut-off of 10 is recommended (22). GAD-7 is well-validated and established in both research and clinical settings (21). Although developed for the disorder GAD, the scale is frequently used to screen for symptoms of anxiety, and anxiety disorders in general. For this purpose a cut-off of 8 has been recommended (23). This cut-off score has previously been used to assess prevalence of clinically significant anxiety in the Swedish general population (18). In the current study, we used a cut point of 8 to indicate clinically significant anxiety symptoms, and the $\geq$15 cut point to indicate severe anxiety and possible GAD (22). Cronbach's α showed excellent internal consistency ($\alpha = 0.91$, $N = 1{,}502$).

Predictors

In addition to background characteristics of the participants, we also included context dependent predictors relating to the pandemic situation. Details about the predictors, including response alternatives and variable coding, can be found in **Table 1**.

The context dependent variables were categorized in four groups. The first group included questions about if the participant or any household member belonged to a known *risk group* for COVID-19. The second group of context dependent variables focused on *pandemic consequences*. In this group we included questions about avoidance of social contacts, negative economic consequences or worry about such consequences, worry about the disease, and changes in the daily life burden. In the third group we assembled items asking about *life style behaviors*. Here we used two sets of life style questions, each with five items. In the first set of questions, participants were asked if they, under the current circumstances, experienced sufficient social stimulation, intellectual stimulation, physical activity, sleep, and recovery. These items were included in the correlation and regression analyses. In the second set of items, the current levels were to be compared with the situation before the pandemic onset. Finally, in the fourth group of context dependent predictors, *information and trust*, we asked participants to rate the time spent on information about the new virus and its consequences and their trust in authorities' capacity to handle the situation. Although not specified in the questionnaire, relevant Swedish authorities were for example the Swedish Government and the Public Health Agency of Sweden.

Data Analysis

Data was analyzed using IBM SPSS Statistics 25. First we deleted participants who had not completed the full survey. The remaining 1,503 participants were included in the analysis. With regard to the symptom scales, we used individual mean imputation to correct for item non-responses not exceeding 20% of a particular scale (24). Participants with a higher rate of missing scale items were excluded scale wise, leading to 1,502 valid cases for both PHQ-9 and GAD-7.

In order to describe the study sample, we used frequencies and proportions with 95% confidence intervals (CI) for nominal and ordinal variables. For the outcome variables, we used descriptive statistics in terms of means with 95% CIs and standard deviations, displayed for the complete sample, for the different age groups, and for men and women in each age group separately. To enable comparisons with previous studies conducted in Sweden, we also calculated the prevalence of clinical levels of depressive and anxiety symptoms, using previously known cut off points and diagnostic algorithms (PHQ-9 $\geq$ 10, PHQ-9 algorithm, GAD-7 $\geq$ 8, and GAD-7 $\geq$ 15).

We thereafter explored the dataset in order to investigate patterns of correlations with the outcome variables. Intercorrelations between predictor variables were also inspected to circumvent multicollinearity. In order to target the most important predictive factors for symptoms of depression and anxiety we performed one multiple linear regression for each outcome, using forced entry of all predictors that correlated significantly with each particular outcome. Having a large sample with several predictors, a significant level of 1% or smaller was adopted.

In order to shed further light on predictors, the regression analyses were followed by descriptive and/or exploratory analyses of key predictor variables. Since these analyses were guided by previous findings, statistical methods are briefly motivated in the Results section, together with a presentation of the most important results.

RESULTS

Sample Characteristics

In this sample, we had participants in all age groups, from 18–29 years of age, to 80 years or older. Since participants in the older age groups were few, all participants over 70 years of age were collapsed into one age group. The sample

TABLE 1 | Detailed information about the predictor variables.

Predictors	Item description
Background characteristics	
Age group	Age cohorts: 18–29 [1], 30–39 [2], 40–49 [3], 50–59 [4], 60–69 [5], ≥ 70 [6].
Gender	Male [0], Female [1], Other.
Education	Primary school [1], Gymnasium [2], University 1–3 years [3], University more than 3 years [4].
Occupational status and employment in February 2020	Employed in public sector, Employed in private sector, Self-employed, Student, Retired, On sick-leave, On parental leave, Unemployed, Other; several response alternatives were possible. In the regression analysis all types of employment and being retired were recoded into Stable income [No = 0, Yes = 1].
Number of people in the household	[1–6 or more].
Children <18 years in the household	[No = 0, Yes = 1].
Household responsibility	How would you describe your responsibility for the household you live in? Not responsible [0], Shared responsibility [1], Full responsibility [2].
Context dependent variables	
Risk group	
Belonging to risk group	Do you have any underlying medical condition that would affect your risk if infected by the Corona virus? (Yes, No, I don't know). This item was coded in combination with the age item into risk group belongingness as follows: No [0], Underlying medical condition, Aged 70 or above [Either or both of these were coded as 1].
Risk group in household	Does anyone else in your household belong to risk group? (No, Yes – due to age, Yes – due to medical condition, I don't know. Several answeres could be given). The item was coded as follows: No [0], Underlying medical condition, Aged 70 or above [Either or both of these were coded as 1].
Pandemic consequences	
Avoidance of social contacts	Has the risk of being infected or transmitting the virus to someone else made you avoid other people? Yes, completely [3], Yes, to a large extent [2], Yes, to some extent [1], No, not at all [0].
Duration of social avoidance	If 1–3 on the previous item: For how long have you been avoiding others in this was? A couple of days [1], About 1 week [2], 2 weeks [3], 3 weeks [4], 1 month [5], 1½ month [6], 2 months or more [7]. If answering Not at all on the previous item, this item was coded as [0].
Negative economic consequences	To what degree have your household suffered from negative economic consequences due to the pandemic? Not at all [0], To a small [1], moderate [2], high [3], and very high degree [4], I don't know.
Worry about economy	To what degree has the pandemic situation made you worry about economic consequences for yourself or someone else in your household? Not at all [0], To a small [1], moderate [2], high [3], and very high degree [4].
Worry about disease	Four items asking for worry about (1) catching the virus, (2) transmitting it to someone close, (3) transmitting it to someone in the social network, and (4) worry about contributing to a general spread. All items had the same response alternatives: Not at all [0], To a small [1], moderate [2], high [3], and very high degree [4]. For the correlation and regression analyses, the mean of the four items was converted to one variable, Worry about the disease [scale item, range 0–4], with an acceptable Chronbach's alpha (α =0.78, N = 1,503, M = 1.96, SD = 0.83).
Overall load/burden	How would you describe your daily life burden today, compared with how it was before the pandemic? Considerably lower [1], Somewhat lower [2], No change [3], Somewhat higher [4], and Considerably higher [5] compared to before the pandemic.
Life style behaviors	
Current level of social stimulation, Intellectual stimulation, Physical activity, Sleep, and Recovery	To what extent do you in your current daily life experience sufficient (1) social stimulation, (2) intellectual stimulation, (3) physical activity, (4) sleep, and (5) recovery? Not at all [0], To a small [1], moderate [2], high [3], and very high degree [4]. This item was included in the correlation and regression analyses.
Changes in social stimulation, Intellectual stimulation, Physical activity, Sleep, and Recovery	How has your way of living changed since the onset of the pandemic, with regard (1) social stimulation, (2) intellectual stimulation, (3) physical activity, (4) sleep, and (5) recovery? (Considerably less, Somewhat less, No change, Somewhat more, and Considerably more compared to before the pandemic). This item was not included in the correlation and regression analyses.
Information and trust	
Time spent on information	How much time do you spend on taking part of information about the virus and its consequences? (None [0], <1 h [1], 1–2 h [2], 2–3 h [3], 3–4 h [4], 4–5 h [5], 5–10 h [6] more than 10 h daily [7]).
Trust in authorities	To what extent do you experience trust in the authorities' capacity to handle the situation? Not at all [0], To a small [1], moderate [2], high [3], and very high degree [4].

Dummy variables encoded for regression analysis are shown in square brackets.

was characterized by a clear majority of female participants (82%) and a generally high level of education (see **Table 2** for demographic information).

Symptoms of Depression and Anxiety

Symptoms of depression (M = 6.24, 95% CI 5.96–6.53) and anxiety (M = 5.73, 95% CI 5.46–6.00) were highly correlated,

TABLE 2 | Characteristics of survey participants (N = 1,503).

Characteristic	*n*	%
Age		
18–29	183	12.2
30–39	368	24.5
40–49	352	23.4
50–59	313	20.8
60–69	189	12.6
≥ 70	98	6.5
Gender		
Female	1,232	82.0
Male	261	17.4
Other	10	0.7
Level of education		
Primary school	24	1.6
High school	263	17.5
University 1–3 years	322	21.4
University >3 years	893	59.4
Response missing	1	0.1
Occupational status *(Several responses possible)*		
Employed in public sector	720	47.9
Employed in private sector	324	21.6
Self-employed	113	7.5
Student	187	12.4
Retired	185	12.3
On sick-leave	59	3.9
On parental leave	29	1.9
Unemployed	62	4.1
Other	39	2.6
Number of people in household		
1	385	25.6
2	439	29.2
3	251	16.7
4	287	19.1
5	91	6.1
≥6	32	2.1
Response missing	18	1.2
Role in household		
Shared responsibility for household	977	65.0
Sole responsibility for household	462	30.7
Someone else is responsible	59	3.9
Response missing	5	0.3
Children in household *(Several responses possible)*		
No children	912	60.7
Children <1 year of age	38	2.5
Children aged 1–5	182	12.1
Children aged 6–11	270	18.0
Children aged 12–17	300	20.0
Response missing	4	0.3
Participants belonging to a risk group		
70 years of age or more[a]	98	6.5
Medical risk group[b]	313	20.8
Unsure of medical risk	80	5.3
Double risk groups (≥70 years and medical risk group)	45	3.0
No risk group	1,061	70.6
Household member belonging to a risk group *(Several responses possible)*		
70 years of age or more[a]	122	8.1
Medical risk group[b]	264	17.6
Unsure of medical risk	51	3.4
Double risk groups (≥70 years and medical risk group)	56	3.7
No risk group	1,131	75.2
Response missing	1	0.1

(Continued)

TABLE 2 | Continued

[a]*In Sweden, people over 70 years of age were defined as belonging to a risk group at this time.*

[b]*Do you have any underlying disease (such as high blood pressure, cardiovascular disease, lung disease, cancer or diabetes) that affects your risk if infected by the new coronavirus?*

r(1,501) = 0.77 (95% CI 0.73–0.80). Descriptive statistics of the two outcomes are presented in **Table 3**. Data from this sample showed a trend of decreasing symptom load with increasing age.

The overall prevalence of clinically significant depression (PHQ-9 $\geq$ 10) was 22.2% (334/1,502, 95% CI 20.2–24.4), and the PHQ-9 algorithm indicated major depression in 10.9% (164/1,502, 95% CI 9.4–12.6). The prevalence of clinically significant levels of anxiety (GAD-7 $\geq$ 8) was 28.3% (425/1,502, 95% CI 26.0–30.6), whereas the prevalence of severe anxiety and possible GAD (GAD-7 $\geq$ 15) was 9.7% (145/1,502, 95% CI 8.2–11.3). The pattern of decreasing symptoms with increased age was once again suggested, with all prevalence ratings decreasing from younger to older age groups (see **Table 4**).

Predictors of Mental Health

The outcome variables showed no correlations with the gender item, number of people in the household, living with children under 18 years of age, household responsibility, or any of the risk group variables (see **Table 5**). Hence, these variables were removed from further analysis.

Residual variance around the regression line for bivariate correlations were visually inspected. No outliers with potential to drive the regression line was identified. Multivariate outliers were visually inspected by plotting individual DfFit values, showing a nicely centered fit of the data. Collinearity statistics showed no risk values of variance inflated factor (VIF), nor any correlations above moderate levels between any two predictors. In **Table 6**, we present beta weights (B), standard errors (SE), and adjusted beta (β) for all predictors in the two regression analyses, respectively.

Depressive Symptoms

The multiple linear regression for depressive symptoms (PHQ-9 M = 6.19, SD = 5.58) was conducted on responses from 1,445

TABLE 3 | Descriptive statistics of mental health variables displayed per age group ($N = 1,503$).

Age group (valid responses)	Depression PHQ-9			Anxiety GAD-7		
	M	*(SD)*	*95% CI*	*M*	*(SD)*	*95% CI*
18–29 years (*n* = 183)	**8.55**	**(5.95)**	**7.68–9.41**	**8.02**	**(5.59)**	**7.20–8.83**
Women (*n* = 138)	8.38	(6.01)	7.37–9.40	8.07	(5.63)	7.13–9.02
Men (*n* = 38)	8.61	(5.90)	6.67–10.54	7.24	(5.28)	5.50–8.97
30–39 years (*n* = 367)	**6.88**	**(5.56)**	**6.31–7.45**	**6.85**	**(5.75)**	**6.26–7.44**
Women (*n* = 304)	6.95	(5.52)	6.32–7.57	7.07	(5.70)	6.43–7.72
Men (*n* = 60)	6.30	(5.23)	4.94–7.65	5.63	(5.73)	4.15–7.11
40–49 years (n = 352)	**6.46**	**(5.62)**	**5.87–7.05**	**5.87**	**(5.21)**	**5.32–6.41**
Women (*n* = 292)	6.33	(5.47)	5.70–6.96	5.78	(5.23)	5.18–6.38
Men (*n* = 60)	7.10	(6.29)	5.47–8.73	6.30	(5.16)	4.97–7.63
50–59 years (n = 312)	**5.57**	**(5.52)**	**4.96–6.19**	**4.63**	**(4.74)**	**4.10–5.16**
Women (*n* = 263)	5.55	(5.54)	4.88–6.22	4.79	(4.89)	4.20–5.39
Men (*n* = 49)	5.69	(5.47)	4.12–7.26	3.76	(3.77)	2.67–4.84
60–69 years (n = 188)	**4.66**	**(5.15)**	**3.92–5.40**	**4.10**	**(4.71)**	**3.43–4.78**
Women (*n* = 160)	4.73	(4.97)	3.96–5.51	4.26	(4.78)	3.51–5.01
Men (*n* = 28)	4.21	(6.13)	1.84–6.59	3.21	(4.25)	1.56–4.86
70 years or more (*n* = 98)	**3.93**	**(3.83)**	**3.16–4.70**	**3.32**	**(3.56)**	**2.61–4.04**
Women (*n* = 73)	4.55	(4.02)	3.61–5.49	4.02	(3.71)	3.16–4.89
Men (*n*= 25)	2.12	(2.51)	1.09–3.15	1.28	(2.01)	0.45–2.11
Total sample (N = 1502)	***6.24***	***(5.60)***	***5.96–6.53***	***5.73***	***(5.33)***	***5.46–6.00***
Women (n = 1232)	***6.23***	***(5.52)***	***5.92–6.54***	***5.84***	***(5.34)***	***5.54–6.14***
Men (n= 261)	***6.06***	***(5.78)***	***5.36–6.77***	***4.99***	***(5.06)***	***4.37–5.61***

PHQ-9: 9-item Patient Health Questionnaire Depression Scale; GAD-7: 7-item Generalized Anxiety Disorder Scale; 95% CI: 95% Confidence Intervals.

TABLE 4 | Prevalence (%) of depression and anxiety in different age groups ($n = 1,503$).

