UNCERTAINTY INDUCED EMOTIONAL DISORDERS DURING THE COVID-19

EDITED BY: Fushun Wang, Fang Pan, Yi-Yuan Tang and Jason H. Huang
PUBLISHED IN: Frontiers in Psychology

frontiers Research Topics

frontiers

ISSN 1664-8714
ISBN 978-2-88976-683-3
DOI 10.3389/978-2-88976-683-3

About Frontiers

Frontiers is more than just an open-access publisher of scholarly articles: it is a pioneering approach to the world of academia, radically improving the way scholarly research is managed. The grand vision of Frontiers is a world where all people have an equal opportunity to seek, share and generate knowledge. Frontiers provides immediate and permanent online open access to all its publications, but this alone is not enough to realize our grand goals.

Frontiers Journal Series

The Frontiers Journal Series is a multi-tier and interdisciplinary set of open-access, online journals, promising a paradigm shift from the current review, selection and dissemination processes in academic publishing. All Frontiers journals are driven by researchers for researchers; therefore, they constitute a service to the scholarly community. At the same time, the Frontiers Journal Series operates on a revolutionary invention, the tiered publishing system, initially addressing specific communities of scholars, and gradually climbing up to broader public understanding, thus serving the interests of the lay society, too.

Dedication to Quality

Each Frontiers article is a landmark of the highest quality, thanks to genuinely collaborative interactions between authors and review editors, who include some of the world's best academicians. Research must be certified by peers before entering a stream of knowledge that may eventually reach the public - and shape society; therefore, Frontiers only applies the most rigorous and unbiased reviews.
Frontiers revolutionizes research publishing by freely delivering the most outstanding research, evaluated with no bias from both the academic and social point of view. By applying the most advanced information technologies, Frontiers is catapulting scholarly publishing into a new generation.

What are Frontiers Research Topics?

Frontiers Research Topics are very popular trademarks of the Frontiers Journals Series: they are collections of at least ten articles, all centered on a particular subject. With their unique mix of varied contributions from Original Research to Review Articles, Frontiers Research Topics unify the most influential researchers, the latest key findings and historical advances in a hot research area! Find out more on how to host your own Frontiers Research Topic or contribute to one as an author by contacting the Frontiers Editorial Office: frontiersin.org/about/contact

UNCERTAINTY INDUCED EMOTIONAL DISORDERS DURING THE COVID-19

Topic Editors:
Fushun Wang, Nanjing University of Chinese Medicine, China
Fang Pan, Shandong University, China
Yi-Yuan Tang, Arizona State University, United States
Jason H. Huang, Baylor Scott and White Health, United States

Citation: Wang, F., Pan, F., Tang, Y.-Y., Huang, J. H., eds. (2022). Uncertainty Induced Emotional Disorders During the COVID-19. Lausanne: Frontiers Media SA. doi: 10.3389/978-2-88976-683-3

Table of Contents

frontiers | Frontiers in Psychology

EDITORIAL
published: 05 July 2022
doi: 10.3389/fpsyg.2022.943966

Editorial: Uncertainty Induced Emotional Disorders During the COVID-19

Fushun Wang[1]*, *Fang Pan*[2], *Yi-Yuan Tang*[3] and *Jason H. Huang*[4,5]

[1] Institute of Brain and Psychological Science, Sichuan Normal University, Chengdu, China, [2] Department of Medical Psychology, Shandong University Medical School, Jinan, China, [3] Department of Psychological Sciences, Texas Tech University, Lubbock, TX, United States, [4] Department of Neurosurgery, Baylor Scott & White Health, Temple, TX, United States, [5] Department of Surgery, Texas A&M University College of Medicine, Temple, TX, United States

Keywords: uncertainty, basic emotions, core affect, arousal, emotional disorder, COVID-19 editorial, uncertainty induced emotional disorders

Editorial on the Research Topic

Uncertainty Induced Emotional Disorders During the COVID-19

The globally devastating COVID-19 was unexpected for most of us. The unexpected high contagion and death rate have impaired the social lives of people all around the world, making many people panicked, anxious, and stressful (Aqeel et al., 2022). The urgent social restriction and nucleic acid testing added further psychological stress. It is reported that more than 30% of people around the world suffer from mental health problems (Levine et al., 2022). The major reason for these psychological problems is due to the uncertainty about COVID-19, for we don't know the death rate of the disease, nor the possibility of getting infected by the disease. In addition, the long-term social restriction further makes people lack information about the conditions of the disease (Daly and Robinson, 2022). In order to resolve these problems, timely knowledge and information, as well as psychological supports, are needed.

Researchers proposed that uncertainty is an important cognitive mechanism for arousal and emotion, and it's also an important cause of various mental disorders such as anxiety and depression (Berchicci et al., 2015). Normally we are calm, but we are aroused if something unexpected happens. The world is full of stimulations, most of which are expected. However, unexpected thing continually occur, for example, we are not sure whether it will rain tomorrow, and the weather forecasts often report that there is an 80% chance of rain. Behavioral economics proposes that most of our thinking is subjected to uncertainty, and most of our choices are not the result of careful deliberations, but result from poor predictors of future behavior, distorted memory, and are affected by our physiological and emotional states (Gu et al., 2021).

Uncertainty plays a very important role in inducing emotions in everyday life, especially for those with affective disorders, and numerous researchers have investigated the power of uncertainty (Gu et al., 2016). For example, the dimensional theory suggested that the external stimulations (and the emotions they induced) have two properties:1) hedonic value, which represents whether they fit into our physiological needs; 2) safety value, which represents whether they happen as expected (Zheng et al., 2016). The hedonic value depends on whether the stimulation fits into our needs: if yes, we will be happy; if not, we will be sad. The safety value depends on whether the stimulations happen as expected: if yes, we are calm; if the stimulations is un-expected, we will be aroused (Zheng et al., 2016). Hedonic value and arousal are two core effects of human emotions (Hutto et al., 2018), which form the two dimensions for the constructive model of emotions (dimensional theory) (**Figure 1**).

OPEN ACCESS

Edited and reviewed by:
Francisco Sampaio, Fernando Pessoa University, Portugal

***Correspondence:**
Fushun Wang
13814541138@163.com

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *14 May 2022*
Accepted: *27 May 2022*
Published: *05 July 2022*

Citation:
Wang F, Pan F, Tang Y-Y and Huang JH (2022) Editorial: Uncertainty Induced Emotional Disorders During the COVID-19. Front. Psychol. 13:943966. doi: 10.3389/fpsyg.2022.943966

FIGURE 1 | Integrative approach for emotional dimensions and basic emotions. The integrative approach for Basic emotion theory and dimensional theory proposes that the reason that "basic emotions" are "basic" is that the basic emotions are located on the axis of the circumplex (Posner et al., 2009). It means that each "basic emotion" is a special emotion that represents one feature of emotion as a whole, named core affect (arousal or hedonic value) (Wilson-Mendenhall et al., 2013): fear and anger represent the arousal value; while sadness and joy represent the hedonic value, which is related to the hedonic values of the stimulus. Put it another way, "pure" fear and anger are not related to hedonic values; "pure" sad and joy are not related to safety values (modified from previous publications). Please refer to Gu et al. (2019a).

Alternatively, another popular emotional theory proposed that there existed a limited number of emotions, which might include anger, disgust, joy, fear, and sad (Ekman, 1992). However, an integrative approach suggested that the basic emotional theory and dimensional theory are not in conflict with each other, instead, they can be integrated (Panksepp, 2007; Gu et al., 2019a). This integrative theory suggested that basic emotions can also find their locations on the dimensions, like all other emotions. The only specialty for the basic emotions is that they are located on the poles of the dimensions (**Figure 1**), and they represent different features of emotions. They can also be called core affects, or prototypical emotions. We also suggested that they are subsided by three monoamine neurotransmitters: dopamine-joy, norepinephrine-fear (anger), and 5-HT-disgust (sadness) (Liang et al., 2021). This theory can be called three primary basic emotion theory (Gu et al., 2019b).

Even though there are two major prevalent theories about emotions, both of which agree upon the idea that emotional arousal depends on the un-expectancy of the simulation (Xu et al., 2022). However, it is still not clear how to treat COVID-19-induced psychological problems. So we proposed a topic to collect recent studies about the mental health problems related to the pandemic, including but not limited to review and experimental studies to help people understand COVID-19 induced mental disorders. And in the last year, we have received 39 submissions, and 30 were accepted after peer reviewing.

In the experimental report titled "*Predicting the Severity of Symptoms of the COVID Stress Syndrome From Personality Traits: A Prospective Network Analysis,*" Taylor et al. recruited 1976 participants from US and Canadian adults, and found that intolerance of uncertainty is a personality trait that is related to negative emotion during COVID-19.

In the paper titled "*Mental Health in COVID-19 Pandemic: A Meta-Review of Prevalence Meta-Analyses,*" Sousa Junior et al. presented a meta-review of studies about the mental problems, including depression, anxiety, stress problems, etc, and they found that the rate of mental health problems ranged from 20-36%, which is higher than most expected.

In Musetti et al.'s paper, titled "*Maladaptive Daydreaming in an Adult Italian Population During the COVID-19 Lockdown,*" the authors recruited 6,277 Italian adults and investigated their mental health problems, including negative stress, anxiety and depression, and compulsive fantasy activities, and found that social restriction might exert additional stresses for these problems.

In the paper titled "*The Prevalence of Psychological Status During the COVID-19 Epidemic in China: A Systemic Review and Meta-Analysis,*" Li, Zhang et al. did a meta-analysis of 67 papers, and they found that fear and stress symptoms are common, and anxiety and depression were also prevalent among the public.

In Di Trani et al.'s paper "*From Resilience to Burnout in Healthcare Workers During the COVID-19 Emergency: The Role of the Ability to Tolerate Uncertainty*," the authors investigated the mental health problems of medical staff in Italy, and the found that tolerance of uncertainty might be the major reason for the mental health problems emergent in COVID-19.

In the paper titled "*A 6-Month Follow-Up Study on Worry and Its impact on Well-Being During the First Wave of COVID-19 Pandemic in an Italian Sample*," the author Ongaro et al. also investigated the health problems of the Italian people, and they found that mental health policymakers should make some policy to spread the information of the virus contagions, as well as making a longitudinal evaluation about its effects.

In the paper "*Gender Differences in Anxiety, Depression, and Nursing Needs Among Isolated Coronavirus Disease 2019 Patients,*" Li, Li et al. investigated the gender differences in anxiety and depression during COVID-19, and they found that men become more easily worried and stressed at the pandemic compared with their female colleagues.

However, in another study by Song et al., titled "*Psychological Resilience as a Protective Factor for Depression and Anxiety Among the Public During the Outbreak of COVID-19*," the author did a thorough investigation on the mental status of 3,180 subjects, and they found that women weremore easily stressed, in addition to younger and less educated people.

Similarly, in Nia et al.'s paper, "*Predictors of Persistence of Anxiety, Hyper-Arousal Stress, and Resilience During COVID-19 Epidemic: A National Study in Iran,*" the authors assessed anxiety, hyper-arousal stress, and psychological resilience in the people of Iran, and they also found that young, female, and less educated people experienced more stress.

In Yan et al.'s paper titled "*Mental Health of Pregnant and Postpartum Women During the Coronavirus Disease 2019 Pandemic: A Systematic Review and Meta-Analysis,*" the authors did an investigation on mothers, fetuses, and children, and

they found that the prevalence rates were much higher than normal populations.

In the paper titled "*Comorbid Anxiety and Depression and Related Factors Among Pregnant and Postpartum Chinese Women During the COVID-19 Pandemic,*" the authors Luo, Xue et al. also reported that the economically poor, pregnant and postpartum Chinese women more easily encountered mental stresses during COVID-19.

In Li, Liang et al.'s paper, titled "*Social Support, Attachment Closeness, and Self-Esteem Affect Depression in International Students in China,*" the authors investigated the psychological conditions of students from abroad and found that their problems were even worse.

In the paper titled "*Association of Stress-Related Factors With Anxiety Among Chinese Pregnant Participants in an Online Crisis Intervention During COVID-19 Epidemic,*" Shangguan, Wang et al. investigated anxiety problems in pregnant women and suggested it is critically important to continually check on fetal development during COVID-19.

In the paper titled "*Perceived Stress, Resilience, and Anxiety among Pregnant Chinese Women during the COVID-19 Pandemic: Latent Profile Analysis and Mediation Analysis*," the authors Luo, Shen et al. also tried to introduce some ways to prevent stress for pregnant women during the pandemic and suggested that psychological intervention to reduce stress is a good way to alleviate the psychological problems.

In the paper titled "*Prevalence of Risk Factors Associated With Mental Health Symptoms Among Outpatient Psychiatric Patients and Their Family Members in China During the Coronavirus Disease 2019 Pandemic,*" Qiu et al. investigated the mental health problems of outpatients and found their worries are even more serious, because of economics and nursing burdens.

In the paper "*A Conditional Process Model to Explain Somatization During COVID-19 Epidemic: The Interaction Among Resilience, Perceived Stress and Gender,*" Shanguan, Zhou et al. reported another study to probe into the mechanisms for mental health problems and suggested that psychological resilience is a key predictor of somatization as well as mental problems.

In the paper titled "*Distress, Appraisal, Coping Among the Frontline Healthcare Provider Redeployed to the Epicenter in China During COVID-19 Pandemic,*" the author Ji et al. evaluated the mental health problems of the medical staff on the frontline in treating the COVID-19 patients and suggested that they are incredibly highly stressed and need more social support.

In the paper titled "*Depression, Anxiety, and Suicidal Ideation in Chinese University Students During the COVID-19 Pandemic*," the author Zhou et al. investigated 11,133 subjects about their anxiety, depression, and suicidal ideation, and found that social support, good education, and being kept well informed are good ways in reducing suicidal ideation.

In the paper titled "*The Stress and Anxiety to Viral Epidemics-6 Items (SAVE-6) Scale: A New Instrument for Assessing the General Population's Anxiety Response to the Viral Epidemic During the COVID-19 Pandemic,*" the author Chung et al. invented a kind of questionnaire, the Stress, and Anxiety to Viral Epidemics-6 items (SAVE-6) scale, and they explored the validity and usefulness of the questionnaire for measuring the general population's anxiety response among 1,009 respondents.

In "*Psychological Impact of COVID-19 on College Students after School Reopening: A Cross-Sectional Study Based on Machine Learning*," the author Ren et al. did an investigation of mental health problems for students after returning to school after the social restriction and found that their anxiety and depression symptoms are very serious.

The paper "*Protective Predictors Associated With Posttraumatic Stress and Psychological Distress in Chinese Nurses During the Outbreak of COVID-19*" reported Xia et al.'s study about the mental health problems of the nurses, and found that exercise, enough sleep, and low stress can help them maintain their mental health.

In the paper "*Factors That Influence Perceived Organizational Support for Emotional Labor of Chinese Medical Personnel in Hubei,*" Zeng et al. did an investigation about the mental problems of the medical personnel who first went to Wuhan at the beginning of the pandemic.

The paper by Li, Xu et al. titled "*Sense of Coherence and Mental Health in College Students After Returning to School During COVID-19: The Moderating Role of Media Exposure,*" reported that social restriction increased uncertainty and increased anxious and depressive symptoms.

Lu et al. contributed a paper titled "*Effects of Wise Intervention on Perceived Discrimination Among College Students Returning Home From Wuhan During the COVID-19 Outbreak,*" to propose that discrimination against students from Wuhan might induce psychological stresses for the students.

In the paper titled "*COVID-19-related Daily Stress Processes in College-Aged Adults: Examining the Role of Depressive Symptom Severity*," the authors Greaney et al. from the University of Texas Arlington, reported that daily exposure to stressful information, rumors, or negative news about the virus might exert a negative effect on the population.

In the paper "*The Relationship Between Perceived Stress, State-Trait Anxiety and Sleep Quality Among Graduating Students During COVID-19 Pandemic*," Liu, Qiao et al. investigated the somatic and mental problems of graduate students and found that uncertainty or perceived stress can work together with poor sleep to induced mental health problems.

In the prospective paper "*Focus on the Mental Health of Pediatric Medical Workers in China After the COVID-19 Epidemic*," Liu and Wang tried to give a perspective on the ways to improve the health conditions for Chinese pediatric workers, and suggest ways to develop psychological intervention programs that are tailored to them.

In the paper "*Using Mindfulness to Reduce Anxiety and Depression of Patient With Fever Undergoing Screening in an Isolation Ward During COVID-19 Outbreak*," the authors Liu, Huyang et al. introduced a short time meditation that might be helpful for people who are waiting in line for a nucleic acid test screening.

In the paper, "*Acupuncture combined With emotional Therapy of Chinese Medicine Treatment for Improving Depressive Symptoms in Elderly Patients With Alcohol Dependency During the Epidemic Period of COVID-19,*" Zhao et al. introduced a

method of therapy for mental health problems stemming from COVID-19, and suggested that acupuncture combined with Chinese medicine is helpful for patients.

In Lv et al.'s paper titled "*The Effect of Computerized Cognitive Behavioral Therapy on People's Anxiety and Depression During the Six Months of Wuhan's Lockdown of COVID-19 Epidemic,*" the authors used mindfulness to treat the patients during the outbreak of the pandemic in Wuhan and found that mindfulness is really helping the patients, especially for women and students.

Collectively, these studies have investigated thoroughly about the prevalence of mental health problems after COVID-19, the uncertainty mechanism for these disorders, as well as some therapies for these emotional problems. It is believed that uncertainty plays a very important role in people's emotional induction, which affects people's emotional response or arousal by affecting the expected process. Individuals who are intolerant of uncertainty are also more likely to have emotional disturbances such as worry, anxiety, and fear. Regardless of the probability of a negative event occurring, individuals with a high intolerance of uncertainty strongly believe that the uncertainty situation is unacceptable (Dugas et al., 2001). Therefore, in the current COVID-19 pandemic, controlling uncertainty may become a new way of intervention for various mood and anxiety disorders.

AUTHOR CONTRIBUTIONS

FW, FP, Y-YT, and JH wrote the paper. All authors agreed upon publishing the manuscript.

FUNDING

The paper was supported by a grant from the Foundation of Humanities and Arts from the Ministry of Education in China (19YJAZH083).