Age group (valid responses)	Clinically significant depressive symptoms (PHQ-9 ≥ 10)		Possible major depression (PHQ-9 algorithm)		Clinically significant Anxiety symptoms (GAD-7 ≥ 8)		Severe anxiety, possible GAD (GAD-7 ≥ 15)	
18–29 years (*n* = 183)	**39.3**	**(32.2–46.8)**	**18.0**	**(12.8–24.4)**	**45.4**	**(38.0–52.9)**	**15.8**	**(10.9–22.0)**
Women (*n* = 138)	37.7	(29.6–46.3)	18.8	(12.7–26.4)	45.7	(37.2–54.3)	16.7	(10.9–24.0)
Men (*n* = 38)	42.1	(26.3–59.2)	13.2	(4.4–28.1)	39.5	(24.0–56.6)	10.5	(2.9–24.8)
30–39 years (*n* = 368)	**25.8**	**(21.4–30.6)**	**11.7**	**(8.6–15.4)**	**34.5**	**(29.7–39.6)**	**13.9**	**(10.5–17.8)**
Women (*n* = 305)	25.6	(20.8–30.9)	11.5	(8.1–15.6)	36.4	(31.0–42.1)	14.4	(10.7–18.9)
Men (*n* = 60)	26.7	(16.1–39.7)	11.7	(4.8–22.6)	25.0	(14.7–37.9)	10.0	(3.8–20.5)
40–49 years (*n* = 352)	**22.4**	**(18.2–27.2)**	**12.8**	**(9.5–16.7)**	**27.8**	**(23.2–32.8)**	**10.2**	**(7.3–13.9)**
Women (*n* = 292)	19.5	(15.1–24.5)	11.0	(7.6–15.1)	26.0	(21.1–31.5)	10.3	(7.0–14.3)
Men (*n* = 60)	36.7	(24.6–50.1)	21.7	(12.1–34.2)	36.7	(24.6–50.1)	10.0	(3.3–20.5)
50–59 years (*n* = 312)	**16.9**	**(12.9–21.6)**	**8.9**	**(6.0–12.7)**	**22.4**	**(17.9–27.5)**	**6.1**	**(3.7–9.3)**
Women (*n* = 263)	17.5	(13.1–22.6)	8.4	(5.3–12.4)	23.6	(18.6–29.2)	6.5	(3.8–10.1)
Men (*n* = 50)	14.0	(5.8–26.7)	12.0	(4.5–24.3)	16.3	(7.3–29.7)	4.1	(0.5–14.0)
60–69 years (*n* = 189)	**13.8**	**(9.2–19.6)**	**6.9**	**(3.7–11.5)**	**17.5**	**(12.3–23.6)**	**5.3**	**(2.6–9.5)**
Women (*n* = 160)	14.4	(9.3–20.8)	6.2	(3.0–11.1)	18.6	(12.9–25.5)	5.6	(2.6–10.3)
Men (*n* = 28)	10.7	(2.3–28.2)	10.7	(2.3–28.2)	10.7	(2.3–28.2)	3.6	(0.1–18.3)
70 years or more (*n* = 98)	**9.2**	**(4.3–16.7)**	**2.0**	**(0.2–7.2)**	**14.3**	**(0.8–22.8)**	**0.0**	**(0.0–3.7)**
Women (*n* = 73)	12.3	(5.8–22.1)	2.7	(0.3–9.5)	17.8	(9.8–28.5)	0.0	(0.0–4.9)
Men (*n* = 25)	0.0	(0.0–13.7)	0.0	(0.0–13.7)	0.4	(0.1–20.4)	0.0	(0.0–13.7)

95% Confidence Intervals are given within parenthesis. GAD, Generalized Anxiety Disorder; PHQ-9: 9-item Patient Health Questionnaire Depression Scale; GAD-7: 7-item Generalized Anxiety Disorder Scale.

TABLE 5 | Significant Pearson's correlations between outcomes and predictors.

Predictors	Valid *N*	Depression PHQ-9 *r*	Anxiety GAD-7 *r*
Background Characteristics			
Group	1,502	−0.22**	−0.26**
Gender	1,492[a]	0.01	0.06
Education	1,501	−0.17**	−0.11**
Stable income	1,502	−0.22**	−0.18**
Number of people in the household	1,484	0.01	0.02
Children <18 years	1,498	<0.01	0.06
Household responsibility	1,497	0.05	−0.03
Context dependent variables			
Risk group			
Belonging to risk group	1,422[b]	0.05	−0.02
Risk group in household	1,454[b]	<0.01	−0.01
Pandemic consequences			
Avoidance of social contacts	1,502	0.15**	0.20**
Duration of social avoidance	1,502[c]	0.07*	0.11**
Negative economic consequences	1,450-51[b]	0.22**	0.21**
Worry about economy	1,502-03	0.33**	0.35**
Worry about disease	1,502	0.24**	0.37**
Overall load/burden	1,501	0.28**	−0.31**
Life style behaviors			
Social stimulation	1,501	−0.30**	−0.27**
Intellectual stimulation	1,501	−0.35**	−0.29**
Physical activity	1,500	−0.34**	−0.25**
Sleep	1,502	−0.39**	−0.34**
Recovery	1,500	−0.42**	−0.42**
Information and trust			
Time spent on information	1,501	0.15**	0.20**
Trust in authorities	1,502	0.24**	−0.23**

*$p \le 0.01$; **$p \le 0.001$.
[a] *The response Other (n = 10) was removed from the present analysis.*
[b] *The response I don't know (n = 65) was removed from the present analysis.*
[c] *People who did not isolate to some degree was coded as 0.*

participants. The analysis showed a significant ANOVA, $F_{(161,428)} = 62.51$, $p < 0.001$, $R = 0.64$, with an adjusted R^2 showing an explained variance of 41%. The most important backgrounds factors were age ($\beta = -0.11$) and whether participants had a stable income or not ($\beta = -0.11$), indicating that symptoms of depression were higher among younger participants and among participants without a stable income. The most important contextual variables contributing to the model were worry about the economy ($\beta = 0.15$), all five lifestyle behaviors (foremost sleep $\beta = -0.17$, recovery $\beta = -0.13$, and social stimulation $\beta = -0.11$), and overall increase in burden ($\beta = 0.12$, see **Table 6**).

Anxiety Symptoms

The model with the anxiety scores (GAD-7 $M = 5.64$, $SD = 5.28$, $N = 1{,}445$) was significant as well, $F_{(161,428)} = 64.84$, $p < 0.001$, $R = 0.65$, adjusted $R^2 = 0.41$. A similar pattern was shown with age group being the most important background variable ($\beta = -0.18$). However, worry about the disease, which was not significant for the depression scores, was one of the most important context dependent predictors ($\beta = 0.17$), together with recovery ($\beta = 0.17$), worry about the economy ($\beta = 0.15$), and overall increase in burden ($\beta = 0.14$, see **Table 6**). Moreover, the degree to which people were isolating from others and time spent seeking information about the pandemic also came forth in this model ($\beta = 0.09$ for both predictors, respectively).

Further Exploration of Predictor Variables

Worry About the Disease

As could be anticipated, worry about the disease predicted symptoms of anxiety. We further wanted to explore if there were differences in what participants were worrying about. The four independent items of the worry about the disease variable (worry about getting the disease, worry about infecting someone close, someone in the social network, or contributing to a general spread if the disease) were analyzed with a one way dependent ANOVA followed by Bonferroni corrected pairwise comparisons. The results showed significant differences between the items, $F_{(3,4497)} = 172.76$, $p < 0.001$, $\eta^2 = 0.10$, with respondents showing the largest worry about infecting someone close ($M = 2.32$, $SD = 1.13$) compared to both worry about infecting others in the social network ($M = 1.91$, $SD = 1.01$, $p < 0.001$), and spreading the disease in general ($M = 1.94$, $SD = 1.01$, $p < 0.001$). There was no significant difference between the two latter. However, participants worried the least about getting infected by the virus themselves ($M = 1.69$, $SD = 0.99$, all comparisons $p < 0.001$).

Burden and Avoidance of Social Contacts

In this sample, 18.6% described their everyday life as considerably (4.7%) or somewhat (14.0%) less burdened than before the pandemic, and 28.3% described it as more or less the same as before. More than half of the participants (53.0%) described an everyday burden that was somewhat (36.7%) or considerably (16.3%) higher than before the virus outbreak.

Only a few people indicated that they did not avoid social contacts to any degree due to the pandemic (4.3%), while 40.5% avoided others to some degree and 47.8% to a large degree. The remaining 7.5% practiced full avoidance of social contacts.

Economy

Negative economic consequences was not a significant predictor in the regression analyses. One explanation could be that the majority of the sample (45.7%) was still unaffected, 24.9% was affected to a small degree, 16.7% to a moderate degree, and 6.5% and 2.7% to a high or very high degree, respectively. In order to give an indication of any difference in symptoms over response categories, Kruskal-Wallis test was used. The results showed increasing symptoms over response categories (indicating more negative economic consequences), for both depression, $\chi^2(4) = 69.56$, $p < 0.001$, and anxiety, $\chi^2(4) = 59.16$, $p < 0.001$. Mean score differences in depressive symptoms, for not at all affected ($M = 5.27$, $SD = 5.10$) and affected to a very high degree ($M = 11.90$, $SD = 7.80$), as well as in anxiety

TABLE 6 | Linear regression for symptoms of depression (PHQ-9), symptoms of anxiety (GAD-7).

	Depression PHQ-9		Anxiety GAD-7	
Predictors	***B (SE)***	***β***	***B (SE)***	***β***
Background variables				
Age Group	**−0.45 (0.09)****	**−0.11**	**−0.65 (0.08)****	**−0.18**
Education	**−0.46 (0.15)***	**−0.07**	−0.20 (0.14)	−0.03
Stable income (No = 0)	**−1.78 (0.34)****	**−0.11**	**−1.28 (0.32)****	**−0.09**
Context dependent variables				
Pandemic consequences				
Avoidance of social contacts	0.38 (0.19)	0.05	**0.70 (0.18)****	**0.09**
Duration of social avoidance	−0.05 (0.11)	−0.01	−0.03 (0.10)	< −0.01
Negative economic consequences	0.19 (0.13)	0.04	0.14 (0.12)	0.03
Worry about economy	**0.72 (0.12)****	**0.15**	**0.67 (0.11)****	**0.15**
Worry about disease	0.33 (0.15)	0.05	**1.10 (0.14)****	**0.17**
Overall load/burden	**0.65 (0.12)****	**0.12**	**0.70 (0.11)****	**0.14**
Life style behaviors				
Social stimulation	**−0.61 (0.15)****	**−0.11**	**−0.58 (0.14)****	**−0.11**
Intellectual stimulation	**−0.56 (0.15)****	**−0.09**	−0.38 (0.14)	−0.07
Physical activity	**−0.48 (0.13)****	**−0.09**	0.10 (0.12)	0.02
Sleep	**−0.98 (0.15)****	**−0.17**	**−0.60 (0.15)****	**−0.11**
Recovery	**−0.75 (0.16)****	**−0.13**	**−0.89 (0.15)****	**−0.17**
Information and trust				
Time spent on information	0.25 (0.10)	0.05	**0.41 (0.10)****	**0.09**
Trust in authorities	**−0.37 (0.13)***	**−0.06**	−0.25 (0.12)	−0.04

*Standardized beta values of significant predictors (p ≤0.01) in bold. *p ≤ 0.01, **p ≤ 0.001.*

($M = 4.71$, $SD = 4.83$ and $M = 10.32$, $SD = 7.46$, respectively) were evident.

The impact of economic factors was even more evident in worry about the economy, which contributed significantly to both outcomes. In the follow up analyses, we explored if worry about the economy was affected by participants' occupational status and type of employment. For this purpose, the worry variable was treated like a scale variable (0–4), and multiple responses in the occupational variable were prioritized in the following order: 1. retired, 2. student, 3. self-employed, 4. employed in private sector, 5. employed in public sector, 6. on sick leave or parental leave without other occupation, 7. other employment, 8. Unemployed. Univariate ANOVA showed a small but significant effect, $F_{(7,1495)} = 8.21$, $p < 0.001$, $\eta^2 = 0.04$. Bonferroni corrected pairwise comparisons indicated that individuals that were retired ($M = 1.25$, $SD = 1.12$) or employed in the public sector ($M = 1.53$, $SD = 1.11$) were less worried than individuals that were self-employed ($M = 2.09$, $SD = 1.128$, $p < 0.001$) or employed in the private sector ($M = 1.83$, $SD = 1.18$, $p < 0.001$ and $p < 0.01$, respectively). Retired participants were also less worried than students ($M = 1.705$, $SD = 1.14$, $p = 0.005$).

Changes in Life Style Behaviors

Among the life-style factors, self-reported changes following the pandemic situation was most evident in participants' social lives. Eighty-two percent of the sample reported some to considerable decrease in social stimulation (37.9 and 44.0% respectively), whereas the corresponding number was lower for all other aspects (intellectual stimulation 42.0%, physical activity 49.9 %, sleep 23.6%, and recovery 24.0 %).

Information and Trust

Almost all participants in this sample were actively taking part of information about the disease and its consequences. Only 1.1% did not spend any time at all taking part of information of this kind. Most participants spent <3 h a day on information (32.5% spent <1 h, 40.0% 1–2 h, and 16.5% 2–3 h), while 7.9% spent 3–5 h, and 1.9% of the sample spent >5 h daily on pandemic information.

The participants in this sample generally reported high levels of trust in the authorities' capability of handling the situation. As many as 71.1% reported high (44.9%) or very high (26.1%) trust in the authorities. Another 20.8% reported moderate levels of trust, and just above eight percent reported low (6.5%) or no (1.6%) trust in the authorities.

DISCUSSION

Depression and Anxiety

Prevalence

In our sample, 22.2% reported clinically significant levels of depressive symptoms (PHQ-9 $\geq$ 10) and 10.9% indicated possible major depression using the PHQ-9 algorithm.

Moreover, 28.3% reported clinically significant levels of anxiety (GAD-7 $\geq$ 8). When this manuscript was first submitted, very few European studies on mental health during the early phase of COVID-19 pandemic were published. Hence, the high level of symptomatology indicated by our data took us by surprise. In comparison with pre-pandemic Swedish prevalence estimates (18), our results show that clinically significant symptoms of both depression and anxiety are approximately twice as common, and the prevalence is also considerably higher than global pre-pandemic prevalence estimates (25). Although available data from China indicated similar mean levels of anxiety and depression (3), cultural differences made comparisons difficult. However, later studies have confirmed the deterioration of mental health during this phase. For example, Pierce et al. (26) have shown that the population prevalence of clinically significant levels of mental distress in the UK rose from 18.9% in 2018–19 to 27.3% in April, 2020. Also, Swedish data from McCracken et al. (27) confirm the high levels of clinically significant symptoms in our data. With these results on hand, the high levels of symptomatology are in line with the latest research.

Predictive Factors

A crisis like this might not affect all parts of the population in the same way. This too has become evident in plural studies published during the last months. These studies have typically found female gender and young age to be risk factors for experiencing anxiety and depression in the early phases of the pandemic (26–29). With regard to gender differences, the disproportionately few men in our sample made us choose not to make statistical comparisons between the genders, but an inspection of the descriptive statistics suggest that we might have caught the expected gender pattern in symptoms of anxiety, although not in depression. In line with others (26–29), younger age did however turn out to be a significant predictor of both anxiety and depression. Although we can only speculate in the reasons for this, reduced social interaction and increased worry might play a role. For example, results from a Belgian study (30) have shown that a decrease in going out for drinks or food was associated with increased mental distress among young people during the pandemic. Based on this finding, the authors discuss the importance of peer interaction for the mental health of the young. In another study, exploratory analyses of students' social networks and mental health before and during the pandemic, have shown that students did not only report more stress, depression and anxiety after the onset of the pandemic, but also more social isolation and loneliness, along with increased worry about their family, friends, own health, economy and future career (31). Hence, young people might be extra vulnerable to the mental health consequences of the pandemic for a larger variety of reasons.

The importance of social interaction was verified in other parts of our results. Only 4% of our sample indicated that they had not avoided social contacts to any extent, and more than 80% reported reduced social stimulation. Social stimulation was also one of the most important predictors of both outcomes. These findings match previously published results, for example U.S. findings from a similar period of time showing that personal distancing and orders of staying at home was associated with higher levels of anxiety and depression (32). In the older parts of the population, staying at home and reducing face-to-face interaction with other people (or "cocooning") has been associated with reporting worse mental health, worse physical health, and reduced quality of life (33). Taken together, avoidance of social interactions and/or reduced social stimulation seem to be important parameters to consider in understanding mental health in pandemic contexts. With sleep, recovery, intellectual stimulation and physical activity also contributing to the regression models, it is clear that life style variables are of importance, also in a crisis like this.