REFERENCES

Aqeel, M., Rehna, T., Shuja, K. H., and Abbas, J. (2022). Comparison of students' mental wellbeing, anxiety, depression, and quality of life during COVID-19's full and partial (smart) lockdowns: a follow-up study at a 5-month interval. *Front. Psychiatry* 13, 835585. doi: 10.3389/fpsyt.2022.835585

Berchicci, M., Lucci, G., Spinelli, D., and Russo, F. D. (2015). Stimulus onset predictability modulates proactive action control in a Go/No-go task. *Front. Behav. Neurosci.* 9, 101. doi: 10.3389/fnbeh.2015.00101

Daly, M., and Robinson, E. (2022). Depression and anxiety during COVID-19. *Lancet* 399, 518. doi: 10.1016/S0140-6736(22)00187-8

Dugas, M., Gosselin, J. P., and Ladouceur, R. (2001). Intolerance of uncertainty and worry: investigating specificity in a nonclinical sample. *Cogn. Therapy Res.* 25.5, 551–558. doi: 10.1023/A:1005553414688

Ekman, P. (1992). An arugment for basic emotions. *Cogn. Emotion* 6, 169–200. doi: 10.1080/02699939208411068

Gu, S., He, Z., Sun, L., Jiang, Y., Xu, M., Feng, G., et al. (2021). Effects of coronavirus-19 induced loneliness on mental health: sleep quality and intolerance for uncertainty as mediators. *Front. Psychiatry* 12, 738003. doi: 10.3389/fpsyt.2021.738003

Gu, S., Wang, F., Cao, C., Wu, E., Tang, Y. Y., Huang, J. H., et al. (2019a). An integrative way for studying neural basis of basic emotions with fMRI. *Front. Neurosci.* 13, 628. doi: 10.3389/fnins.2019.00628

Gu, S., Wang, F., Patel, N. P., and Bourgeois, J. A., and Huang, J. H. (2019b). A model for basic emotions using observations of behavior in drosophila. *Front. Psychol.* 10, 781. doi: 10.3389/fpsyg.2019.00781

Gu, S., Wang, W., Wang, F., and Huang, J. H. (2016). Neuromodulator and emotion biomarker for stress induced mental disorders. *Neural Plasticity* 2016, 2609128. doi: 10.1155/2016/2609128

Hutto, D. D., Robertson, I., and Kirchhoff, M. D. (2018). A new, better BET: rescuing and revising basic emotion theory. *Front. Psychol.* 9, 1217. doi: 10.3389/fpsyg.2018.01217

Levine, L., Kay, A., and Shapiro, E. (2022). The anxiety of not knowing: diagnosis uncertainty about COVID-19. *Curr. Psychol.* 3, 1–8. doi: 10.1007/s12144-022-02783-y

Liang, F., Feng, R., Gu, S., Jiang, S., Zhang, X., Li, N., et al. (2021). Neurotransmitters and electrophysiological changes might work as biomarkers for diagnosing affective disorders. *Dis. Markers* 2021, 9116502. doi: 10.1155/2021/9116502

Panksepp, J. (2007). Neurologizing the psychology of affects: how appraisal-based constructivism and basic emotion theory can coexist. *Perspect. Psychol. Sci.* 2, 281–296. doi: 10.1111/j.1745-6916.2007.00045.x

Posner, J., Russell, J. A., Gerber, A., Gorman, D., Colibazzi, T., Yu, S., et al. (2009). The neurophysiological bases of emotion: an fMRI study of the affective circumplex using emotion-denoting words. *Hum. Brain Mapp.* 30, 883–895. doi: 10.1002/hbm.20553

Wilson-Mendenhall, C. D., Barrett, L. F., and Barsalou, L. W. (2013). Neural evidence that human emotions share core affective properties. *Psychol. Sci.* 24, 947–956. doi: 10.1177/0956797612464242

Xu, Q., Jiang, M., Gu, S., Zhang, X., Feng, G., Ma, X., et al. (2022). Metabolomics changes in brain-gut axis after unpredictable chronic mild stress. *Psychopharmacology (Berl)* 239, 729–743. doi: 10.1007/s00213-021-05958-w

Zheng, Z., Gu, S., Lei, Y., Lu, S., Wang, W., Li, Y., et al. (2016). Safety needs mediate stressful events induced mental disorders. *Neural Plasticity* 2016, 8058093. doi: 10.1155/2016/8058093

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's Note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

frontiers in Psychology

SYSTEMATIC REVIEW
published: 25 November 2020
doi: 10.3389/fpsyg.2020.617001

Mental Health of Pregnant and Postpartum Women During the Coronavirus Disease 2019 Pandemic: A Systematic Review and Meta-Analysis

*Haohao Yan, Yudan Ding and Wenbin Guo**

National Clinical Research Center for Mental Disorders, and Department of Psychiatry, The Second Xiangya Hospital of Central South University, Changsha, China

Background: Prenatal and postnatal mental disorders can exert severe adverse influences on mothers, fetuses, and children. However, the effect of the coronavirus disease 2019 (COVID-19) pandemic on the mental health of pregnant and postpartum women remains unclear.

Methods: Relevant studies that were published from January 1, 2019 to September 19, 2020 were identified through the systematic search of the PubMed, EMBASE, and Web of Science databases. Quality assessment of included studies, random-effects meta-analysis, sensitivity analysis, and planned subgroup analysis were performed.

Results: A total of 23 studies conducted with 20,569 participants during the COVID-19 pandemic and with 3,677 pregnant women before the COVID-19 pandemic were included. The prevalence rates of anxiety, depression, psychological distress, and insomnia among pregnant women during the COVID-19 pandemic were 37% (95% confidence interval [CI] 25–49%), 31% (95% CI 20–42%), 70% (95% CI 60–79%), and 49% (95% CI 46–52%), respectively. The prevalence of postpartum depression was 22% (95% CI 15–29%). Multigravida women and women in the first and third trimesters of pregnancy were more vulnerable than other pregnant women. The assessment of the associations between the COVID-19 pandemic and mental health problems revealed that the pooled relative risks of anxiety and depression in pregnant women were 1.65 (95% CI: 1.25–2.19) and 1.08 (95% CI: 0.80–1.46), respectively.

Conclusions: The prevalence rates of mental disorders among pregnant and postpartum women during the COVID-19 pandemic were high. Timely and tailored interventions should be applied to mitigate mental problems among this population of women, especially multigravida women and women in the first and third trimesters of pregnancy.

Keywords: coronavirus disease 2019, pregnant women, anxiety, depression, insomnia

OPEN ACCESS

Edited by:
Fushun Wang,
Nanjing University of Chinese Medicine, China

Reviewed by:
Manli Huang,
Zhejiang University, China
Yinan Wang,
Beijing Normal University, China

****Correspondence:***
Wenbin Guo
guowenbin76@csu.edu.cn

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *13 October 2020*
Accepted: *04 November 2020*
Published: *25 November 2020*

Citation:
Yan H, Ding Y and Guo W (2020) Mental Health of Pregnant and Postpartum Women During the Coronavirus Disease 2019 Pandemic: A Systematic Review and Meta-Analysis. Front. Psychol. 11:617001. doi: 10.3389/fpsyg.2020.617001

INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic has become an unprecedented global crisis. All of us are battling the most powerful threat since the 21 century. However, a cure or an adequate safety vaccine has not yet been found or developed. Thus far, there is no indication that the COVID-19 pandemic will end quickly. Thus, pregnant women have to give birth during the COVID-19 pandemic. The pregnancy and the postpartum periods involve several drastic changes at the social, biological, and psychological levels in future mothers. Previous studies have painted a particularly difficult transition for pregnant and postpartum women. A systematic review and meta-analysis that involved 102 studies with 221,974 antenatal and postnatal women from 34 countries found that the pooled prevalence of anxiety among these participants was 15.2% (Dennis et al., 2017). Another systematic review and meta-analysis including 101 studies discovered that the pooled prevalence of depression among women in the perinatal period was 11.9% (Woody et al., 2017). The prevalence of postpartum depression was evaluated at 12.0% in a systematic review and meta-analysis that encompassed 58 studies with 37,294 postnatal women (Shorey et al., 2018). A meta-analysis involving data contributed by 11,002 pregnant women found that 45.7% of these women had poor sleep quality (Sedov et al., 2018). In 2020, pregnant and postpartum women have had to face the COVID-19 pandemic, its accompanying quarantine measures, and disruptions in medical practices. Many studies have found that during disasters or events, the prevalence rates of mental disorders among prenatal and postnatal women are significantly higher than those among the general population (Lechat, 1979; Vesga-López et al., 2008; Harville et al., 2010). Meeting the mental health needs of pregnant and postpartum women during the COVID-19 pandemic is a growing concern and a serious issue because a large body of robust evidence suggests that prenatal and postnatal mental disorders induce severe adverse influences on mothers, fetuses, and children. Prenatal and postnatal mental disorders induce disturbances in the physical activity, nutrition, and sleep of pregnant and postpartum women; these disturbances subsequently affect the mood of pregnant and postpartum women and the development of fetuses and children (Coussons-Read, 2013). Prenatal and postnatal mental disorders are correlated with physical disorders, such as preeclampsia (Zhang et al., 2013; Asghari et al., 2016), gestational hypertension (Zhang et al., 2013), and gestational diabetes (Gilbert et al., 2019); preterm birth (Grigoriadis et al., 2013, 2018; Ding et al., 2014); miscarriage (Accortt et al., 2015; Qu et al., 2017); low infant birth weight (Grigoriadis et al., 2013, 2018; Ding et al., 2014); fetal growth restriction (Grote et al., 2010; Ciesielski et al., 2015); lower Apgar scores at birth (Wu et al., 2020a); and socioemotional (Madigan et al., 2018), behavioral (Van den Bergh et al., 2005) and cognitive problems (Glover, 2014; Stein et al., 2014; Tarabulsy et al., 2014; MacKinnon et al., 2018), as well as changes in the brain structures and functions of infants and children (Sandman et al., 2015; Lebel et al., 2016; Adamson et al., 2018). Timely interventions are helpful in mitigating mental disorders (Kessler et al., 2007; Xiang et al., 2020). Knowing the effect of the COVID-19 pandemic on the mental health of pregnant and postpartum women, exploring the specific vulnerable groups among this population of women, and applying tailored interventions on the basis of data are urgent. The aims of this systematic review and meta-analysis are to quantify the influence of the COVID-19 pandemic on the mental health of pregnant and postpartum women, and to explore the specific vulnerable groups among this population of women.