Another evident characteristic of the ongoing crisis is its consequences for the economy. In this early stage of the pandemic, few people had experienced severe negative economical effects. However, people highly affected showed mean symptom ratings above diagnostic cutoffs for both depression and anxiety, and more than twice as high compared to people unaffected. Even though sample sizes were very unequal and the variance was rather high, this gave an indication of an association that later has been confirmed. For example, Witteveen and Velthorst have shown that a sudden loss of income during the pandemic lockdown almost doubled the risk of depressive feelings (34). Our results also show that two of the economic predictors (not having a stable income and worry about the economy) were important predictors for both depressive and anxiety symptoms. In line with previous results associating economic hardship to mental ill-health (14), economy seem to be an important factor for mental health also during this crisis.

Also, worry about the disease itself showed to be of importance, especially in predicting symptoms of anxiety. Interestingly, our participants were more worried about spreading the disease to others, especially close ones, than about being infected themselves.

We finally had a look at the role of information and media consumption. In line with lessons learned from the Ebola outbreak, where extensive Ebola related media exposure was an important predictor of distress (9), we found that spending more time on information predicted higher levels of anxiety. Similar findings have been shown by others (35, 36).

Strengths and Limitations

In interpreting the findings from this study, several methodological limitations need to be considered. Given the rapidly changing circumstances, we aimed for a brief time window for data collection. We also aimed to launch the survey as soon as possible, in order to capture mental health in the early phases of the pandemic. To ensure a rapid distribution of the survey, we chose to advertise primarily in social media. However, since we expected that this might skew the sample in a younger direction, we also spread information about the study in other channels that were thought to attract an older audience.

Despite these efforts, our sample was not representative of the Swedish population. With an overwhelming majority of female participants (82%) along with underrepresentation of older, and to some extent also younger participants, great caution is needed when interpreting and generalizing the findings. Without dismissing the possibility of female overrepresentation contributing to the high level of symptoms found, we acknowledge that the prevalence rates identified here are still higher than previous findings among women (18), suggesting that the uneven gender distribution alone is unlikely to account for the discrepancy with previous findings.

Self-selection of participants may also have contributed to the overall high levels of anxiety and depression. It is possible that individuals with mental ill-health are more interested in sharing their experiences by participating in a study like this. It is also likely that the older participants in our sample were healthier and more active than could be expected from a random population sample of the same age. Since they found the survey through social media, they might also be more socially active. This might have contributed to the low levels of depression and anxiety in the oldest age group.

The limitations of a cross-sectional design also need to be taken into account, since a design like this does not support inferences regarding causality or the development of symptoms over time.

CONCLUSION AND FUTURE SUGGESTIONS

With these limitations in mind, we still believe that the current study can contribute to the ongoing exploration of mental health consequences of the COVID-19 pandemic. When initiating this study, it was one of few investigating predictors of mental health in the context of the pandemic in Sweden. Since then, many of our findings have been verified. However, in order to fully understand the mental health consequences of the current crisis, and to guide both future research and societal policies, every piece of information can be of value. This paper adds to the literature exploring a wide range of possible predictors of mental health during the pandemic, primarily showing the influence of age, life style behaviors and worry. These findings could form the basis for studies developing and evaluating interventions to improve mental health among vulnerable groups. Our study showed that symptom burden varied with several background factors such as age and income, suggesting that interventions could be tailored to the varying needs in different groups. However, since factors such as sleep and lack of recovery also showed an association with increased levels of symptoms, general health promoting strategies may also be beneficial and evaluated.

Based on our results, we urge policy makers to promote and enable safe social activities. The fact that young age was associated with a heavier symptom burden indicates that this may be of special importance for young individuals. The positive association between economic worries and distress, as well as the buffering effect that having a stable income seemed to have, further point to the importance of economic support to individuals and companies affected by pandemic related economic difficulties.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because preparation of additional articles using these data is currently in progress. Requests to access the datasets should be directed to Elisabet Rondung, elisabet.rondung@miun.se.

ETHICS STATEMENT

Since we did not collect any data that could be used to identify the participants, ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Informed consent for participation was not required to be written for this study in accordance with the national legislation and the institutional requirements. However, a digital informed consent was obtained.

AUTHOR CONTRIBUTIONS

ER and AB constructed the online survey, performed data analyses, and interpreted the findings. AL and ER conducted the literature search and reviewed previous research. ER led the manuscript work, in which AL, JM, and AB made substantive contributions in both drafting and by critical revisions. All authors contributed to the study design and development of the study questionnaire. All authors approved the final version of the manuscript for submission.

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BRIEF RESEARCH REPORT
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Inverse Correlation Between Distress and Performance in the Medical Rescuers Against COVID-19 in Wuhan

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Background: During the COVID-19 pandemic, the Chinese government had transferred many medical rescuers to Wuhan, which provided effective support in disease control. The high-intensity working and mental stress during rescue could induce distress and negatively impact the performance of rescuer afterward.

Materials and Methods: To identify the characteristics of stress load and its possible effects on performance, the study surveyed 90 medical rescuers in Wuhan using a mobile phone–based self-rated questionnaire.

Results: The results showed an existence of universal but mostly mild distress in rescuers. About 95.6% of the participants reported that they had at least one symptom of distress, whereas, the median scores were <30 (100 as max). Compared with civilian rescuers, a higher proportion of working with immediate virus contact was found in military medical rescuers ($P = 0.008$); however, no statistical differences of stress load were found between civilians and militaries. The rescuers with positive cognition or good psychological preparation were found having lower stress loads than other rescuers. An inverse correlation between the stress load and performance ($R = -0.24$, $P = 0.023$) and a positive correlation between social support and working performance ($R = 0.349$, $P = 0.001$) were found in our survey, suggesting the possible negative effects of stress and the beneficial effects of social support on performance.

Conclusion: Our study indicated that more attention should be paid to the distress of medical rescuers against COVID-19. Positive cognitions, good psychological preparations, and sufficient social support would be necessary to reduce the distress and improve the performance in COVID-19 rescue.

Keywords: medical rescuer, COVID-19, stress load, performanc, social support

INTRODUCTION

Since January 2020, a severe outbreak of the coronavirus disease in Wuhan has caused over 80,000 infectors in China (1). In order to provide effective medical support for controlling COVID-19, the Chinese government had mobilized and transferred more than 30,000 medical rescuers to Wuhan from January to April in 2020. These actions with other feasible strategies were proved to be very efficient since the pandemic has already been well-controlled in China, and all medical rescuers have already left Wuhan before May 2020. During the antipandemic rescue, these members of the medical staff have suffered both high-intensity work and high-pressure mental stress, which could lead to a variety of distress injuries and harm the performance of rescuers to some extent (2, 3). The information of distress and performance in medical rescuers is not only important in guiding the psychological intervention for those rescuers with mental problems but also beneficial for the country to modify the pandemic coping strategies (4, 5).

Distress contains various symptoms: scare and anxiety could appear immediately after exposure to a stressor, while later-appearing depression, somatic alterations, and even post-traumatic stress symptoms could last for a long time with profound impact (6, 7). Stress load has been introduced as a concept in stress evaluation and has been used to describe distress or potential distress risk quantitatively; however, a standard method for its calculation is still absent. Physiologists tend to use physical or biochemical parameters to reflect somatic alterations (8), whereas, psychiatrists prefer to evaluate the mental problems *via* the psychological diagnose scale (9, 10). In the present study, we created a self-rated questionnaire to identify the characteristics of stress load in four dimensions (depression, anxiety, scare, and somatic distress). Ninety COVID-19 disease medical rescuers in Wuhan were employed to answer this self-rated questionnaire *via* the mobile app WeChat. The performance of rescue of the Wuhan medical staff was also evaluated in the questionnaire survey.

MATERIALS AND METHODS

Participants

Medical rescuers working in Wuhan, including doctors, nurses, medical administrators, and logistic servers, were recruited to participate in this survey *via* a mobile phone app–based questionnaire from February 27, 2020 to April 20, 2020. The study was approved by the Academic Ethics and Security Committee of Academy of Military Medical Sciences. An anonymous, self-rated questionnaire was established using a SaaS cloud platform called "Kuyidian" (wx.kyd5.cn) and was published on the WeChat Official Accounts for Stress Control. The electronic questionnaire was only pushed *via* WeChat to the individuals with informed consent feedback of "yes."

Questionnaire

The questionnaire consists of four parts: basic demographic data, subjective view for rescue, stress load assessment, and self-perceived performance status compared to that before medical rescue.

The demographic data included gender, age, marriage status, occupation, education, military or not, working department, and working time per day for rescue. Two levels of virus contact were divided according to the possibility of exposure to confirmed patients. The immediate contact department includes the fever clinic, the emergency department, the general isolation ward, and the intensive care unit. Social supporting status was also included by inquiring how many social and family support they could receive during the rescue process: <50% (rating as 1), 50–80% (rating as 2), 80–100% (rating as 3), or more than 100% (rating as 4) compared to their support before rescue. Subjective view assessment was designed to know the motive of participants for joining the rescue and whether they had worries about their life/health being threatened or getting COVID-19 infection.

In order to minimize the interference to the normal work of rescuers, we self-designed a very brief stress testing questionnaire (only consisted of 24 items) for stress assessment in four dimensions. The items to depression (five items), anxiety (six items), scare (six items), and somatic alteration (seven items) dimension were selected from the Stress Overload Scale, the Self-Rating Anxiety/Depression Scale, and the Depression Anxiety Stress Scale (9–11) and were modified slightly based on these standardized scales. Each item score ranges from 1 (never) to 4 (always), and the stress load score in each dimension was calculated as a normalized ($\times 100$ to make it from 0 to 100) ratio between total scores to possible max scores in the respective dimension. The average among scores in four dimensions was defined as the general stress load score. Experts' content validity index (CVI) of each item and Cronbach's alpha coefficients of the total stress questionnaire and each dimension were calculated for content validity and reliability evaluation. Exploratory factor analysis was administrated for stress questionnaire structure test. Accordingly, three items with a lower factor component (one in depression and two in scare) were deleted, and only 21 items were used for stress load assessment finally.

The self-perceived performance status was determined by asking the participants whether their error increased and whether their capacity of execution, comprehension, and judgment declined compared to those before medical rescue. Each question score was set in four grades from 1 (<50% to original capacity) to 4 (>100% to original capacity). Especially, the error question had reversed the score range from 4 to 1 (less than usual is 4, equal to usual is 3, mild increase is 2, and significant increase is 1). The summation of each question score was calculated as the performance score to evaluate the working performance in rescue.

Statistical Analysis

All statistical analysis was performed by IBM SPSS Statistics 25.0, and data were described using the median and interquartile range. Considering the non-normal distribution of data, Kruskal–Wallis H test was used for the comparison of stress load and performance score. Chi-square test or Fisher's exact test was used to compare the frequency statistics. The correlation between stress load score, social support rating, and performance score

TABLE 1 | Demographic and characteristics of rescue participants for COVID-19 disease, according to contact severity.

Characteristic	All participants ($n = 90$)	Contact		
		Immediate ($n = 33$)	Mediate ($n = 57$)	P-value
Demographic characteristic				
Female—no. (%)	42 (46.7%)	13 (39.4%)	29 (50.9%)	0.293[a]
Median age range—year	30–39	30–39	30–39	-
Married—no. (%)	61 (67.8%)	25 (75.8%)	36 (63.2%)	0.218[a]
Military participates—no. (%)	15 (16.7%)	10 (30.3%)	5 (8.8%)	0.008[a,*]
Working time ≥8 h per day—no. (%)	27 (30%)	15 (45.5%)	12 (21.1%)	0.015[a,*]
With social support deficiency—no. (%)	35 (38.9%)	16 (48.5%)	19 (33.3%)	0.155[a]
Subjective view for rescue				
Accepted the rescue task—no. (%)	34 (37.8%)	11 (33.3%)	23 (40.4%)	0.508[a]
Voluntary for rescue—no. (%)	33 (36.7%)	16 (48.5%)	17 (29.8%)	0.077[a]
Strived for rescue opportunity—no. (%)	23 (25.5%)	6 (18.2%)	17 (29.8%)	0.222[a]
With worry for life threaten—no. (%)	42 (46.7%)	19 (57.6%)	23 (40.4%)	0.114[a]
With worry for health threaten—no. (%)	65 (72.2%)	23 (69.7%)	42 (73.7%)	0.684[a]
With worry for self-infection—no. (%)	56 (62.2%)	23 (69.7%)	33 (57.9%)	0.266[a]
Stress load assessment				
With at least one item score >2—no. (%)	86 (95.6%)	31 (93.9%)	55 (96.5%)	0.622[b]
With at least one depression-item score >2—no. (%)	76 (84.4%)	30 (90.9%)	46 (80.7%)	0.241[b]
With at least one anxiety-item score >2—no. (%)	80 (88.9%)	30 (90.9%)	50 (87.7%)	0.74[b]
With at least one scare-item score >2—no. (%)	70 (77.8%)	27 (81.8%)	43 (75.4%)	0.483[a]
With at least one somatic-item score >2—no. (%)	70 (77.8%)	30 (90.9%)	40 (70.2%)	0.034[b,*]
Performance assessment				
With error increase—no. (%)	2 (2.2%)	2 (6.1%)	0 (0%)	0.132[b]
With execution decline—no. (%)	33 (36.7%)	13 (39.4%)	20 (35.1%)	0.683[a]
With comprehension decline—no. (%)	45 (50%)	15 (45.5%)	30 (52.6%)	0.512[a]
With judgment decline—no. (%)	29 (32.2%)	11 (33.3%)	18 (31.6%)	0.864[a]

*$P < 0.05$.
[a]Chi-square test.
[b]Fisher's exact test.

was analyzed by Spearman's coefficients. Data were considered statistically significant when $P < 0.05$.

RESULTS

Demographic Characteristics and Subjective View

In total, 90 medical rescuers, including 48 (53.3%) doctors, 8 (8.9%) nurses, 23 (25.6%) medical administrators, and 11 (12.2%) logistic servers, returned valid questionnaires. A total of 33 (36.7%) rescuers worked in an immediate virus contact department. General demographic characteristics, such as gender, age, marriage status, etc., are shown in **Table 1**. Significant differences of identity (military or not) and working time per day were found between the rescuers with immediate or mediate virus contact, respectively. Compared with civilian rescuers, a higher proportion of working with immediate virus contact was found in military medical rescuers ($P = 0.008$). The rescuers with immediate virus contact have a higher proportion in work overtime ($P = 0.015$). Among all the participants, 34 people (37.8%) accepted the rescue as a task, 33 (36.7%) volunteered for rescue, and 23 (25.5%) strived to create an opportunity to join the rescue. The percentages of rescuers with worry for life being threatened, health being threatened, and self-infection were 46.7, 72.2, and 62.2%, respectively. No significant differences were found between immediate and mediate contact rescuers. Thirty-five rescuers could not obtain enough social support, and their ratio equaled statistically in rescuers with immediate or mediate COVID-19 contact.

Psychometric Properties for Stress and Performance Questionnaire

Based on the results of factor analysis for the original 24-item stress questionnaire, three items with a lower factor component (one in depression and two in scare) were deleted, and only 21 items were used for stress assessment finally. The scale level CVI average (S-CVI/Ave) of the final stress questionnaire increased from 0.94 (24-item) to 0.97 (21-item). Four factors corresponding to the respective dimension were extracted by factor analysis for the new 21-item stress questionnaire, which could explain 63.33% cumulative variance. Cronbach's alpha coefficients for the 21-item stress questionnaire reached 0.93, whereas, that for each dimension ranged from 0.76 to 0.88 (depression 0.80, anxiety 0.88, scare 0.76, and somatic alterations 0.87). The four-item

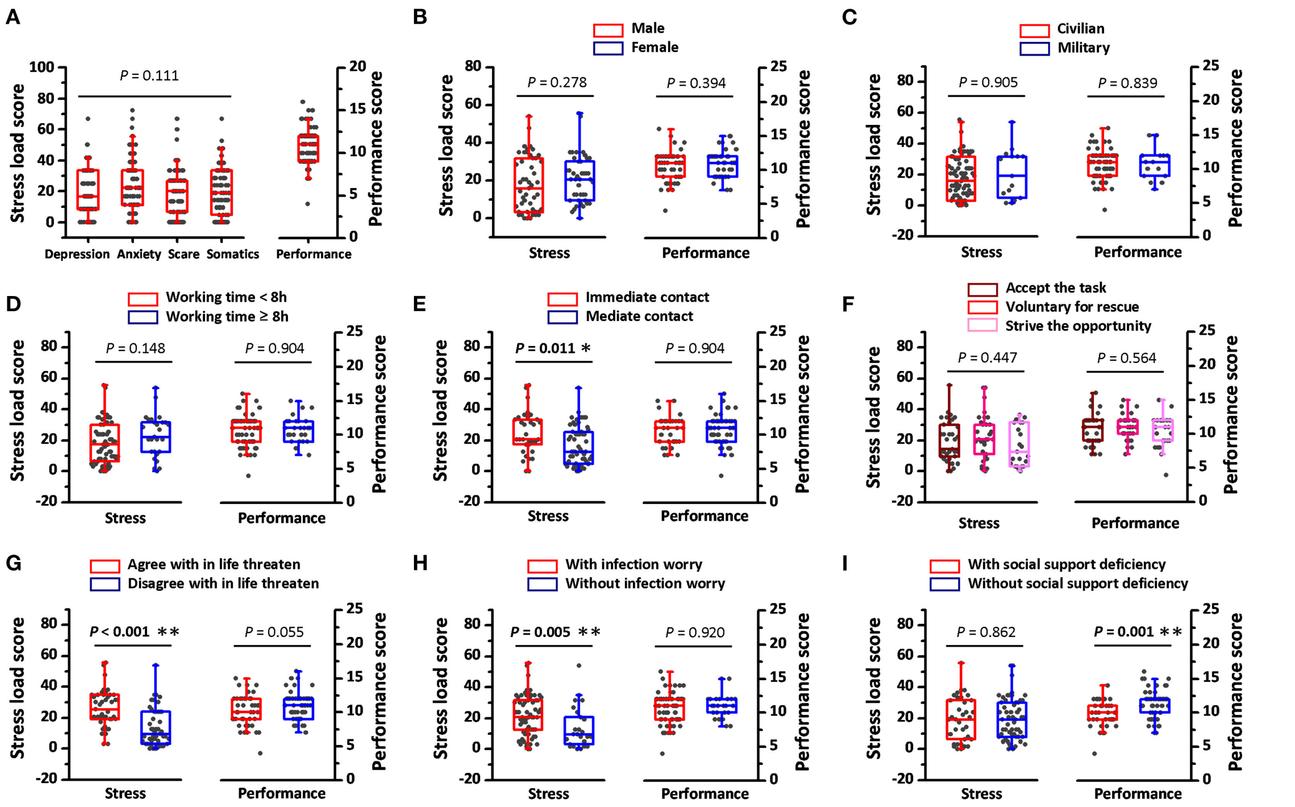

FIGURE 1 | Stress load and working performance assessment in Wuhan medical rescuers. **(A)** The stress load score of all survey participants in depression, anxiety, scare, and somatic alteration dimensions. The stress load score in each dimension was calculated as a normalized (×100 to make it from 0 to 100) ratio between items total scores to possible max scores in the respective dimension. Performance scores, calculated as the summation of four items scores, were also presented to show the performance in all survey participants. **(B–I)** The stress load scores and performance scores in different genders, identities, working time per day, COVID-19 contacts, motives for joining rescue, subjective views, and social supports. The general stress load scores were calculated as the average among the scores in the four dimensions. Social support deficiency was determined as rescuers receiving <80% support compared to that before rescue. Horizontal lines across each box represent medians of the stress load score or the performance score, while heights of each box represent interquartile ranges of stress or performance distribution. **P* < 0.05, ***P* < 0.01.

performance assessing questionnaire confided its S-CVI/Ave (1.00) and the Cronbach's alpha coefficients (0.794) under the same analysis. The cumulative variance contribution rate reached 61.875, which indicated acceptable reliability and validity of this plain performance questionnaire.

Stress Load Assessment

Although, 95.6% of the participants reported that they had at least one stress symptom (**Table 1**), the median of the stress load score was maintained at a lower level (**Figure 1A**), which suggested that the distress in medical rescuers was universal but mostly mild. No statistical differences were identified among the four dimensions in stress load, and according to this, only general stress load scores were shown subsequently. Factors that might affect stress were then verified by comparing the general stress load scores. Gender, military or not, working time per day, motives for joining the rescue, and social supporting did not show statistical impact on the stress load score (**Figures 1B–D,F,I**), whereas, the immediate COVID-19 contact was found to induce a significant higher stress load score (**Figure 1E**). Cognition and psychological preparation to rescue could also affect stress loads. Both the worry for possible infection and the self-agreement to having life being threatened lead to higher scores in stress load (**Figures 1G,H**).

Performance Assessment

Only two rescuers in our survey thought their working error increased significantly compared to that before the medical rescue, while many more people reported that they had over 20% performance decline in execution, comprehension, and judgment during the rescue period (**Table 1**). Performance scores were calculated as the summation of scores of error, execution, comprehension, and judgment, which ranged from 4 to 16 (**Figure 1A**). Factors that might affect performance were verified, and only sufficient social and family support showed benefits to maintain performance (**Figures 1B–I**). Spearman's coefficients showed an inverse correlation between the stress load score and working performance ($R = -0.24$, $P = 0.023$, **Figure 2A**), and a positive correlation between social support rating and

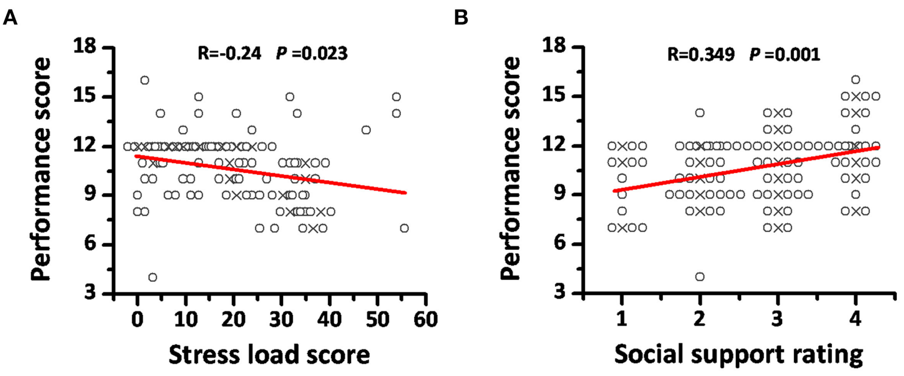

FIGURE 2 | The correlations between the stress load score, social support rating, and the performance score. **(A)** The inverse correlation between the stress load score and the performance score. Stress load scores were calculated as normalized (×100 to make it from 0 to 100) ratios between the item score summation and the possible max score in the 21-item questionnaire. Performance scores were calculated as the summation of four performance items scores. **(B)** The positive correlation between social support rating and the performance scores. Social supporting rating was achieved by inquiring how many social and family support the rescuers could receive during the rescue process: <50% (rating as 1), 50–80% (rating as 2), 80–100% (rating as 3), or more than 100% (rating as 4) compared to their support before rescue. "×" means the central position of overlapped points, and overlapped points were plotted as offset.

performance (R = 0.349, P = 0.001, **Figure 2B**), suggesting the possible negative effects of stress and the positive effects of social support on performance.

DISCUSSION

Pandemic outbreak is known as an intensive stressor for medical workers not only because of their direct exposure to the working environment but also owing to the possibility of death of the people around whom they had to face. A notable example would be the severe acute stress reaction of healthcare workers observed during the SARS outbreak in 2003 (7, 12). Stress load assessment is not an effortless task, and the standard method is still absent even today. Most psychiatrists tend to use psychological scales such as the stress overload scale (9), the stress anxiety/depression scale (10) etc., However, members of the hospital staff were found with both physical and psychological stress responses to medical work during the current COVID-19 pandemic (13, 14). Some symptoms of insomnia and myalgia in healthcare workers were thought of as being a result of stress that exacerbates the psychological injury further (3). In the present study, we created a self-rated questionnaire for stress load in both physical and psychological dimensions and identified a universal but mostly mild distress in Wuhan medical rescuers, which is consistent with other studies reporting the subthreshold or mild mental disturbances in more than 70% medical staff members during the COVID-19 pandemic (2). When somatic distress was also included as shown in our study, the proportion of medical rescuers with stress disturbance would be even higher. This mild distress could enhance the rescue motives or immune reaction in medical staff members (2, 15) but would produce some negative effects on their rescue performance. An inverse correlation between the stress load score and working performance was identified in our study, which verified the presumed hazard of stress on rescue performance. To the best of the authors' knowledge, this study is the first one to focus on the association between stress load and performance of medical rescuers in COVID-19 control. On the contrary, good social, and family support was believed to play important roles in health maintenance, especially in the situation of being under stress (16, 17). Consistently, this has also been verified in our present study by the better performance of those rescuers with sufficient social support and the positive correlation between working performance and social support rating.

In stress load assessments, the level of COVID-19 contact was found as the only objective factor impacting stress load. Medical rescuers with immediate virus contact represented higher stress load. Similarly, other surveys also presented the higher risk for suffering depression and anxiety in those medical staff members working with close COVID-19 contact compared to the staff with mediate contact (2, 18, 19). Considering the higher proportion of working with immediate contact in the case of military medical rescuers, the statistical undifferentiated stress load between military and civilian rescuers seems really interesting. The similarity in the working environment between the newly built mobile hospital for COVID-19 patients and the field hospital in military training could possibly account for the better stress resilience of military medical rescuers (20). This implied that the military medical staff members and even some military medicine experience might be beneficial to national-wide COVID-19 control. In contrast with most objective factors, the subjective factors showed more determinative effects on stress load. Our data showed that positive cognition, good psychological preparations, and sufficient social support were helpful for stress load reduction and even performance promotion. This is consistent with most surveys demonstrating that higher trust in infection control predicted less emotional fatigues and anxieties (21–23). These findings highlighted the crucial role of prior preparation and rescue organizing in pandemic control. Clear plans, stable policies, and definitive task arrangements can help medical rescuers focus on key issues in medical operations and reduce their crisis of stress sufferings.

Our study also has certain limitations. First, the measuring instruments used in our study were self-designed especially focusing on the medical rescuers of the Wuhan COVID-19 pandemic, and the validity and reliability of the questionnaire we used were statistically calculated just based on the present survey. Further psychometric properties of these measuring instruments would still be needed and verified in other future studies. Second, most rescuers were too busy and too tired to face the extra burden of survey during the medical rescue against COVID-19. Although, we prolonged our survey to April 20, 2020 (before the evacuation of the medical rescue team from Wuhan), only 90 valid questionnaires were collected. A larger-sized investigation is necessary to verify our results in the future.

CONCLUSION

In summary, our study found a possible inverse correlation between universal distress and working performance in the medical rescuers against COVID-19 in Wuhan, which indicated that more attention should be paid to the stress load of medical staff members during the pandemic to maintain their rescue efficiency. Positive cognition, good psychological preparations, and sufficient social support would be helpful to reduce the stress and might improve the performance in COVID-19 rescue.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Academic Ethics and Security Committee of Academy of Military Medical Sciences. The patients/participants provided their electronic informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

LJQ and FX contributed to the conception and design of the study. FX, XW, YZ, SDW, CX, XTW, and YXC collected and interpreted the data. FX and XW performed the statistical analysis and wrote and revised the manuscript. All authors contributed to manuscript revision and read and approved the submitted version.

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Psychosocial Impacts of COVID-19 on Healthcare Workers During the Nationwide Partial Lockdown in Vietnam in April 2020

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Background: The psychosocial impact of COVID-19 is greater among healthcare workers (HCWs) than the general population. This study aims to identify psychosocial problems faced by HCWs in Vietnam during the national partial lockdown between 1 and 22 April 2020 and to identify risk factors associated with psychosocial issues among this population.

Methods: A cross-sectional study was conducted in the second week of April 2020 during the national lockdown in Vietnam. Snowball sampling technique was used to recruit participants through web-based surveys. The Impact of Events Scale-Revised (IES-R) was used to assess the impact of COVID-19 on HCWs through online surveys.

Results: Of the 349 HCWs, we found 22.6% reported psychosocial problems. Most of participants reported having exposure to COVID-19 daily (48.7%). The majority of them also felt that their job put them at risk of SARS-CoV-2 infections (90.3%) and expressed fear of potential infection (85.7%). Despite COVID-19 risks, 95.4% of participants, however, expressed their willingness to continue working at their current health facility. In addition, 94.8% of participants believed if they or their family members had been infected, their agency leaders would have provided them with appropriate medical care. Lastly, HCWs who worked in the internal medicine department who did not take care of COVID-19 patients or expressed fear of becoming infected were more likely to have higher total IES-R scores.

Conclusion: Our findings suggest that the support of healthcare leaders and assurance of care might be helpful in mitigating the psychological effects of COVID-19 among HCWs in Vietnam. These resources should be tailored to HCWs who are working in different areas of health services, including staff who are not working directly with COVID-19 patients. In addition, psychosocial health resources should be provided for not only physicians but also nursing staff.

Keywords: COVID-19, mental health, psychosocial impact, healthcare worker, Vietnam

INTRODUCTION

The present coronavirus disease 2019 (COVID-19) due to SARS-CoV-2 has resulted in widespread reports of worsening mental health (1–4). In particular, rising numbers of COVID-19 cases and the consequent institutionalized stay-at-home orders exacerbated feelings of isolation along with fear of potential infections, thereby contributing to the increasing issues around psychosocial well-being. A study in China found that panic disorders, anxiety and depression were the most widespread during this pandemic (1). Other common psychological impacts included anger, guilt, grief and loss, post-traumatic stress disorder (PTSD), and stigmatization (5, 6).

The institution of public health measures, such as stay-at-home orders, has played a crucial role in delaying the spread of infections and alleviating pressure on healthcare systems particularly in low-to-middle income countries (LMICs), such as Vietnam, where critical care resources are already limited. Due to Vietnam's rigorous public health interventions, as of the end of April 2020, there were only 270 confirmed COVID-19 cases with zero deaths nationally. Nevertheless, the stringent social distancing measures, combined with the stress of working in high-risk, resource-poor settings have put people, particularly healthcare workers (HCWs) at risk of developing psychosocial disorders (7). These issues have been further compounded by the absence of mental health resources for HCWs—in particular interventions to combat stress, burnout, and PTSD during early stages of the outbreak (8).

The higher rates of mental problems among HCWs during the COVID-19 pandemic have been widely documented (9, 10). Previous studies among HCWs treating COVID-19 patients in China found higher levels of anxiety, stress, and self-efficacy based on sleep quality and social support (11). Another study found that non-frontline nurses were more likely to suffer psychological consequences than frontline nurses (12), highlighting the varying adverse mental health effects on all HCWs regardless of their direct contact with COVID-19 patients. Furthermore, poor mental health among HCWs has been apparent in past outbreaks, with previous studies demonstrating poor psychosocial outcomes even 1 year after the SARS outbreak in 2003 (13) and MERS in 2005 (14). In the present pandemic, a greater understanding of risk factors to support the development of early intervention for mental health illnesses among HCWs will thus be crucial to ensure the sustainability of our healthcare system in the years to come.

In this study, we examined the psychosocial impact of COVID-19 on HCWs during the first national lockdown in the history of Vietnam in April 2020. We aim to identify rates of psychosocial disorders among HCWs in Vietnam, trends contributing to these rates, and opportunities to improve the psychosocial health of this population. A better understanding of mental health needs among HCWs will help further ensure the well-being of this critical workforce during the present COVID-19 and potentially future pandemics in Vietnam.