MATERIALS AND METHODS

A systematic review and meta-analysis was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) (Moher et al., 2009) and Meta-Analysis of Observational Studies in Epidemiology (MOOSE) (Stroup et al., 2000) guidelines. The review protocol was registered at PROSPERO as CRD42020210035.

Search Strategy

Two authors (HY and YD) independently identified relevant studies that were published from January 1, 2019 to September 19, 2020 by searching the PubMed, EMBASE, and Web of Science databases. The following combined terms were applied in the search: ("pregnant woman" OR "breastfeeding women" OR "postpartum") AND ("COVID-19" OR "2019 novel coronavirus disease" OR "2019-nCoV disease" OR "SARS-CoV-2") AND ("mental health" OR "anxiety" OR "depression" OR "insomnia" OR "Stress Disorders, Post-Traumatic"). In addition, the reference lists of the identified records were hand-searched to find additional relevant studies.

Study Selection Criteria

Studies were included if they reported the prevalence rates of depression, anxiety, insomnia, post-traumatic stress disorder (PTSD), and/or other mental health disorders among pregnant and/or postpartum women during the COVID-19 pandemic. Studies were also included if they reported data from which prevalence rates could be calculated. Letters, case reports, or reviews were excluded.

Data Extraction and Quality Assessment

Two authors (HY and YD) independently extracted the following data from the studies that were eligible for this systematic review and meta-analysis: the name of the first author; the type of study; the time and locations of the studies; response rates; participants and the total number of participants; mean age; mean or median gestational age; the percentage of participants $\geq$ 35 years old; the percentage of nulliparous pregnant women; the percentages of pregnant women in the first, second, and third trimesters; the percentage of participants who were married or living with their partners; the percentage of participants who had a University degree or above; the used scales and applied cut-offs; and the percentages or the numbers of participants who were evaluated to be positive for mental disorders.

Two authors (HY and YD) independently evaluated the risk of bias of the studies included in the systematic review and meta-analysis. A third team member performed verification. Discrepancies were discussed and resolved among the 3

researchers. A modified form of the Newcastle–Ottawa scale was applied for quality assessment (Pappa et al., 2020). The modified form of the Newcastle–Ottawa scale has 5 items: 1, the representativeness of the sample (the number of pregnant or postpartum women ≥ 65% of the total sample); 2, the sample size of each study > 500 pregnant or postpartum women; 3, response rate > 80%; 4, the study applied validate measurement scales with appropriate cut-offs; and 5, appropriate and adequate statistics. Each item was given a score of 1 if the criterion was met or a score of 0 if the criterion was not met. Total scores of the studies ≥ 3 points indicated a low risk of bias. The total scores of studies assessed < 3 points were regarded as at a high risk of bias.

Data Analysis

Data analyses were performed by using Stata software version 12.0 (Stata Corp LP, College Station, USA). For the anticipated clinical heterogeneity, the pooled prevalence rates of anxiety, depression, insomnia, and other mental disorders with 95% confidence interval (CI) were calculated by using a random effects model. A random effects model is considered more suitable for meta-analyses with substantial heterogeneity than fixed effects model. Given that the included studies reported prevalence rates of mental disorders of close to 1 or 0, the Freeman–Tukey double arcsine transformation was performed before data pooling. I^2 (significance level of $I^2 > 50\%$) and Q-tests (significance level of $P < 0.05$) were applied to evaluate heterogeneity across studies. Sensitivity analysis was conducted to evaluate the effect of each included study on the prevalence rates of mental disorders among pregnant or postpartum women by omitting each study and calculating the pooled prevalence rates of the remaining studies. Subgroup analysis was also performed on the basis of the used scales, study locations, parity, trimester, educational level, employment status, and mental disorder severity. Considering that some included studies reported the prevalence rates of mental disorders among pregnant or postpartum women during the COVID-19 pandemic and before the COVID-19 pandemic in the same study locations, a random effects model was utilized to evaluate summary relative risks (RRs) (during the COVID-19 pandemic vs. before the COVID-19 pandemic). Chi-squared statistic and I^2 were applied to evaluate the homogeneity of effects across studies.

RESULTS

Literature Search

Our initial search identified a total of 232 records (66 records in Pubmed, 104 records in Embase, and 62 records in Web of Science). A total of 119 articles were duplicates. After the duplicates were removed, 67 studies were excluded after reviewing their titles and abstracts. A total of 46 potentially relevant records were retrieved for detailed full-text evaluation. Finally, 23 articles met the selection criteria and were deemed to contain data relevant to the systematic review and meta-analysis. A PRISMA diagram detailing the process of article selection is shown in **Figure 1**.

Characteristics of the Included Studies

A total of 23 studies (Ayaz et al., 2020; Berthelot et al., 2020; Ceulemans et al., 2020; Durankuş and Aksu, 2020; Farewell et al., 2020; Gu et al., 2020; He et al., 2020; Lebel et al., 2020; Li et al., 2020; Liu et al., 2020; Mappa et al., 2020; Matsushima and Horiguchi, 2020; Oskovi-Kaplan et al., 2020; Parra-Saavedra et al., 2020; Patabendige et al., 2020; Preis et al., 2020; Saccone et al., 2020; Sade et al., 2020; Silverman et al., 2020; Wu et al., 2020b; Yue et al., 2020; Zanardo et al., 2020; Zhang and Ma, 2020) performed with 20 569 participants (16,797 pregnant women and 3,772 postpartum women) during the COVID-19 pandemic and with 3,677 pregnant women before the COVID-19 pandemic were included in this systematic review and meta-analysis. A total of 19 studies (Ceulemans et al., 2020; Durankuş and Aksu, 2020; Farewell et al., 2020; He et al., 2020; Lebel et al., 2020; Li et al., 2020; Liu et al., 2020; Mappa et al., 2020; Matsushima and Horiguchi, 2020; Oskovi-Kaplan et al., 2020; Parra-Saavedra et al., 2020; Patabendige et al., 2020; Preis et al., 2020; Saccone et al., 2020; Sade et al., 2020; Silverman et al., 2020; Wu et al., 2020b; Yue et al., 2020; Zhang and Ma, 2020) were cross-sectional, and 4 (Ayaz et al., 2020; Berthelot et al., 2020; Gu et al., 2020; Zanardo et al., 2020) were case–control studies. Among the 23 studies, 7 were located in China (Gu et al., 2020; He et al., 2020; Li et al., 2020; Liu et al., 2020; Wu et al., 2020b; Yue et al., 2020; Zhang and Ma, 2020), 3 were implemented in America (Farewell et al., 2020; Preis et al., 2020; Silverman et al., 2020), 3 were performed in Turkey (Ayaz et al., 2020; Durankuş and Aksu, 2020; Oskovi-Kaplan et al., 2020), 3 were undertaken in Italy (Mappa et al., 2020; Saccone et al., 2020; Zanardo et al., 2020), 2 were conducted in Canada (Berthelot et al., 2020; Lebel et al., 2020), 1 took place in Belgium (Ceulemans et al., 2020), 1 occurred in Japan (Matsushima and Horiguchi, 2020), 1 was carried out in Colombia (Parra-Saavedra et al., 2020), 1 was accomplished in Sri Lanka (Patabendige et al., 2020), and 1 was done in Israel (Sade et al., 2020). The median questionnaire response rate was 88.05% (range 74.00%, 93.33%). The median percentage of the age of the participant ≥ 35 years old was 15.01% (range 10.94%, 44.44%). The median percentage of nulliparous pregnant women was 51.40% (range 34.50%, 71.55%). The median percentage of women who were married or living with their partners was 98.80% (range 90.00%, 100.00%). The median percentage of participants with a University degree or higher was 59.80% (range 10.00%, 93.00%). A summary of the characteristics of the 23 included studies is shown in **Supplementary Table 1**.

The scoring results obtained by using the modified form of the Newcastle–Ottawa scale are exhibited in **Supplementary Table 2**. Two studies were rated 2 points (Gu et al., 2020; Li et al., 2020), and 21 studies were rated ≥ 3 points.