METHODS

Study Setting and Participants

A cross-sectional study was conducted on the second week of April 2020 during the national lockdown in Vietnam. During this time, all Vietnamese people were highly encouraged to stay at home and physically distance to prevent COVID-19 outbreak. By the end of April 2020, there were 270 cases of COVID-19 in Vietnam. Of note, Vietnam's healthcare system provides services at commune, district, provincial and central levels, and in this study, participants were all HCWs associated with hospital facilities—not just physicians and nurses. They were recruited according to the following eligibility criteria: (1) agreement to participate in the study through online informed consent forms, (2) ability to access the web-based surveys, and (3) ability to read and respond to the questionnaire.

Sample and Sampling

In this study, we used a snowball sampling technique to recruit participants; active participants were asked to recruit other subjects for the study. This sampling method was considered to be suitable to study small groups of specialized workers who are likely to already know each other (15). At the beginning of the recruitment process, a core group of Hanoi Medical University medical doctors were established to conduct recruitment. The selected group reflected the diversity of study subjects with regards to age, gender, and occupation throughout the country. By distributing the questionnaire link, the core group disseminated the survey to their close contacts and other groups through social media (e.g., Facebook or Zalo). Study participants were asked to invite their colleagues and other HCWs across the country to take the survey. Using this approach, we recruited a total of 349 HCWs including those in hospitals, healthcare centers and medical universities throughout all 63 provinces of Vietnam during 1 week of data collection.

Instruments and Measurements

The introduction of the study and informed consent were presented on the first page of the survey. After agreeing to participate the study, the respondents answered questions on the following topics:

Demographic Characteristics

The demographic characteristics included region, level of hospital and department which HCWs are working, gender, marital status, people that respondents were living with, education level, occupation, age, and duration of career.

Risk of Exposure to COVID-19

Participants self-reported their risk of exposure to COVID-19, which included exposure level (every day, several times per week, seldom, or unknown). Participants also answered eight questions about their perception on risk of COVID-19 which rated by using a five-point Likert scale from one representing "Strongly disagree" to five representing "Strongly agree".

Psychological Impacts

To evaluate the psychosocial impacts of COVID-19, we used the Impact of Event Scale-Revised (IES-R) which evaluates post-traumatic stress symptoms (PTSD) or acute stress of participants and its severity after exposure the traumatic event during the national lockdown. There are 22 questions which were rated from 0 (Not at all) to 4 (Extremely). The total score of IES-R scale (15) was calculated by adding the scores of each question; it ranged from 0 to 88—a cutoff score of 33 or greater was considered positive for PTSD. In addition to providing a total score, the IES-R scale also contained three sub-scales for (1) Intrusion (8 items), (2) Avoidance (8 items), and (3) Hyperarousal (6 items). The score of each subscale was calculated by taking the average of total items in this subscale, which ranged from 0 to 4 (16). The IES-R total scores were interpreted using the following breakdown: 0–23 was normal, 24–32 was considered to be clinically concerning, 33–36 was classified as PTSD, and 37+ was represented extreme symptoms. The IES-R scale has been validated to measure levels of PTSD in both Western and Asian populations (17, 18). In this study, the Cronbach's alpha was 0.94.

Data Analysis

STATA 15.0 (StataCorp LP, College Station, TX) was used to analyze the data. Descriptive statistics were adopted to calculate frequency, percent, mean and standard deviation. Inferential statistics were applied to perform the comparison among three subject groups by the *t*-test or Mann-Whitney test for quantitative variables and by the Fisher-exact test or chi-square test for qualitative variables. Ordered logistic regression and multivariable regression models were applied to identify factors associated with the psychological impacts of participants during COVID-19 lockdown. The outcomes of regression models were the severity of PTSD and three subscales of IES-R scale (Intrusion, Avoidance, and Hyperarousal). Independent variables included demographic characteristics and risk of exposure to COVID-19. To obtain reduced models, stepwise forward selection strategies were utilized with a log-likelihood ratio test at a p-value of 0.2. Statistical significance was defined at a p-value of less than 0.05.

Ethical Consideration

This study was approved by the Ethics Review Committee at the Institute for Preventive Medicine and Public Health, Hanoi Medical University, dated March 28, 2020. The purpose of research and informed consent forms were provided through the web-based platform. Participation was voluntary, and anonymity was assured. Participants were informed they could decline to participate or withdraw from the online survey at any time.

RESULTS

The socioeconomic characteristics of the participants ($n = 349$) are presented in **Table 1**. Thirty-nine percent of participants were male. The majority of participants worked in provincial and central hospitals (30.7 and 33.8%, respectively), were hysicians (57.0%) and were married (75.1%). There were 57.9% of participants had attained a University level of education or lower. The mean age was 35.2 (SD = 8.8) years. The mean career duration was 10.3 (SD = 8.2) years.

Table 2 shows the self-reported and perceived risk of exposure to COVID-19. There were no significant difference in HCWs' risk of exposure to COVID-19 and the presence of PTSD. Over half of participants (48.7%) reported risk of COVID-19 exposure every day. On the contrary, 13.5% of HCWs reported they were not at risk of COVID-19 exposure, and 13.8% reported that they were unaware of their risk. Most of HCWs agreed to continue working at their current health facility, despite a possible risk of COVID-19 exposure (95.4%). Nearly all participants believed their agency leaders would provide them with medical services if they were infected with the virus (94.8%). Nevertheless, the majority of HCWs felt their jobs put them at risk of SARS-CoV-2 infections (90.3%) and reported fear of being exposed to COVID-19 (85.7%). The majority of participants reported their families perceived them to be at high risk for COVID-19 (82.8%).

Figure 1 presents levels of PTSD as indicated by participants' IES-R score. The psychosocial impacts of COVID-19 on HCWs were categorized into four groups: normal (77.4%), clinically concerning (10.3%), PTSD (4.6%) and extreme symptoms (7.7%). **Table 3** shows the relationship between IES-R scores, the perceived risk of SARS-CoV-2 infections, and demographic characteristics of the participants. We found that Internal Medicine department staff were more likely to experience greater psychosocial effects of COVID-19 across the three IES-R subscales in comparison to their those in Emergency-Intensive Care. We also found participants who were not responsible for caring for COVID-19 patients and those who were fearful of SARS-CoV-2 infections were more likely to have higher total IES-R scores across all three domains. Regarding the education levels, we found that those who had attained a degree greater than University were more likely to be affected by the psychosocial effects of COVID-19; however, they were less likely to suffer from intrusion, avoidance and hyperarousal symptoms.

DISCUSSION

The association between emerging infectious diseases and mental illness has been demonstrated during outbreaks in the past and

TABLE 1 | Socioeconomics characteristics of participants.

	Posttraumatic stress disorder (IES-R)				Total		*p*-value
	No		Yes				
	n	%	n	%	n	%	
Total	306	87.7	43	12.3	349	100.0	
Region							
Northern	224	73.2	33	76.7	257	73.6	0.80
Central	63	20.6	7	16.3	70	20.1	
South	19	6.2	3	7.0	22	6.3	
Level of hospital							
Central level	106	34.6	12	27.9	118	33.8	0.48
Provincial level	93	30.4	14	32.6	107	30.7	
District health center	34	11.1	8	18.6	42	12.0	
Others	73	23.9	9	20.9	82	23.5	
Gender							
Male	114	37.3	22	51.2	136	39.0	0.08
Female	192	62.7	21	48.8	213	61.0	
Marital status							
Single / Separated/Widowed	77	25.2	10	23.3	87	24.9	0.79
Married	229	74.8	33	76.7	262	75.1	
Living with							
Family/friends	279	91.2	37	86.0	316	90.5	0.27
Alone	27	8.8	6	14.0	33	9.5	
Education							
University and lower	171	55.9	31	72.1	202	57.9	0.04
Higher than university	135	44.1	12	27.9	147	42.1	
Occupation							
Doctor	180	58.8	19	44.2	199	57.0	0.19
Nurse	69	22.5	13	30.2	82	23.5	
Others	57	18.6	11	25.6	68	19.5	
Department							
Emergency-Intensive care	23	7.5	5	11.6	28	8.0	0.85
Internal medicine	38	12.4	5	11.6	43	12.3	
Surgery-Obstetrics-Pediatrics	37	12.1	8	18.6	45	12.9	
Imaging Diagnosis-Scientific laboratory - Clinic	44	14.4	4	9.3	48	13.8	
Administrative offices	47	15.4	7	16.3	54	15.5	
Infectious disease-Infection control	14	4.6	2	4.7	16	4.6	
Preventive medicine-Public health-Nutrition	41	13.4	4	9.3	45	12.9	
Others	62	20.3	8	18.6	70	20.1	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	***p*-value**
Age (unit: years)	35.0	8.5	36.3	10.7	35.2	8.8	0.54
Duration of career (unit: years)	10.1	7.9	11.7	9.7	10.3	8.2	0.44

is observed in this study (19, 20). Psychosocial interventions should prioritize HCWs, who have been found to experience worse mental health during these crises than the general population (9). In this study, we assessed the perceived risks of COVID-19, its psychosocial impact on HCWs during the partial lockdown in Vietnam in April 2020. We found that 22.6% of Vietnamese HCWs had reported psychosocial problems (**Figure 1**). Approximately half (48.7%) of participants reported exposure to COVID-19 daily, and the majority felt that their job put them at risk of SARS-CoV-2 infections (90.3%) and expressed fear of infection (85.7%). Nevertheless, we found that nearly all participants (95.4%) were willing to continue working at their current health facility despite the possible exposure to COVID-19. A similarly high number of participants (94.8%) believed that if they became infected, their agency leaders would provide them with appropriate medical care. Lastly, we found that those in the internal medicine department, those who reported not having to take care of COVID-19 patients, and those who expressed fear of

TABLE 2 | Risk of exposure to COVID-19.

	Posttraumatic stress disorder (IES-R)				Total		*p*-value
	No		Yes				
	n	%	n	%	n	%	
Risk of exposure to COVID 19							
Do not expose to risk factors	38	12.4	9	20.9	47	13.5	0.53
Everyday	153	50.0	17	39.5	170	48.7	
Several times per week	32	10.5	4	9.3	36	10.3	
Seldom	42	13.7	6	14.0	48	13.8	
Do not know	41	13.4	7	16.3	48	13.8	
Perception on risk of COVID 19							
Accept to continue working at a current health facility, even though it may be contaminated with COVID 19	293	95.8	40	93.0	333	95.4	0.43
The agency leader will provide me with the necessary medical services if I am infected with COVID 19	291	95.1	40	93.0	331	94.8	0.47
Feel the job put you at high risk of being exposed to COVID 19	277	90.5	38	88.4	315	90.3	0.59
Fear of being infected COVID 19	261	85.3	38	88.4	299	85.7	0.59
My family believes that I am at high risk for COVID 19	255	83.3	34	79.1	289	82.8	0.49
Accept colleagues to quit their jobs because they are afraid of COVID-19 infection	138	45.1	20	46.5	158	45.3	0.86
Do not take care of COVID 19 patients	54	17.6	15	34.9	69	19.8	0.01
If infected with COVID 19, I believe that my chances of survival are low	40	13.1	12	27.9	52	14.9	0.01

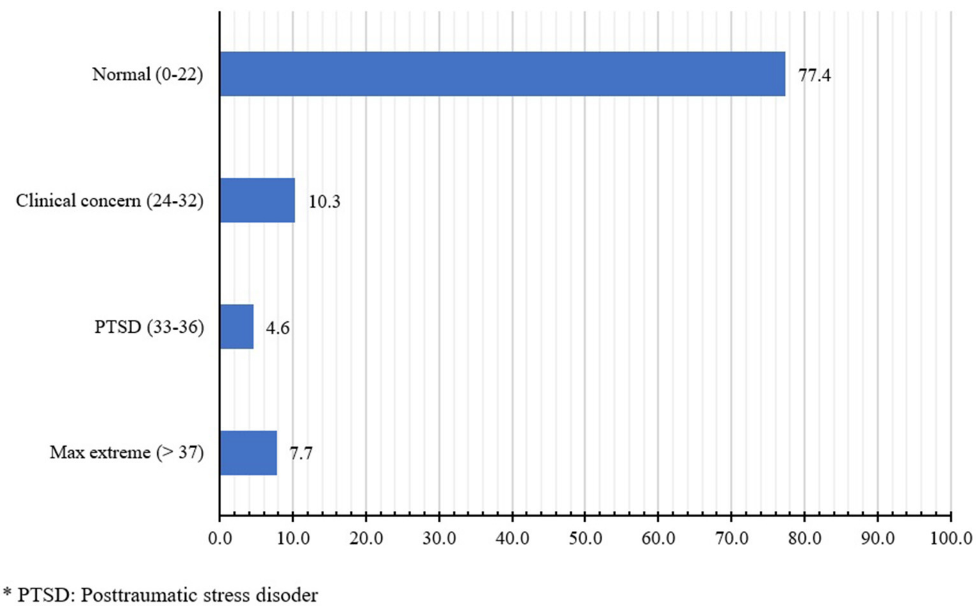

FIGURE 1 | Levels of posttraumatic stress disorder impact by COVID-19 among HCWs.

becoming infected with the virus were more likely to have higher total IES-R scores.

The overall percentage of HCWs who reported having psychosocial problems in this study (22.6%) is lower than the rates found in heavily endemic countries, such as China (37%), but is higher than other Asian countries, such as Singapore (<20%) and India (<10%), during early stages of the COVID-19 pandemic (21). Nevertheless, the majority of participants

TABLE 3 | Associated factors of psychological and social impacts of COVID-19.

	IES-R level		**IES-R scale**					
			Intrusion subscale		**Avoidance subscale**		**Hyperarousal subscale**	
	OR	**95% CI**	**Coef.**	**95% CI**	**Coef.**	**95% CI**	**Coef.**	**95% CI**
Age			0.01**	0.00; 0.02				
Education (vs. University and lower)								
> University	0.56*	0.32; 1.00	−0.24***	−0.41; −0.07	−0.14*	−0.30; 0.02	−0.21***	−0.36; −0.06
Gender (vs Male)								
Female							−0.14**	−0.27; −0.00
Marital status (vs. Single/Separated/Widowed)								
Marriage			0.17*	−0.02; 0.36				
Department (vs. Emergency-Intensive care)								
Internal medicine	2.02**	1.06; 3.85	0.24**	0.03; 0.45	0.30***	0.12; 0.48	0.35***	0.16; 0.54
Surgery-Obstetrics-Pediatrics							0.14	−0.05; 0.34
Administrative offices			0.14	−0.06; 0.34				
Level of hospital (vs. Central level)								
Others					−0.13*	−0.28; 0.02		
Occupation (vs Doctor)								
Nurse					0.14*	−0.03; 0.32		
Others					0.12	−0.05; 0.29		
Years of career (years)	1.04**	1.01; 1.08			0.01***	0.00; 0.02	0.01**	0.00; 0.02
Perception on risk of COVID-19(Agree vs Not Agree)								
Feel the job put you at high risk of being exposed to COVID-19					−0.14	−0.36; 0.07		
Fear of being infected COVID-19	2.23*	0.90; 5.53	0.28**	0.06; 0.49			0.21**	0.02; 0.40
Do not take care of COVID-19 patients	1.71*	0.93; 3.16	0.19**	0.00; 0.38	0.27***	0.11; 0.43	0.25***	0.08; 0.42
Accepting of colleagues who quit their jobs due to fear of SARS-CoV-2 infection					0.12*	−0.01; 0.25		
My family believes that I am at high risk for COVID-19			0.14	−0.06; 0.34				

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

expressed fear of SARS-CoV-2 infection (83.7%), felt that their job put them at risk of COVID-19 exposure (89.7%), and reported that their families believed they were at a high risk for COVID-19 exposure (80.9%). Half of the participants (51.4%) reported daily exposure to COVID-19. Given these high rates of reported COVID-19 exposure and fear of infections, the relatively low prevalence of psychosocial disorders is a source of optimism.