Anxiety Prevalence

Anxiety was evaluated in 13 studies (Ayaz et al., 2020; Berthelot et al., 2020; Ceulemans et al., 2020; Gu et al., 2020; Lebel et al., 2020; Li et al., 2020; Liu et al., 2020; Mappa et al., 2020; Parra-Saavedra et al., 2020; Patabendige et al., 2020; Preis et al., 2020; Saccone et al., 2020; Yue et al., 2020) with 10,424 pregnant women. The pooled prevalence of anxiety among

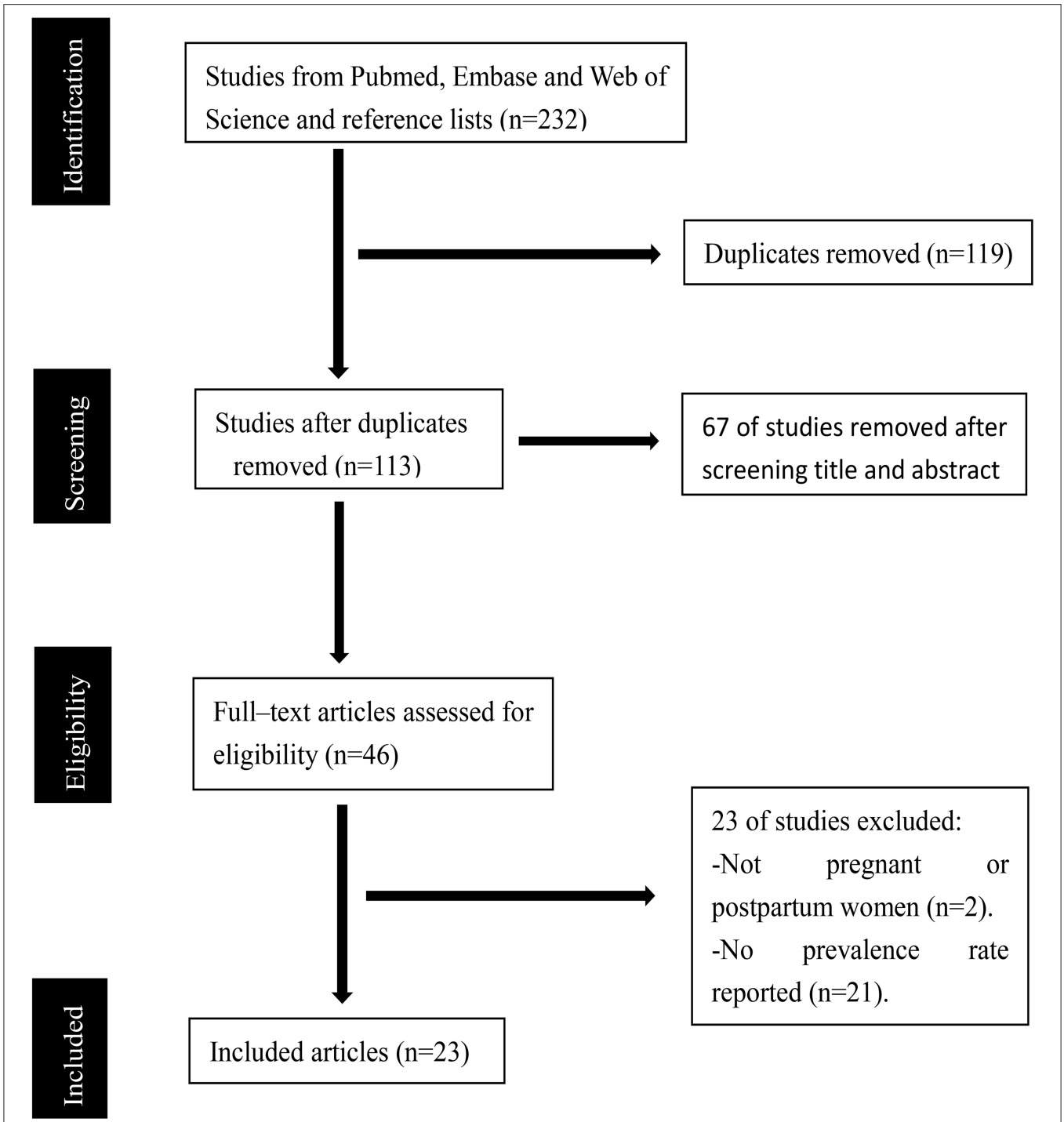


FIGURE 1 | Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) study selection flow diagram.

pregnant women was 37% (95% CI 25–49%, $I^2 = 99.4\%$) as shown in **Figure 2**. After excluding studies with a high risk of bias, 11 studies with a low risk of bias (Ayaz et al., 2020; Berthelot et al., 2020; Ceulemans et al., 2020; Lebel et al., 2020; Liu et al., 2020; Mappa et al., 2020; Parra-Saavedra et al., 2020; Patabendige et al., 2020; Preis et al., 2020; Saccone et al., 2020; Yue et al., 2020) showed a pooled prevalence of anxiety among pregnant women of 34% (95% CI 22–47%, $I^2 = 99.4\%$). In sensitivity analysis, 5 studies (Berthelot et al., 2020; Ceulemans et al., 2020; Li et al., 2020; Saccone et al., 2020; Yue

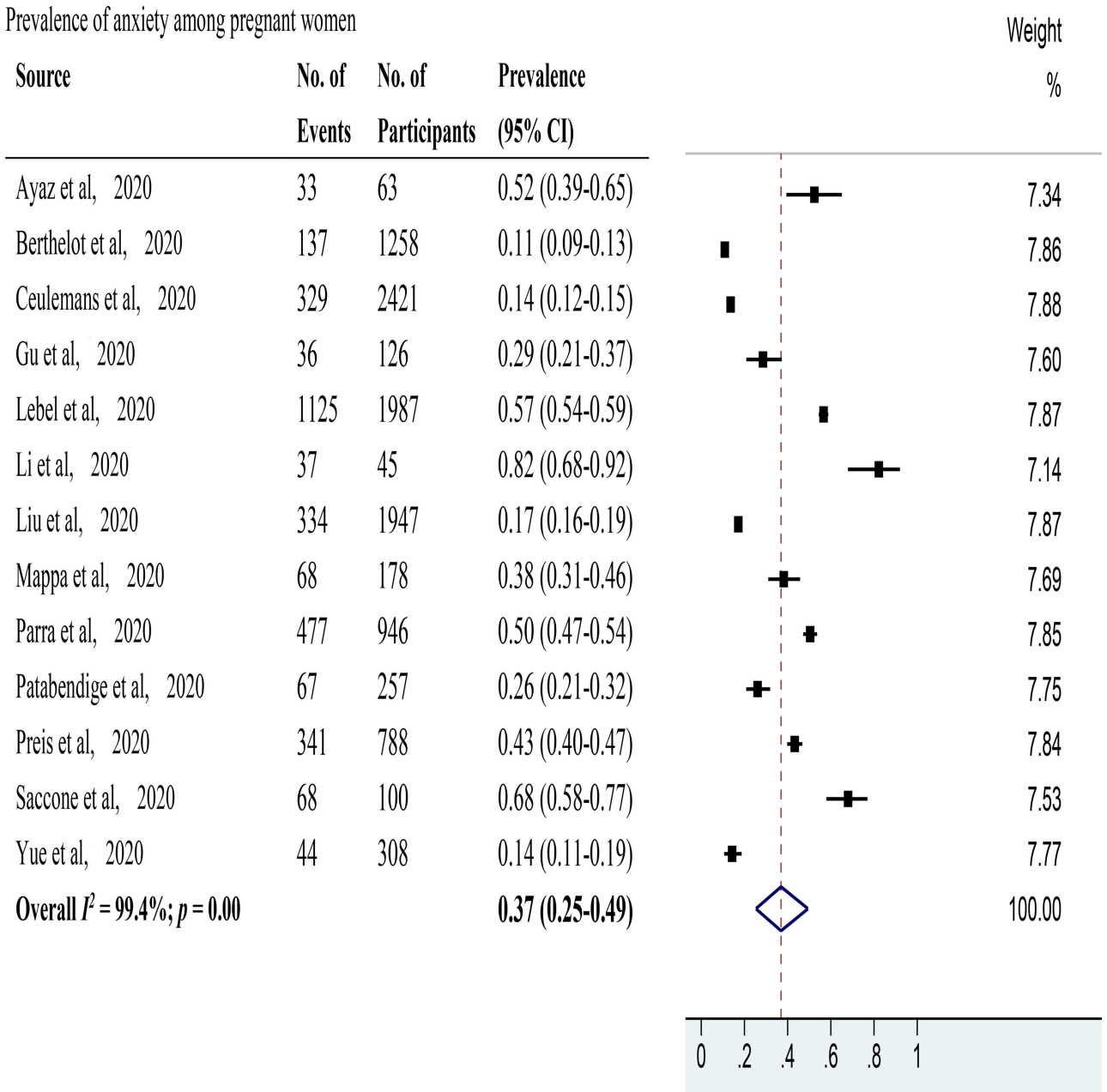


FIGURE 2 | The pooled prevalence of anxiety among pregnant women during the COVID-19 pandemic.

et al., 2020) affected the pooled prevalence of anxiety among pregnant women by over 2%. After excluding these 5 studies, the recalculated prevalence of anxiety among pregnant women was 39% (95% CI 25–53%, I^2 = 99.1%). As for study locations (**Supplementary Figure 1**), 4 studies (Gu et al., 2020; Li et al., 2020; Liu et al., 2020; Yue et al., 2020) that were performed in China reported a pooled prevalence rate of anxiety among pregnant women of 33% (95% CI 18–50%, I^2 = 96.9%), 2 studies (Berthelot et al., 2020; Lebel et al., 2020) undertaken in Canada disclosed a pooled prevalence rate of 37% (95% CI 35–38%, I^2 = 99.9%), and 2 studies (Mappa et al., 2020; Saccone et al., 2020) conducted in Italy provided a pooled prevalence rate of 49% (95% CI: 43–55%, I^2 = 96.1%). Each of the 5 remaining studies was carried out in a different country. For the used scales (**Supplementary Figure 2**), 2 studies (Ceulemans et al., 2020; Preis et al., 2020) applied the Generalized Anxiety Disorder 7-item Scale with a pooled prevalence rate of anxiety among pregnant women of 45% (95% CI: 17–74%, I^2 = 99.4%),

2 (Liu et al., 2020; Yue et al., 2020) utilized the Self-Rating Anxiety Scale with a pooled prevalence rate of anxiety among pregnant women of 17% (95% CI: 15–18%, $I^2 = 42.8\%$), and 2 studies (Mappa et al., 2020; Saccone et al., 2020) applied state-trait anxiety inventory with a pooled prevalence rate of anxiety among pregnant women of 49% (95% CI: 43–55%, $I^2 = 96.1\%$). Each of the 7 remaining studies utilized a different scale. Two studies (Ayaz et al., 2020; Berthelot et al., 2020) reported the percentages of positive anxiety among pregnant women in the same location during and before the COVID-19 pandemic (**Supplementary Figure 3**). The pooled RR was 1.65 (95% CI: 1.25–2.19, $I^2 = 0.0\%$). The pooled prevalence rate of anxiety among postpartum women was not evaluated due to the limited data available.

Depression Prevalence

Depression was evaluated in 13 studies (Berthelot et al., 2020; Ceulemans et al., 2020; Durankuş and Aksu, 2020; Gu et al., 2020; He et al., 2020; Lebel et al., 2020; Li et al., 2020; Matsushima and Horiguchi, 2020; Parra-Saavedra et al., 2020; Patabendige et al., 2020; Sade et al., 2020; Silverman et al., 2020; Wu et al., 2020b) with 12,839 pregnant women. The pooled prevalence of depression among pregnant women was 31% (95% CI 20–42%, $I^2 = 99.4\%$) as shown in **Figure 3**. After excluding studies

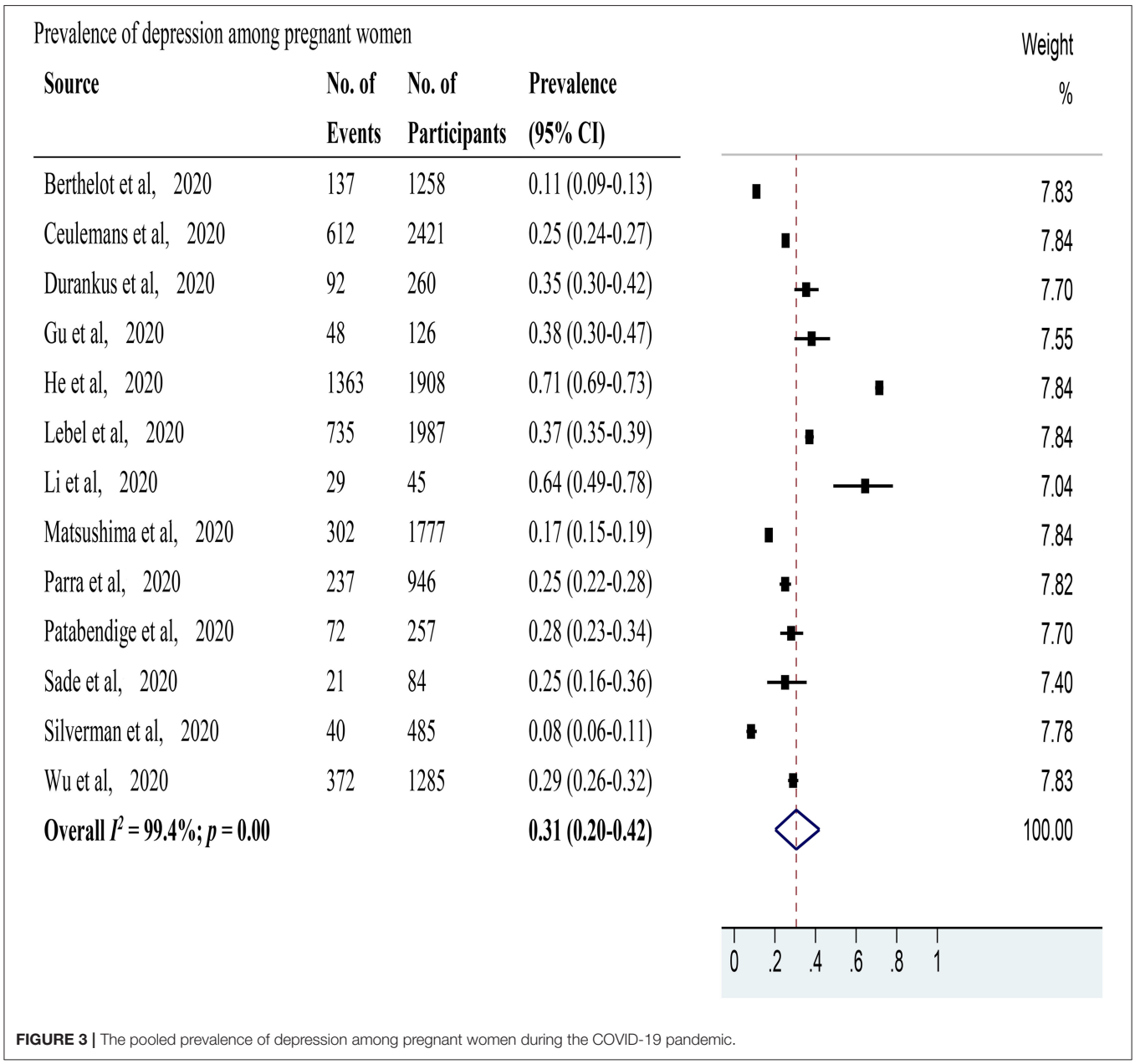


FIGURE 3 | The pooled prevalence of depression among pregnant women during the COVID-19 pandemic.

with a high risk of bias, 11 studies with a low risk of bias (Berthelot et al., 2020; Ceulemans et al., 2020; Durankuş and Aksu, 2020; He et al., 2020; Lebel et al., 2020; Matsushima and Horiguchi, 2020; Parra-Saavedra et al., 2020; Patabendige et al., 2020; Sade et al., 2020; Silverman et al., 2020; Wu et al., 2020b) were included. These studies showed a pooled prevalence of depression among pregnant women of 27% (95% CI 17–40%, $I^2 = 99.5\%$). Through sensitivity analysis, 2 studies (He et al., 2020; Silverman et al., 2020) were found to affect the pooled prevalence of depression among pregnant women by over 2%. After excluding these 2 studies, the recalculated prevalence of depression among pregnant women was 29% (95% CI 23–35%, $I^2 = 97.8\%$). Regarding study locations (**Supplementary Figure 4**), 4 studies (Gu et al., 2020; He et al., 2020; Li et al., 2020; Wu et al., 2020b) were performed in China with a pooled prevalence rate of depression among pregnant women of 51% (95% CI 23–78%, $I^2 = 99.5\%$), and 2 studies (Berthelot et al., 2020; Lebel et al., 2020) were conducted in Canada with a pooled prevalence rate of 26% (95% CI 24–27%, $I^2 = 99.7\%$). Each of the 7 remaining studies took place in a different country. For used scales (**Supplementary Figure 5**), 7 studies (Durankuş and Aksu, 2020; He et al., 2020; Lebel et al., 2020; Matsushima and Horiguchi, 2020; Sade et al., 2020; Silverman et al., 2020; Wu et al., 2020b) applied the Edinburgh Postpartum Depression Scale with a pooled prevalence rate of depression among pregnant women of 31% (95% CI: 15–49%, $I^2 = 99.6\%$). Each of the 6 remaining studies utilized a different scale. Two studies (Sade et al., 2020; Wu et al., 2020b) reported the percentages of positive depression among pregnant women in the same location during and before the COVID-19 pandemic (**Supplementary Figure 3**). The pooled RR was 1.08 (95% CI: 0.80–1.46, $I^2 = 56.8\%$). Depression in postpartum women was evaluated in 3 studies (Ceulemans et al., 2020; Oskovi-Kaplan et al., 2020; Zanardo et al., 2020) with 3,759 postpartum women (**Figure 4**). The pooled prevalence of postpartum depression was 22% (95% CI 15–29%, $I^2 = 85.7\%$). Two studies (Oskovi-Kaplan et al., 2020; Zanardo et al., 2020) that assessed the prevalence of depression among postpartum women within 48 h after birth reported the pooled prevalence rate of 18% (95% CI 14–23%, $I^2 = 85.2\%$).