It is worth noting we did identify a positive relationship between fear of SARS-CoV-2 infection and IES-R score, an expected association given the well-established relationship between fear and PTSD (22). Nevertheless, regarding the reported exposure to COVID-19, we found that HCWs who did not have to take care of COVID-19 patients were more likely to have higher IES-R scores. This result was reported in a previous study in China (12). In our study, we also found that differences in educational level, job title and family condition between those selected to work with COVID-19 patients might contributed to the observed perception of risks of exposure and of the consequent psychological impact. Other possible explanations may include the desensitization among those on the "frontlines" associated with their routine interactions with COVID-19 patients, which could reduce their anxiety levels. Lastly, these findings may be a result of differing effects of concrete vs. theoretical risks in which the uncertainty of COVID-19 exposure could produce greater levels of anxiety than the accepted known threats of exposure.

In spite of high levels of fear, agency support appears to be an important factor for the relatively low psychosocial impact on HCWs. Nearly all participants (95.4%) were still willing to continue working at their current health facilities despite the possible risk of COVID-19 exposure, and 94.8% believed their agency leader would provide necessary medical services should they become infected. While the economic instability may play a role in these responses, these data highlight the potential impact of providing proper overall support for HCWs in the management of psychosocial disorders among this population. It might be worth considering extending such support and healthcare coverage to family members of HCWs because transmission to family members has been found to be a significant source of anxiety for HCWs (23). Given that 82.8% of participants reporting that their family believed they have high risk of COVID-19 exposure, these measures would provide further reassurance to family members and could relieve the pressure from the social stigma associated with HCWs' profession (24).

The relatively low psychosocial impact of COVID-19 on HCWs was also likely mediated by low rates of infections in Vietnam. With only 270 confirmed COVID-19 cases by the end of April 2020, Vietnam is among the global leaders with regards to its pandemic preventative strategies. Between March and April 2020, Bach Mai Hospital, the country's national hospital in Hanoi, had 19 positive cases of COVID-19 (25). Since the virus's initial introduction into Vietnam, there have only been four reported COVID-19 cases in HCWs as of April 2020 (25). This is much lower than in the U.S. with over 10,000 COVID-19 cases among HCWs (26, 27) and in China where 3,300 HCWs have been infected as of early March (23). Previous studies have found that the availability of personal protective equipment (PPE) and increasing work demands is among the primary concerns of HCWs regarding COVID-19 exposure (28). Given the low number of cases in Vietnam and the country's early preparation for the pandemic (29), these pressures were adequately mitigated, potentially contributing to our observed lower rates of psychosocial disorders among HCWs.

We also found Internal Medicine staff had significantly higher IES-R scores than their colleagues in the Emergency-Intensive Care department. These differences were likely mediated by greater preparation in anticipation of COVID-19-related needs by the Emergency-Intensive Care department. While preparedness in the intensive care department is critical, only a portion of hospitalized patients would require such a level of care (30). In fact, increasing pressure related to COVID-19 is distributed throughout the hospital system. In our study, we found that even those who did not take care of COVID-19 patients were psychosocially affected. Therefore, although greater effort to ensuring appropriate support for departments who might demonstrate higher needs of psychological support, such as the Internal Medicine reported in our study, healthcare systems should be prepared to provide adequate support to all HCWs regardless of the level of care and direct interactions with COVID-19 patients.

Moreover, we found that nurses had significantly higher IES-R scores on the avoidance subscale than physicians, which echoes findings from a similar study among HCWs during the H7N9 influenza outbreak in China in 2015–16 (31). These results are likely related to the higher degree in which nurses are on the "frontlines" than physicians due to their greater levels of patient interactions on a daily basis. In addition to disease prevention measures, greater provision of mental health screenings and other psychological or safe social services and activities could better address psychological needs for nurses during this high-stress time.

Several limitations of this study should be noted. First, the snowball sampling technique used in this study did not permit calculation of sampling error; caution should be taken in generalizing these findings to other settings. Second, the cross-sectional study design did not allow the identification of cause-effect relationships. Third, despite our effort in sampling to ensure the diversity of participants, our respondents were not randomly selected. Further, while IES-R questions have been validated in the evaluation of PTSD among both Western and Asian populations, participants' reports of risk of exposure and risk perception were self-reported. Therefore, even though the surveys were anonymized, social-desirability and recall bias might have impacted participants' responses.

CONCLUSIONS

In outbreak settings, HCWs experience the brunt of the psychosocial effects. In this study, however, we found a relatively small number of HCWs self-reporting psychosocial problems associated with risk of COVID-19 exposures during the Vietnam's national lockdown in April 2020. This low rate could be attributed to a combination of factors, including the national pandemic response strategies, greater institutional support and lower rates of infections. Nevertheless, greater effort is needed to ensure proper access and adequate provision of psychological services for HCWs, especially nurses, HCWs in less acute settings, such as Internal Medicine staff, and those who might not have direct responsibility and interactions with COVID-19 patients. Further studies determining the effectiveness of specific forms of psychosocial support reflecting unique HCWs' needs and preferences are warranted.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Review Committee of Hanoi Medical University dated 28 March 2020. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

All authors contributed to conceptualizing the manuscript: conceptualization, QP, NT, QTN, and TrN: data curation, LV and HP: data analysis, ThN, XL, HL, AN, DK, and BT: methodology, HL, XL, BT, AL, and RH: supervision, ThN, XL, NN, and QNN: writing—original draft, ThN, XL, NN, QNN, HL, QP, NT, QTN, AN, MH, HP, LV, AL, DK, TrN, BT, CL, CH, and RH: writing—review and editing.

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Impact of Perceived Severity of COVID-19 (SARS-COV-2) on Mental Health of University Students of Pakistan: The Mediating Role of Muslim Religiosity

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Background: Perceived severity of COVID-19 (SARS-COV-2) is known to be associated with mental health of people in general and health professionals in particular in Western societies. However, its association with the mental health of students in Pakistan, which is predominantly a Muslim society, remains unclear so far. Moreover, the role of Muslim religiosity for such an association has not yet been investigated. We aimed to examine the association and report findings on the impact of perceived severity on mental health with a sample of students from all five provinces of Pakistan.

Methods: We did a cross-sectional online survey from 1,525 Pakistani students in March 2020 using standardized measurement tools. We then determined the prevalence of perceived severity among students and its impact on their mental health. The strength of associations between these variables was estimated using generalized linear models, with appropriate distribution and link functions. Structural equation modeling through SmartPLS (3.0) software was utilized to analyze the results.

Findings: The perceived severity of COVID-19 is significantly associated with mental health of Pakistani students, whereas Muslim religiosity is a strong mediator between perceived severity and mental health of Pakistani students.

Conclusions: Though the perceived severity of COVID-19 is associated with mental health, this relationship can be better explained by the role of Muslim religiosity. When tested individually, the perceived severity accounted for only 18% variance in mental health that increased up to 57% by the mediating role of Muslim religiosity. This difference clearly indicates the mediating role of Muslim religiosity in the association between perceived severity and mental health for Pakistani students.

Keywords: COVID-19, perceived severity, mental health, muslim religiosity, Pakistani students

INTRODUCTION

At end of December 2019, an outbreak of respiratory disease cases in Wuhan, China, is caused by virus spread through the local wet market. Initially, this disease was named as Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-COV-2) that later was renamed as Corona Virus Disease 2019 (COVID-19) by WHO, on February 11, 2020 (1, 2). This epidemic is spreading rapidly all over the world including many other European and Asian countries (3). This wide spreading of COVID-19 and increase in death tolls have caused extreme effect on the mental health of the whole world (4–6). Due to this outbreak, gatherings have been prohibited all over the world with emphasis on social distancing and self-quarantine, which have resulted in various depressive states, low mood, sense of loneliness, worry, and anxiousness. Studies have pointed that perceived severity of disease causes anxiousness and depression in individuals (4). This is in line with past studies that found that an individual's negative perceptions about the incident (e.g., risk and threat/severity) were related to more mental health problems during the outbreak of the severe acute respiratory syndrome (SARS) and the Ebola (7, 8). It has been reported that pandemics such as COVID-19 have caused several mental issues such as stress and negative psychiatric illness among individuals. A study conducted in Latin America (Chile) have shown that serious mental health problems are caused by the COVID-19 pandemic (9). Another study has explored that, in South Asia, the long prevalence of this pandemic COVID-19 has created several mental health-related problems (10). However, little is known about the influence of perceived severity of COVID-19 on mental health (11). On February 26, two cases of COVID-19 were confirmed in Pakistan, and according to Daily Situation Report-Pakistan-COVID-19 of May 7, a total of 24,644 cases were reported as positive for COVID-19, from which 6,464 were discharged after recovery, 181 are in critical condition, and 585 have died (Humanitarian Response Pakistan, 2020). It is an alarming state for Pakistan, being an underdeveloped country, with limited medical resources and facilities. With such rapid increase in the rate of suspected cases of COVID-19, there is great expectancy for Pakistani population to perceive the threat and fear regarding the severity of this respiratory disease as serious and significant. As discussed above, since the effect on mental health due to this pandemic is not explored to the best of authors' knowledge, this study sought to measure this effect in the Pakistani population. Furthermore, Pakistan is an Islamic country, where most of the Muslims have strong religious beliefs. They practice religion strictly and keep faith in praying and seeking help from God. In such severe situation, where the number of COVID-19-positive patients is growing each day, having strong faith on the power of the Creator could serve as a resilient factor for individuals. Having strong religious beliefs could serve as the mediator between the perceived severity for pandemic and mental health of individuals. It is a common observation that the Pakistani population tends to utilize the religious paradigm as a protective shield against any worse condition and situation as compared to other external worldviews. Previously, a number of studies have also found that religion plays a significant role in improving mental health problems such as anxiety, depression, stress, and hopelessness (12, 13). Studies have also established the fact that individuals use religion to cope with adversities. People have a firm belief that practicing several religious activities such as prayers, five times a day (Salah), helps them to relieve anxiety and depressive states and keep them hopeful for better outcomes (14, 15). Muslims often turn to their religious beliefs to cope with any loss due to incidents, and according to more recent research, religiosity is related to less depression, less anxiety, and greater well-being. Muslims who accept and hold on to teachings of religion appear to have better mental health (16). So, keeping in view the mentioned studies, this study is designed to bridge the research gap in the literature of perceived severity of COVID-19, effects on mental health, and the role of Muslim religiosity in mediating the relationship between the two. The population of this study consisted of students (young adults) as they are most vulnerable toward the perceived severity/threats of disease and mental health problems nowadays, because of limited life activities due to the lockdown situation in this COVID-19 outbreak, and because they are facing a number of stressors as compared to people of other age groups. Furthermore, the researchers had direct contact with the students, and in this state of adversity, it was crucial to address the mental health of students. So, this study was sought to examine the effect of perceived severity of COVID-19 on the mental health of Pakistani students. Moreover, this study examined the mediating role of Muslim religiosity between perceived severity of COVID-19 and mental health of Pakistani students. This study would be unique in its nature as there is no other literature to date that addresses the psychological and mental health issues regarding COVID-19 in a Pakistani perspective.

MATERIALS AND METHODS

Design and Participants

A cross-sectional research design was employed in which data were collected from students by employing a convenient sampling technique. This sampling technique was chosen because of the emergency state of the COVID-19 pandemic where all the educational institutes were closed. The sample size was justified by utilizing the *a priori* online statistical calculator for structural equation modeling, in which anticipated effect size = 0.1, desired statistical power level = 0.9, latent variable = 2, and observed variable = 1 with 0.05 probability level. The minimum sample size calculated was 1,267 with 20% attrition rate; the sample size estimated for this study was 1,520 (17). We did an online survey through the www.questionstar.com survey website and distributed the survey link to students all over Pakistan through WhatsApp and Facebook groups. The students were from various universities and colleges of all provinces in Pakistan, but our focus was to gather information only about the province from which they belong. For this study, samples from five provinces (Punjab, Sindh, Balochistan, Khyber Pakhtunkhwa, and Gilgit-Baltistan) of Pakistan were taken. The survey questionnaire consisted of information related to research purpose, demographic information sheet, consent form and measurement instruments. A total of 1,645 students accessed the questionnaire link, among which 1,525 students completed the survey and the rest of the questionnaires were omitted because they were incomplete. The frequency distribution of the respondent's demographic characteristics is presented in **Table 1** under *Results* section.

Measurement Instruments

The online survey consisted of a set of questionnaires including consent form, demographic information sheet (age, gender, and province), and three measurement tools whose details are given below.

Risk Behavior Diagnostic Scale

This risk behavior diagnostic scale is used to measure the perceived severity of disease (18). It has three items that can be used to measure the perception of severity associated with any health threat. For this study, perception of COVID-19 health threat was asked from the participants, and items were as follows: (1) I believe that the health threat of COVID-19 is severe, (2) I believe that the health threat of COVID-19 is serious, and (3) I believe that the health threat of COVID-19 is significant. This scale has a five-item response scale from strongly disagree to strongly agree. The Cronbach's alpha = 0.90 for the original scale, and for the current study, the Cronbach's alpha value was 0.80.

Patient Health Questionnaire-4

The PHQ-4 is a four-item inventory rated on a four-point Likert-type scale (19). Its purpose is to allow a very brief measurement of depression and anxiety. According to this measurement instrument, depression is described as feeling down, depressed, hopeless, and little interest in doing things, whereas anxiety is described as feeling nervous, anxious, and not able to control worrying. The Cronbach's alpha for the current study is 0.84.

Muslim Religiosity Personality Inventory

The Islamic worldview subscale of Muslim Religiosity Personality Inventory (MRPI) developed by Krauss and Hamzah (20) was used in this study. This subscale has 23 items with a five-point Likert response format (strongly agree to strongly disagree). For the Islamic Worldview scale, the Cronbach's alpha was 0.86 for original scale, whereas for the internal consistency of this scale, Cronbach's alpha for the current study was 0.81.

TABLE 1 | Prevalence of mental health disorders (depression and anxiety) using PHQ ($N = 1,525$).

Subscales	Categories	*f* (%)
Depression*	Mild	923 (60.5)
	Moderate	515 (33.8)
	Severe	87 (5.7)
Anxiety**	Mild	844 (55.3)
	Moderate	567 (37.2)
	Severe	114 (7.5)

**Depression; feeling down, depressed, hopeless, and little interest in doing things.*
***Anxiety; feeling nervous, anxious, and not able to control worrying.*

Procedures

A proposal for the present study was approved by the institutional research board and research process was started. It was quite feasible for the researchers to collect required data through the online survey form, so a questionnaire was developed on the web consisting of a consent form, a demographic information sheet, and questionnaires chosen for the study after receiving formal permission from the authors of measurement instruments. The respondents were informed that their participation is voluntary and the information they provided will be kept confidential. They were also ensured about the anonymity of their identities. The respondents were aware that they can leave the survey at any time they wished.

Statistical Analysis

We analyzed data in SPSS (24.0) and SmartPLS (3.0). First, descriptive statistics for frequency distribution of demographic variables were obtained. SmartPLS was used to analyze the direct effect of latent variable (perceived severity of COVID-19) and indirect effect through a mediator (Muslim religiosity) on the dependent variable (mental health) through several steps. First, construct reliability was assessed by composite reliability analysis, and Cronbach's alpha value and average variance were estimated. Second, the construct reliability and item validity were determined using a discriminant and convergent validity method following the Fornell and Larcker (21). Third, the structural model was assessed by examining the path coefficients using standardized betas (β), sample mean, standard deviations, and t statistics ($t > 1.96$). Fourth, the mediating effect was used to determine the difference in the results of direct effect and indirect effect with mediating variable. In the fifth step, the value of R^2 was used as an indicator of the overall predictive strength of the model. In the sixth step, the value of f^2 was used as a measure to determine the effect size of predicting variable in the model. Finally, the value of Q^2 was used as a criterion to assess the model's predictive relevance (22).

RESULTS

This section demonstrates the tables defining the values obtained by various statistical tests and brief descriptions of study findings.

Prevalence of Depression and Anxiety Among the Sample

Table 1 demonstrates the prevalence of mild, moderate, and severe levels of depression and anxiety among the students through frequencies and percentages.