Psychological Distress Prevalence

Psychological distress was evaluated in 3 studies (Li et al., 2020; Saccone et al., 2020; Zhang and Ma, 2020) with 705 pregnant women (**Figure 4**). The pooled prevalence rate of psychological distress among pregnant women was 70% (95% CI 60–79%, $I^2 = 76.7\%$). After excluding a study with a high risk of bias, 2 studies with a low risk of bias (Saccone et al., 2020; Zhang and Ma, 2020) showed a pooled prevalence rate of psychological distress among pregnant women of 66% (95% CI 63–70%, $I^2 = 30.6\%$). The pooled prevalence rate of psychological distress among postpartum women was not evaluated due to the limited data available.

Insomnia Prevalence

Insomnia was evaluated in 2 studies (Li et al., 2020; Parra-Saavedra et al., 2020) with 991 pregnant women (**Figure 4**). The pooled prevalence rate of insomnia among pregnant women was 49% (95% CI 46–52%, $I^2 = 0.0\%$). However, 1 of the 2 studies used to calculate the prevalence rate of insomnia was assessed to have a high risk of bias.

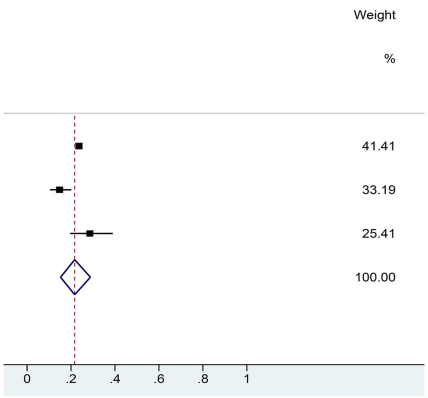
Subgroup Analysis

The subgroup analysis of the prevalence rate of anxiety among pregnant women was performed in accordance with the following categories: parity, trimester, educational level, employment status, and anxiety severity (**Table 1** and **Supplementary Table 3**). Subgroup analysis for postpartum women was not conducted due to the limited data available. Parity data were provided by 2 studies (Mappa et al., 2020; Patabendige et al., 2020). The pooled prevalence rate of anxiety among primigravida women was 30% (95% CI 24–37%, $I^2 = 86.3\%$) and that among multigravida women was 31% (95% CI 26–37%, $I^2 = 46.3\%$). Trimester data were given by 2 studies (Patabendige et al., 2020; Saccone et al., 2020). The pooled prevalence rate of anxiety among pregnant women in the first trimester was 45% (95% CI 33–58%, $I^2 = 99.7\%$), that in the second trimester was 40% (95% CI 32–49%, $I^2 = 90.2\%$), and that in the third trimester was 35% (95% CI 27–43%, $I^2 = 95.0\%$). The data of educational level were available from 2 studies (Mappa et al., 2020; Patabendige et al., 2020). The pooled prevalence rate of anxiety among pregnant women with a University degree or above was 36% (95% CI 29–43%, $I^2 = 93.4\%$) and that with pregnant women with educational attainment below University education was 25% (95% CI 20–31%, $I^2 = 0.0\%$). Employment data were available in 2 studies (Mappa et al., 2020; Patabendige et al., 2020). The pooled prevalence rate of anxiety among employed pregnant women was 32% (95% CI 26–38%, $I^2 = 89.3\%$) and that among unemployed pregnant women was 23% (95% CI 18–29%, $I^2 = 70.4\%$). The data on mild anxiety in pregnant women were given in 5 studies (Ayaz et al., 2020; Ceulemans et al., 2020; Gu et al., 2020; Liu et al., 2020; Yue et al., 2020), and the pooled prevalence rate of mild anxiety among pregnant women was 24% (95% CI 11–40%, $I^2 = 99.0\%$). The data of moderate anxiety among pregnant women was available in 6 studies (Ayaz et al., 2020; Ceulemans et al., 2020; Gu et al., 2020; Lebel et al., 2020; Preis et al., 2020; Yue et al., 2020), and the pooled prevalence rate of moderate anxiety among pregnant women was 17% (95% CI 4–36%, $I^2 = 99.6\%$). The data of severe anxiety among pregnant women were provided in 6 studies (Ayaz et al., 2020; Ceulemans et al., 2020; Gu et al., 2020; Lebel et al., 2020; Preis et al., 2020; Yue et al., 2020), and the pooled prevalence rate of severe anxiety among pregnant women was 7% (95% CI 3–13%, $I^2 = 97.9\%$).

The subgroup analysis of depression prevalence rates among pregnant women was conducted in accordance with parity and trimester due to the limited data available (**Table 1**). The parity data were available in 2 studies (Durankuş and Aksu, 2020; Patabendige et al., 2020). The pooled prevalence rate of depression among primigravida women was 29% (95% CI 24–35%, $I^2 = 35.6\%$) and that in multigravida women was 34% (95% CI 29–41%, $I^2 = 79.4\%$). The data for the first and second trimesters were provided in 2 studies (Matsushima and

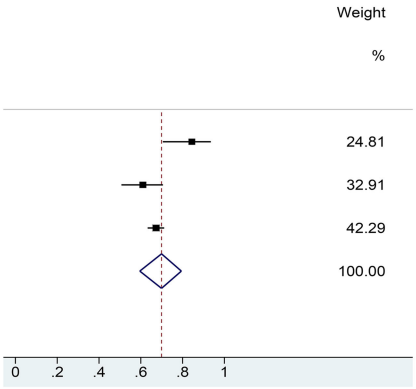
A Prevalence of postpartum depression

Source	No. of Events	No. of Participants	Prevalence (95% CI)	Weight %
Ceulemans et al, 2020	813	3445	0.24 (0.22-0.25)	41.41
Oskovi et al, 2020	33	223	0.15 (0.10-0.20)	33.19
Zanardo et al, 2020	26	91	0.29 (0.20-0.39)	25.41
Overall I^2 = 85.7%; p = 0.001			**0.22 (0.15-0.29)**	100.00



B Prevalence of psychological distress among pregnant women

Source	No. of Events	No. of Participants	Prevalence (95% CI)	Weight %
Li et al, 2020	38	45	0.84 (0.71-0.94)	24.81
Saccone et al, 2020	61	100	0.61 (0.51-0.71)	32.91
Zhang et al, 2020	377	560	0.67 (0.63-0.71)	42.29
Overall I^2 = 76.7%; p = 0.01			**0.70 (0.60-0.79)**	100.00



C Prevalence of insomnia among pregnant women

Source	No. of Events	No. of Participants	Prevalence (95% CI)	Weight %
Li et al, 2020	24	45	0.53 (0.38-0.68)	4.59
Parra et al, 2020	464	946	0.49 (0.46-0.52)	95.41
Overall I^2 = 0.0%; p = 0.574			**0.49 (0.46-0.52)**	100.00

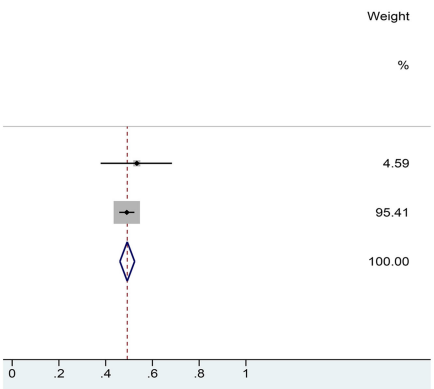


FIGURE 4 | (A) The pooled prevalence of postpartum depression during the COVID-19 pandemic; **(B)** The pooled prevalence of psychological distress among pregnant women during the COVID-19 pandemic. **(C)** The pooled prevalence of insomnia among pregnant women during the COVID-19 pandemic.

Horiguchi, 2020; Patabendige et al., 2020). The pooled prevalence rate of depression among pregnant women in the first trimester was 21% (95% CI 17–27%, I^2 = 51.2%) and that among women in the second trimester was 20% (95% CI 17–22%, I^2 = 91.0%). The data of pregnant women in the third trimester were given in 3 studies (Matsushima and Horiguchi, 2020; Patabendige et al., 2020; Wu et al., 2020b), and the pooled prevalence of depression in the third trimester was 22% (95% CI 12–33%, I^2 = 96.6%).

The subgroup analysis of psychological distress and insomnia was not conducted due to the limited data available.

TABLE 1 | Subgroup analysis of prevalence of anxiety and depression among pregnant women.

		Anxiety	Depression
Parity	Primigravida	**30%** 95% CI 24–37% $I^2 = 86.3\%$	**29%** 95% CI 24–35% $I^2 = 35.6\%$
	Multigravida	**31%** 95% CI 26–37% $I^2 = 46.3\%$	**34%** 95% CI 29–41% $I^2 = 79.4\%$
Trimester	First trimester	**45%** 95% CI 33–58% $I^2 = 99.7\%$	**21%** 95% CI 17–27% $I^2 = 51.2\%$
	Second trimester	**40%** 95% CI 32–49% $I^2 = 90.2\%$	**20%** 95% CI 17–22% $I^2 = 91.0\%$
	Third trimester	**35%** 95% CI 27–43% $I^2 = 95.0\%$	**22%** 95% CI 12–33% $I^2 = 96.6\%$

95% CI, 95% confidence interval. The bold values are the prevalence rates of anxiety and depression among pregnant women according to different categories.