Sample Characteristics

In **Table 2**, the baseline characteristics of students are demonstrated with age, gender, and province.

Reliability and Validity Estimate of Constructs

Table 3 depicts the reliability and validity of constructs, as it is clearly seen that Cronbach's alpha of all construct lies in the acceptable range of internal consistency. The values of composite reliability and Cronbach's alpha were >0.8, indicating that the instrument used in this study showed high internal consistency (23, 24). In **Table 4**, the discriminant validity of the constructs has been established through cross-loadings and the Fornell–Larcker criterion method.

Perceived Severity of Disease and Mental Health

Table 5 displays the direct effect of perceived severity of COVID-19 on the mental health of Pakistani students with the correlation value, mean, SD, t-value, p-value, R^2, effect size, and cross-validated redundancy estimates. It can be seen that the path coefficient value $\beta = 0.425$ shows significant positive relationship and direct impact $R^2 = 0.18$ (18% variance) of perceived severity and mental health through the PLS algorithm (**Figure 1**), whereas the significance of path coefficient through $t = 5.904$ at 1% level of significance was obtained through bootstrapping (**Figure 2**). The cross-validated redundancy and relevance of the predicted effect through $Q^2 = 0.113$ value of model were generated from the estimates of blindfolding (**Figure 3**).

Muslim Religiosity as a Mediator

Table 6 mainly focuses on the mediating role of Muslim religiosity between perceived severity of COVID-19 and mental health of Pakistani students with the correlation value, mean, SD,

TABLE 2 | Baseline characteristics of study respondents ($N = 1{,}525$).

Respondent's characteristics		*f* (%)
Age	15–18 years	541 (35.6)
	19–21 years	625 (40.9)
	21 and above	359 (23.5)
Gender	Male	749 (49.1)
	Female	776 (50.9)
Province	Punjab	451 (29.6)
	Sindh	333 (21.8)
	Balochistan	308 (20.2)
	KPK	255 (16.7)
	Gilgit-Baltistan	178 (11.7)

TABLE 3 | Reliability and validity estimates of study variables.

Variables	Average	Cronbach's alpha	Composite reliability
Perceived severity of COVID-19	0.699	0.80	0.82
Mental health	0671	0.84	0.89
Muslim religiosity	0.570	0.81	0.80

TABLE 4 | Discriminant validity according to the Fornell–Larcker criterion.

	Perceived severity	Mental health	Muslim religiosity
Perceived severity	0.670	0.421	0.96
Mental health	–	0.819	–
Muslim religiosity	–	0.703	0.755

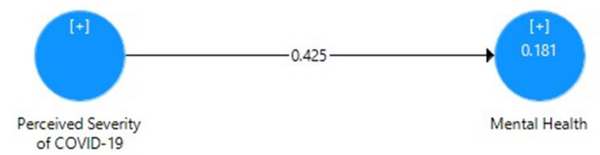

FIGURE 1 | Path coefficient model for direct effect of perceived severity of COVID-19 on mental health.

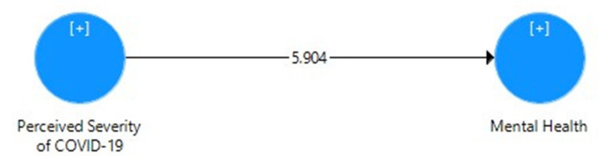

FIGURE 2 | Bootstrapping model for direct effect of perceived severity of COVID-19 on mental health.

FIGURE 3 | Blindfolding value for relevance of direct effect model.

TABLE 5 | Significance of path coefficients for perceived severity of COVID-19 > mental health.

Direct effect of perceived severity of COVID-19 and mental health among Pakistani students ($N = 1{,}525$)									
Relationship	**Path coefficient**	**Mean**	**SD**	***t*-value**	***p*-value**	R^2	**Adj.** R^2	f^2	Q^2
PS > MH	0.425	0.462	0.072	5.904***	0.000	0.181	0.172	0.221	0.113

*PS, Perceived Severity; MH, Mental Health; ***Significance at 1%.*

TABLE 6 | Significance of path coefficients for perceived severity of COVID-19 > Muslim religiosity > mental health.

Indirect effect of perceived severity of COVID-19 on mental health through Muslim religiosity among Pakistani students (N = 1,525)									
Relationship	**Path coefficient**	**Mean**	**SD**	***t*-value**	***p*-value**	R^2	**Adj.** R^2	f^2	Q^2
PS > MH	0.295	0.293	0.095	3.091***	0.002	-	-	-	-
PS > MR	0.196	0.231	0.095	2.067***	0.009	-	-	-	-
MR > MH	0.645	0.648	0.11	5.584***	0.000	-	-	-	-
PS > MR > MH	-	-	-	-	-	0.57	0.56	0.94	0.364

*PS, Perceived Severity; MH, Mental Health; MR, Muslim Religiosity; ***Significance at 1%.*

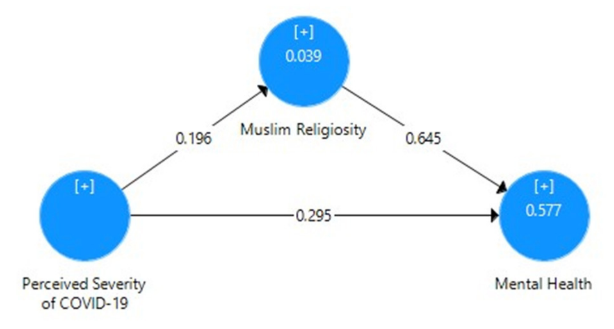

FIGURE 4 | Path coefficient model for the mediating role of Muslim religiosity.

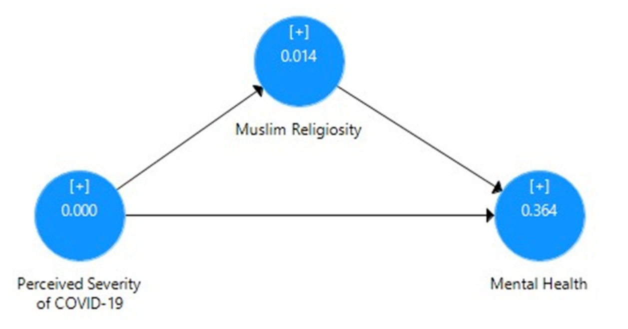

FIGURE 6 | Blindfolding value for the relevance of the mediating model.

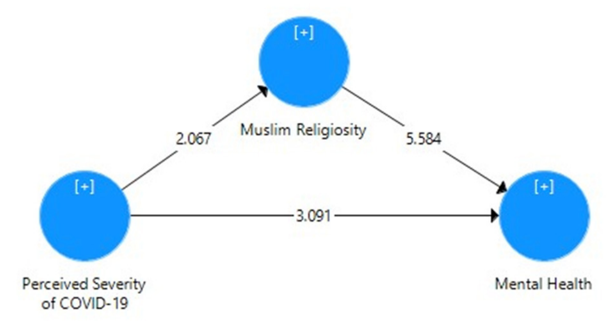

FIGURE 5 | Bootstrapping model for the mediating role of Muslim religiosity.

t-value, *p*-value, R^2, effect size, and cross-validated redundancy estimates. Here, it can be clearly seen that the direct relationship between perceived severity and mental health has been reduced due to the mediating role of Muslim religiosity. As shown in **Figure 4**, the path coefficient for perceived severity and mental health was $\beta = 0.295$, that for perceived severity and Muslim religiosity was $\beta = 0.196$, and that for Muslim religiosity and mental health was $\beta = 0.645$. These path coefficients show a significant positive relationship between these three variables. **Figure 5** also depicts the indirect impact of perceived severity on mental health through Muslim religiosity with $R^2 = 0.577$ (57% variance). Moreover, the significance of path coefficient was determined by *t*-value at 1% level of significance through bootstrapping. $Q^2 = 0.364$ showed the cross-validated redundancy and relevance of predicted mediation, and the estimates of this Q^2 (blindfolding) can be clearly seen in **Figure 6**.

DISCUSSION

COVID-19 (SARS-COV-2) is a virus that can lead toward severe respiratory disease. The vaccine for this virus is still under trial process. There are several other preventive measures suggested apart from the vaccine; for example, it can be controlled through social distance, mask-wearing, and sanitization or self-hygiene. After its rapid growth in more than 174 countries including Pakistan, every individual is concerned about its uncertainties. The severity and seriousness of COVID-19 are perceived by individuals, affecting their mental health. To evaluate this effect on Pakistani students, we used a cross-sectional research design and collected data through already developed questionnaires asking about the perceived severity of the COVID-19 pandemic, mental health, and Muslim religiosity for measuring the mediating role of religiosity in Pakistani students among predictors and predicted variables.

In the study, at first, we hypothesized that there would be a significant positive impact of perceived severity of COVID-19 on mental health of Pakistani students. The findings showed that perceived severity explained variance in mental health and there was a significant positive relationship between perceived severity and mental health of Pakistani students. Therefore, we can conclude that our hypothesis is supported, as the results show that perceived severity is a strong predictor of mental health. Extending the testing of hypothesis in this research, f^2 depicts the test for effect size and Q^2 shows that the predictive relevance of the independent variable (perceived severity of COVID_19) was obtained through bootstrapping and blindfolding procedures, respectively (22). The direction of models and values within the tables helps us to understand how perceived severity of SARS-COV-2 could spread across the Pakistani population and what effects they may have on the mental health of students. The transmission of COVID-19 is itself an anxiety- and depression-inducing indicator, and it can severely affect the overall normal mental functioning. So, here we can conclude that the findings are in line with previous literature that suggested that perceived severity of COVID-19 may impose a significant main effect on mental health (25, 26). We must admit that little is known about the effect of disease severity and risk factors affecting mental health and the literature in this regard is scarce. However, the relationship established in this study between the perceived severity of disease and mental health of students can however the concerns toward other subsiding factors of health too.

Furthermore, we also hypothesized in this research that there would be a significant mediating role of Muslim religiosity between perceived severity of COVID-19 and mental health among Pakistani students. The mediation analysis shown in **Table 5** shows that the perceived severity and inclusion of Muslim religiosity explains 57% of variance in mental health, indicating that the mediating variable provides moderate support for the model (27). It can be compared with the direct effect of perceived severity on mental health with 18% of variance as discussed in the outcomes of hypothesis. The hypothesis testing further shows that the relationship between perceived severity and Muslim religiosity was significantly correlated with mental health ($\beta = 0.425$, $t = 5.904$). This supports our hypothesis, and these results confirm that Muslim religiosity acts as a significant mediating variable in the relationship between perceived risk of contracting infectious disease and mental health of Pakistani students examined in this study. The findings of mediation analysis establish the notion in literature that Muslim religiosity is a significant mediator between the perceived severity of acquiring an infectious disease (i.e., COVID-19) and mental health. We can relate these findings to the previous studies, which exhibited a strong relationship between the religiosity and mental health of individuals (16, 28) and religious practices prevent individuals from mental health problems like depression, anxiety, and hopelessness (14, 29). Although much is unknown in the literature about the indirect link of disease severity on mental health through religiosity, our study has provided some support to conclude that for the Pakistani Muslim population, the significance of Muslim preaching and theological doctrines can help provide a protective shield to its followers against any state of adversity and uncertainty. We arrived at the finding that individuals who have a higher level of Muslim religiosity depicted a lower level of mental health issues and lower perceived severity of disease (COVID-19).

CONCLUSION

In conclusion, our study shows that Islamic religiosity is a strong coping mechanism for Muslims against anxiety or depression The COVID-19 pandemic and its severity are affecting the mental health of individuals.

Future Avenues of Study

Considering the emergency situation involving COVID-19 in Pakistan, we designed this study to address the possible psychological impacts in general and mental health issues in particular among the young Pakistani population. The findings of our study could help to bridge the gap regarding the psychological risk factors of COVID-19 in the existing body of knowledge. There should be further rigorous scientific investigations into aspects of religious practice that help preserve mental health in the face of adversity and the vicissitudes of life. It is also suggested to replicate the study among frontline medical workers such as doctors and allied medical staff.

Limitations and Strengths of the Study

Being a startup research for COVID-19, there are several limitations of this study; being an initial study, the evidence for literature support was not adequate. Since COVID-19 is spreading in many countries and is considered an urgent emergency for public health, we expect to extend and improve our study taking data from other countries and improving the findings of our study. However, the results of this study can serve as preliminary evidence for future research. Furthermore, this study also holds a strength of including multi-centered data collection and a large sample size.

Implications of the Study

Muslim religiosity plays an important part not only in improving the mental health of Pakistani students but also in the association between perceived severity of COVID-19 (SARS-COV-2) and the mental health of students. The findings contribute substantially to the understanding and management of mental health in Pakistan. In order to reduce the adverse effect of the prevailing COVID-19 pandemic on mental health, the policymakers and media in the country can appeal to the religious belief system of Pakistani people. The study also offers an initial platform for further research into exploring the social and cultural values of a society to combat such devastating situations.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Departmental Research Committee from the Department of Applied Psychology-Bahawalnagar Campus-The Islamia University of Bahawalpur. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

MS conceived the study and finalized the manuscript. AB did data collection and manuscript reviewing. AD did statistical analyses and manuscript writing. ZM did literature review. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

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Post-Traumatic Growth of Nurses Who Faced the COVID-19 Epidemic and Its Correlation With Professional Self-Identity and Social Support

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Objective: To investigate post-traumatic growth (PTG) and analyze its correlation with professional self-identity and social support in Chinese nurses who faced the coronavirus disease 2019 (COVID-19) epidemic.

Methods: A cross-sectional descriptive design was used in this study. An online questionnaire was completed by 266 nurses who faced the COVID-19 emergency in Hubei Province, China. The Post-traumatic Growth Inventory (PTGI), Professional Self-identity Scale, and Perceived Social Support Scale were used to assess the level of PTG, professional self-identity, and social support. Descriptive, univariate analysis and multiple regression analyses were used in exploring related influencing factors.

Results: Participants' mean scores were 96.26 (SD = 21.57) for PTG, 115.30 (SD = 20.82) for professional self-identification, and 66.27 (SD = 12.90) for social support. Multiple regression analysis showed that nurses from other provinces moving to support Hubei Province, professional self-identity, and social support were the main factors affecting nurse stress (p = 0.014, <0.001, and 0.017, respectively). Professional self-identity and social support were positively correlated with PTG (r = 0.720 and 0.620, respectively).

Conclusions: There was a phenomenon of PTG when the nurses faced COVID-19 in Hubei Province. Providing an active coping style helps to improve the level of PTG.

Keywords: COVID-19, nurses, professional self-identity, social support, Hubei, cross-sectional survey, post-traumatic growth

INTRODUCTION

The current pandemic is caused by a novel coronavirus that has been dubbed COVID-19 (1). On January 30, 2020, the World Health Organization (WHO) declared the COVID-19 outbreak a global health emergency (2). As the epidemic spread around the world, on March 11, 2020, the WHO officially classified COVID-19 as a pandemic (3).

"Nurses are the backbone of any health system. Today, many nurses find themselves on the frontline in the battle against COVID-19," said Dr. Tedros Adhanom Ghebreyesus (4). A total of 28,600 nurses had sent to Hubei Province to fight against the COVID-19 epidemic in China (5).

Nurses on the frontline in this event are showing commitment and compassion, but they are putting their lives at risk in the course of their duties (6). The COVID-19 outbreak has been even more devastating. More than 3,000 medical workers in China were infected (7), over 8,000 in Italy (8), and over 19,000 in Spain (9). The unfolding emergency caused by COVID-19 is putting nursing services under intense pressure.

A systematic review concluded that high prevalence of post-traumatic stress symptoms was related to the COVID-19 pandemic among healthcare workers and summarized potential predictors, such as young age, female, and lack of social support (10). Distressing or harmful events can result in negative outcomes, such as post-traumatic stress disorder (PTSD) symptoms (11), but they can also lead to positive post-trauma changes, experiences termed post-traumatic growth (PTG). PTG, first proposed by Tedeschi and Calhoun in 1996 (12), is defined as a significant positive change in an individual's life as a consequence of exposure to a challenging or traumatic event. According to Tedeschi and Calhoun's theory, social support, as a positive external resource, could facilitate PTG. However, whether the positive relationship between social support and PTG in persons who have experienced trauma directly should be investigated further.

Nurses have always played an important role in public health (13). Maintaining the mental health of nursing staff is essential to controlling infectious diseases (14, 15). Certain investigations have focused on post-traumatic growth in nurses in China, but mainly on the analysis of influencing factors. This study aimed to explore the level of PTG among frontline nurses and analyzed its correlations with professional self-identity and social support. On the basis of Tedeschi and Calhoun's model of PTG, we hypothesized that the phenomenon of PTG among frontline nurses existed and was correlated with professional self-identity and social support.

MATERIALS AND METHODS

Study Design

The study design used a descriptive cross-sectional survey. Data were collected from February 1, 2020 to April 30, 2020.

Participants and Sampling

Nurses who faced the COVID-19 epidemic in Hubei Province were selected for the survey. The inclusion criteria were as follows: licensed nurses, nurses who were working against COVID-19, those without other traumatic events (e.g., sudden deaths of immediate family members and traffic accidents) in the past 6 months, and those who volunteered to participate in this study. A total of 270 frontline nurses completed the questionnaire, and 266 respondents provided usable data.

The study involving human participants were reviewed and approved by the Ethics Committee of the Second affiliated hospital of Guangxi Medical University (No. 2020-KY0005). All subjects had signed an informed consent before the study was initiated. To protect the respondents' privacy, the survey was conducted anonymously.

Measurement Tools

Basic Information Survey Form

A questionnaire was developed to collect basic information, including gender, age, nursing experience, marital status, children, education, staff title, specialty, whether working locally, current working place, patient's disease severity, whether volunteered to participate in support work, whether regretted participating in the support work, support duration, and working hours per day.

Assessment of Post-Traumatic Growth

The Post-traumatic Growth Inventory (PTGI) developed by Tedeschi and Calhoun is currently widely used to evaluate post-traumatic growth (12). The scale consists of five major domains: relating to others, new possibilities, personal strength, spiritual change, and appreciation of life. A total of 21 entries use a six-point scoring method, with the total score in the range of 0–105 points. In this study, the Cronbach's alpha coefficient for the total PTGI was 0.972. The subscales' alpha coefficients were as follows: Relating to Others = 0.789, New Possibilities = 0.856, Personal Strength = 0.944, Spiritual Change = 0.897, and Appreciation of Life = 0.943.

Assessment of Professional Self-Identity

A nurse professional self-identity scale was developed by professor Liu (16). The scale consists of five dimensions: professional cognitive, professional social support, professional social skills, coping with setbacks, and professional self-reflection, with 30 entries using a five-point scoring method, with the total score in the range of 30–150 points. The higher the score, the greater the professional self-identity. The Cronbach's α value is 0.938.

Assessment of Social Support

Zimet et al. developed the Perceived Social Support Scale (17), and Jiang introduced it to China and conducted cultural commissioning (18). The Chinese version of the Perceived Social Support Scale has good reliability and validity. The scale consists of two dimensions: in-family support (four entries) and out-of-family support (eight entries), with 12 entries using a seven-point scoring method, with the total score in the range of 12–84 points. The scores of social support were analyzed as follows: low level 12–28, moderate level 29–57, and high level 58–84. The higher the score, the greater the pressure load. The Cronbach's α value was 0.936.

Data Collection

Online survey (via a questionnaire website platform) was sent to the nurse managers in Hubei Province who worked against COVID-19. The managers were asked to forward the survey to nurses. Participants could complete the questionnaire via a computer or mobile phone, which can open a web link or scan a Quick Response code.

Data Analysis

Data analysis was performed with IBM SPSS Statistics for Windows (version 21.0, IBM Corp., Armonk, NY, USA), with two-tailed $p < 0.05$ considered statistically significant.

TABLE 1 | Basic information survey form ($N = 266$).

Variables	*n* (100%)
Gender	
Male	24 (9.02%)
Female	242 (90.98%)
Marital statuses	
Married	145 (54.51%)
Unmarried	119 (44.74%)
Divorced or others	2 (0.75%)
Children	
Yes	136 (51.13%)
No	130 (48.87%)
Education	
Junior college or below	55 (20.67%)
Undergraduate	205 (77.07%)
Master	6 (2.26%)
Staff title	
Junior	147 (55.26%)
Middle	93 (34.96%)
Sub-senior	26 (9.78%)
Senior	0 (0.00%)
Specialty	
Department of Respiration	39 (14.66%)
Department of Infectious disease	27 (10.15%)
Department of Emergency	54 (20.30%)
Intensive Care Unit	60 (22.56%)
Others	54 (20.30%)
Whether nurses were from other provinces to support Hubei Province	
Yes	214 (80.45%)
No	52 (19.55%)
Current working place	
Temporary treatment centers	115 (43.23%)
Designated hospitals	151 (56.77%)
Patient's disease status of care	
Suspected	53 (19.92%)
Mild	38 (14.29%)
Common	73 (27.44%)
Severe	65 (24.44%)
Critically ill	37 (13.91%)
Volunteered to participate in the support work	
Yes	266 (100.00%)
No	0 (0.00%)
Regret to participate in the support work	
Yes	0 (0.00%)
No	266 (100.00%)

Descriptive statistical methods were used to describe the basic characteristics and to assess the level of PTG, professional self-identity, and social support among the participants. Counting data were expressed as frequency and percentage, and the measurement data were expressed as $\bar{x} \pm$ s. Two independent samples t-test was used for comparison between two groups and one-way ANOVA was used for comparison between multiple groups. Taking the score of PTGI as the dependent variable and all the other indicators as the independent variables, univariate analysis and multiple regression analysis were performed to identify the main influencing factors of clinical frontline nurses' PTG. Data with a value of $p < 0.05$ were considered statistically significant. Pearson correlation analysis was used to explore the correlation between nurses' PTG, professional self-identity, and social support.

TABLE 2 | Scores of PTG, Professional Self-identity, and Social Support ($N = 266$).

Items	Mean (SD)
PTG	96.26 (21.57)
Relating to others	31.75 (7.41)
New possibilities	22.01 (5.58)
Personal strength	18.87 (4.48)
Spiritual change	9.48 (2.22)
Appreciation of life	14.08 (3.29)
Professional self-identity	115.30 (20.82)
Professional cognitive	34.08 (6.99)
Professional social support	23.82 (4.07)
Professional social skills	21.99 (4.71)
Coping with setbacks	23.66 (3.97)
Professional self-reflection	11.76 (2.15)
Social support	66.27 (12.90)
In-family support	22.24 (4.89)
Out-of-family support	44.04 (8.61)

RESULTS

The participants consisted of 266 nurses, the average age of the respondents was 32.34 (SD = 6.01) years, the average length of nursing experience was 11.35 (SD = 3.60) years, the average supporting day was 48.36 (SD = 12.70) days, and the average working hours per day was 5.91 (SD = 1.25) h. More basic information is shown in **Table 1**.

The participants' mean score for PTG was 96.26 (SD = 21.57). The subscales' mean score of PTG was as follows: Relating to Others = 31.75 (SD = 7.41), New Possibilities = 22.01 (SD = 5.58), Personal Strength = 18.87 (SD = 4.48), Spiritual Change = 9.48 (SD = 2.22), and Appreciation of Life = 14.08 (SD = 3.29). The participants' mean score for professional self-identity was 115.30 (SD = 20.82). The participants' mean score for social support was 66.27 (SD = 12.90). The scores of each dimension are shown in **Table 2**.

Univariate analysis of the PTG of frontline nurses showed that different education profiles, marital statuses, fertility statuses, whether nurses were from other provinces to support Hubei Province, and working hours per day affected nurses' PTG ($p < 0.05$), as follows (**Table 3**).

To determine the best predictors of PTG, multiple regression analysis was conducted. When the PTG was used as a dependent variable, the single factor analysis of the PTG was

TABLE 3 | Univariate analysis of the PTG of nurses (x ± s, $N = 266$).

Items	Classification	*n* (%)	PTG (Mean ± SD)	Statistics	*p*
Education	Junior college or below	55 (20.68)	94.41 ± 20.25	$F = 2.727$	0.045
	Undergraduate	205 (77.07)	96.77 ± 21.75		
	Master	6 (2.26)	104.83 ± 16.27		
Marriage	Unmarried	119 (44.74)	92.38 ± 22.82	$F = 5.695$	0.004
	Married	145 (54.51)	99.82 ± 19.84		
	Divorce or others	2 (0.75)	69.00 ± 3.53		
Children	Yes	130 (48.87)	92.51 ± 22.97	$t = 7.893$	0.005
	No	136 (51.13)	99.85 ± 19.55		
Whether nurses were from other provinces to support Hubei Province	Yes	214 (80.45)	93.89 ± 22.64	$t = 13.820$	0.001
	No	52 (19.55)	106.00 ± 12.53		
Working hours per day	<6 h	130 (48.87)	92.51 ± 22.97	$F = 4.220$	0.016
	6–8 h	116 (43.61)	100.41 ± 18.08		
	>8 h	20 (7.52)	96.55 ± 26.94		

Only statistically significant results are listed.

TABLE 4 | Multiple-factor analysis of PTG on nurses (x ± s, $N = 266$).

Dependent variable	Regression coefficient	SE	Standardized regression coefficient	*t*-value	*p*-Value
Constant	7.727	8.376		0.922	0.357
Whether nurses were from other provinces to support Hubei Province	5.781	2.334	0.107	2.477	0.014
Professional self-identity	0.589	0.077	0.569	7.635	0.000
Social support	0.299	0.124	0.179	2.412	0.017

$R^2 = 0.546$, adjusted $R^2 = 0.533$, $F = 44.255$, $p < 0.001$.

statistically significant in education (junior college or below = 1, undergraduate = 2, master = 3), marital status (married = 1, unmarried = 2, divorced or widowed = 3), children (yes = 1, no = 2), whether nurses moved from other provinces to support Hubei Province (yes = 1, no = 2), working hours per day (6 h = 1, >6 h and 8 h = 2, >8 h = 3). The total scores of professional self-identity and social support (substituting the actual value) were independent variables for multiple linear regression analysis. The results showed that whether nurses moved from other provinces to support Hubei Province, professional self-identity, and social support were the main factors influencing the PTG of nurses assisting in the fight against COVID-19, possibly explaining 53.3% of the total variation, as follows (**Table 4**).

According to Pearson's correlation analysis, the professional self-identity, and social support were positively correlated with PTG (the *r* values were 0.720, 0.620). The correlations of each dimension were as follows (**Table 5**).

DISCUSSION

In our study, the total PTG score among frontline nurses was 96.26 (SD = 21.57), which was at a high level. The results of this study are higher than those of other domestic scholars on post-traumatic growth of frontline nurses during the COVID-19 pandemic. The total PTG score of Cui's study (19) was 70.53 (SD = 17.26), Zhang's study (20) was 67.17 (SD = 14.79), and Li's study (21) was 70.40 (SD = 22.17). In the subscale of PTG, except for the scale of "Appreciation of Life," the mean values of the other four scales were all higher than those of other scholars. This may be due to differences in the basic information of the participants. Nurses are more likely to develop PTSD than the general population because they are exposed to the frontlines of a disaster, and they are exposed to a stressful working environment and overwork (22). Furthermore, taking care of patients during the COVID-19 outbreak is a new challenge. COVID-19 patients die every day, possibly causing psychological shock and PTSD in nurses (23). Li et al. found that COVID-19 first responders had significantly higher PTSD scores than in healthcare workers who struggled with SARS in Zhang and Yang's survey (24–26). Meta-analysis provides evidence that PTG positively correlated with PTSD symptoms (27, 28). From this, we can preliminarily speculate that COVID-19 has had a significant post-traumatic growth for nurses working on the frontline.

Multiple regression analysis revealed that professional self-identity, social support, and whether nurses moved from other provinces to support Hubei Province were significant predictors of PTG. Notably, 214 (80.45%) nurses moved from

TABLE 5 | Correlation analysis of PTG with professional self-identity and social support ($N = 266$).

	Professional self-identity	Social support
PTG	0.720[a]	0.652[a]

[a]$p < 0.05$.

all over China to support Hubei Province. In addition to China, the United States (29) and Peru (30) also called on nurses to join the fight against the epidemic and support the worst-affected areas. Medical workers faced cross-cultural adaptation problems, which were manifested in psychological and physiological adjustments in diet, living environment, and new working environment (31). Nurses not only take care of patients at risk of infection but also need to overcome cultural differences. Social and cultural maladjustment was a challenge for aid nurses (32). Previous studies have shown that highly challenging life events, circumstances, major life crises, trauma, and other extremely stressful events provoke an ability to cope with adversity, heighten self-discipline, and raise appreciation for life, bringing forth significant positive changes (33–36). Thus, cultural differences may be the reason for higher PTG scores in aid nurses. Research suggests that standardized multicultural nursing knowledge and skills training can improve the multicultural nursing ability of nurses (37). Good communication and psychological development between old and new team members can also help aid nurses understand the local situation and prepare for it, improving their ability of cross-cultural adaptation.

This study indicated that the professional self-identity of aid nurses was at the medium level (MD = 115.30, SD = 20.82 points). A significant positive correlation was found between nurses' professional identity and PTG (the *r* values were 0.720), that is, nurses with a high level of professional identity obtain high PTG, were highly likely to realize the value of their work, and gain a considerable sense of accomplishment from participating in COVID-19 epidemic treatment. Gibbons et al. found that job satisfaction and feeling valued in one's professional role were significant predictors of PTG in healthcare providers (38). Thus, our conclusions are consistent. All the nurses in this study volunteered to fight against the epidemic and did not regret this decision. Aylward noted that Chinese medical workers in the fight against the COVID-19 epidemic have a sense of responsibility and collective action; they all had a mindset of fighting to complete the task (39).

It was found that there was a significant positive correlation between nurses' social support and PTG (the *r* values were 0.620), indicating that nurses with high level of social support could obtain high PTG. Our findings indicated that social support should be a predictor of post-traumatic growth, consistent with other studies. Social support and empathy (40), cumulative exposure to traumatized patients (41), therapists' bonds with their patients (42), and professional self-esteem and secondary traumatization (43) have been identified as significant predictors of PTG in healthcare providers. Attachment theorists had suggested that viewing others favorably had profound influences on social relations (44). Social support is an important protective factor for psychological resilience that maintains mental health and lifts psychological barriers (45). Given the high infectivity of COVID-19, to reduce cross-infection, nurses need to stay alone in a single room when they finish working. They may feel loneliness and helplessness. Thus, efforts to improve social support systems of nurses who work against COVID-19 are necessary.

Several limitations should be considered. Firstly, this survey only investigated the nurses who were fighting against COVID-19 in Hubei Province without data from nurses from other provinces. Secondly, as a cross-sectional design, this study could only evaluate PTG at a specific time without longitudinal observation of the subjects. Thirdly, due to time constraints, we only conducted a questionnaire survey and not an intervention. Fourthly, this study did not assess personality traits involved in PTG and professional identity.

CONCLUSIONS

PTG in the nurses who faced COVID-19 was found to be at an above-average level. Nurses from other provinces moving to support Hubei Province, professional self-identity, and social support were important influencing factors. Nurse leaders should pay attention to PTG and the influencing factors of nurses and offer solutions to retain mental health among these nurses.

DATA AVAILABILITY STATEMENT

The dataset compiled for this study is available upon reasonable request to the corresponding authors.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee of The Second Affiliated Hospital of Guangxi Medical University (No. 2020-KY0005). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

HH and RL conceived and designed this study. YM and PT created and performed the literature search strategy. LC and GLiu built the data extraction file. SL and GZ conducted the data extraction. GLi and YM gathered the results. All authors contributed extensively to this work, interpreted the data and contributed substantially to the writing and revision of the manuscript, and read and approved the final manuscript.

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