DISCUSSION

To the best of our knowledge, this is the first systematic review and meta-analysis to estimate the effect of the COVID-19 pandemic on the mental health of pregnant and postpartum women. A total of 23 studies conducted with 20,569 participants (16,797 pregnant women and 3,772 postpartum women) during the COVID-19 pandemic and with 3,677 pregnant women before the COVID-19 pandemic were included in this systematic review and meta-analysis. According to our analysis, the prevalence rates of anxiety, depression, psychological distress, and insomnia among pregnant women during the COVID-19 pandemic were 37% (95% CI 25–49%), 31% (95% CI 20–42%), 70% (95% CI 60–79%), and 49% (95% CI 46–52%), respectively. The prevalence of postpartum depression during the COVID-19 pandemic was 22% (95% CI 15–29%). The pooled RRs of anxiety and depression in pregnant women were 1.65 (95% CI: 1.25–2.19) and 1.08 (95% CI: 0.80–1.46), respectively, relative to those in pregnant women in the same locations during and before the COVID-19 pandemic. Through subgroup analysis, we found that multigravida women had higher prevalence rates of anxiety and depression than primigravida women during the COVID-19 pandemic. We also found that the prevalence of anxiety in pregnant women during the COVID-19 pandemic decreased throughout pregnancy, whereas the prevalence of depression followed a U pattern and was high in the first and third trimesters and lowest in the second trimester.

The pregnancy and postpartum periods involve several changes at the social, biological, and psychological levels in future mothers. Previous studies have found that pregnant and postpartum women have high prevalence rates of anxiety, depression, and insomnia (Dennis et al., 2017; Woody et al., 2017; Sedov et al., 2018; Shorey et al., 2018). During disasters or events, the prevalence rates of mental disorders in prenatal and postnatal women are significantly higher than those in the general population (Lechat, 1979; Vesga-López et al., 2008; Harville et al., 2010). In 2020, pregnant and postpartum women have to face the COVID-19 pandemic and its accompanying quarantine measures and disruptions in medical practices. Thus, adverse mental outcomes are amplified during the COVID-19 pandemic.

Before the COVID-19 pandemic, the estimated prevalence of anxiety among antenatal and postnatal women was 15.2% (Dennis et al., 2017), the pooled prevalence of depression among women in the perinatal period was 11.9% (Woody et al., 2017), the prevalence of postpartum depression was 12.0% (Shorey et al., 2018), and the prevalence of poor sleep quality was 45.7% among pregnant women (Sedov et al., 2018). In this systematic review and meta-analysis, we found that the prevalence rates of anxiety, depression, and insomnia among pregnant and postpartum women during the COVID-19 pandemic were higher than those before the COVID-19 pandemic. Pregnant and postpartum women also showed obvious higher prevalence rates of mental disorders during the COVID-19 pandemic than the general population. A systematic review and meta-analysis that included 50 studies found that the prevalence rates of anxiety, depression, psychological distress, and poor sleep quality among the general population were 26, 24, 26, and 34%, respectively (Krishnamoorthy et al., 2020). In this meta-analysis, we found that the pooled RRs of anxiety and depression in pregnant women were 1.65 (95% CI: 1.25–2.19) and 1.08 (95% CI: 0.80–1.46), respectively. These results verified that the COVID-19 pandemic induced increments in the prevalence rates of anxiety and depression.

Through subgroup analysis, we found that multigravida women had higher prevalence rates of anxiety and depression than primigravida women during the COVID-19 pandemic. Some previous studies which performed before the COVID-19 pandemic also reported similar results (Dipietro et al., 2008; Figueiredo and Conde, 2011). Multigravida women have to face several challenges, such as having an additional child, the reorganization of the existing parental system, and an increase in parental and financial responsibilities. These challenges may have a negative effect on the mental health of multigravida women. We also found that the prevalence of anxiety among pregnant women during the COVID-19 pandemic decreased throughout pregnancy (Woods-Giscombé et al., 2010; Figueiredo and Conde, 2011), whereas the prevalence of depression followed a U pattern (Lee et al., 2007; Bunevicius et al., 2009). Specifically, the prevalence of depression was high in the first and third trimesters and was the lowest in the second trimester. The increased prevalence rate of depression in the third trimester might be correlated with the proximity of giving birth. Moreover, these results might be induced by hormonal changes. Through the subgroup analysis of anxiety, we also found several results that contradicted the results of some previous studies and highlighted a higher prevalence of anxiety among pregnant women with a University degree or above than among pregnant women with low educational levels (Albrecht and Rankin, 1989; Qiao et al., 2009; Kannenberg et al., 2016) and a higher prevalence of anxiety among employed pregnant women than among unemployed pregnant women (Rubertsson et al., 2014). High educational

level indicates high knowledgeability, which may amplify adverse effects on mental health during the COVID-19 pandemic. Employed pregnant women may face difficult situations, such the loss of jobs and earnings due to the COVID-19 pandemic. These difficult situations have a negative influence on mental health. We also found that the majority of pregnant women experienced mild and moderate anxiety, whereas severe anxiety was not common. Thus, timely and tailored interventions should be applied.

Some included studies also reported a high prevalence of fear (67.46%) (Gu et al., 2020), loneliness (60%) (Farewell et al., 2020), and PTSD (15.04%) (He et al., 2020) among pregnant women and a high RR of thoughts of self-harm among pregnant women in the same locations (during the COVID-19 pandemic vs. before the COVID-19 pandemic), (RR = 2.85; 95% CI: 1.70–8.85) (Wu et al., 2020b), although these data were not used in the final meta-analysis.

Meeting the mental health needs of pregnant and postpartum women during the COVID-19 pandemic is a serious issue. Numerous pieces of evidence suggest that prenatal and postnatal mental disorders exert heavy and lasting adverse influences on mothers, fetuses, and children. The induced adverse outcomes include preeclampsia (Zhang et al., 2013; Asghari et al., 2016), gestational hypertension (Zhang et al., 2013), and gestational diabetes of pregnant women (Gilbert et al., 2019); preterm birth (Grigoriadis et al., 2013, 2018; Ding et al., 2014); miscarriage (Accortt et al., 2015; Qu et al., 2017); low infant birth weight (Grigoriadis et al., 2013, 2018; Ding et al., 2014); fetal growth restriction (Grote et al., 2010; Ciesielski et al., 2015); lower Apgar scores at birth (Wu et al., 2020a); and socioemotional (Madigan et al., 2018), behavioral (Van den Bergh et al., 2005) and cognitive problems (Glover, 2014; Stein et al., 2014; Tarabulsy et al., 2014; MacKinnon et al., 2018), as well as changes in the brain structures and functions of infants and children (Sandman et al., 2015; Lebel et al., 2016; Adamson et al., 2018). This systematic review and meta-analysis highlighted the high prevalence rates of mental disorders among pregnant and postpartum women during the COVID-19 pandemic. The mental health of multigravida women and women in the first and third trimesters of pregnancy was vulnerable to the COVID-19 pandemic. Mental disorders in pregnant and postpartum women are the outcomes of a multivariate model with combined effects. This multivariate model comprises sociodemographic factors (age, parity, trimester, marital status, educational level, and socioeconomic status); stress (disaster or crisis, life events, marital satisfaction, and medical or obstetric complications); and support from partners, families, societies, and countries (Glazier et al., 2004; Farewell et al., 2020; Lebel et al., 2020; Mappa et al., 2020; Wu et al., 2020b; Yue et al., 2020). Although we found that the COVID-19 pandemic induced increments in the prevalence rates of mental disorders in pregnant and postpartum women, we cannot infer that the COVID-19 pandemic is the main factor across the factors influencing mental health of pregnant and postpartum women. Tailored interventions should be applied to mitigate mental problems in pregnant and postpartum women, especially multigravida women and women in the first and third trimesters of pregnancy.

This work is the first systematic review and meta-analysis that summarized existing literature on the mental health of pregnant and postpartum women, estimated the pooled prevalence rates of mental disorders, and highlighted vulnerable groups among the study population. Our review has certain limitations. One major drawback is the high heterogeneity across studies. The included studies applied different assessment tools and cut offs, although some studies used the same tools and cut offs. The studies' locations involved 10 countries, which face different severity levels of the COVID-19 pandemic. The included studies exhibit demographic differences such as the percentage of the age of the participants $\geq$ 35 years old, the percentage of nulliparous pregnant women, the percentage of women who were married or living with their partners, and the percentage of participants with a University degree or higher. Another limitation is that most of the included studies applied online questionnaires. This approach resulted in selection bias for the target population and lacked objectivity in the assessment outcomes. Moreover, the most of the included studies were cross-sectional. Thus, the long-term effects of the COVID-19 pandemic on the mental health of pregnant and postpartum women warrant additional longitudinal studies.

CONCLUSION

This systematic review and meta-analysis summarized existing literature on the mental health of pregnant and postpartum women and highlighted the high prevalence rates of anxiety, depression, psychological distress, and insomnia among this population. Multigravida women and pregnant women in the first and third trimesters of pregnancy are highly vulnerable. Our findings are helpful for formulating tailored interventions to mitigate the effects of COVID-19 on the mental health of pregnant and postpartum women.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Materials**, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

HY designed the study and created the first draft of the manuscript. HY, YD, and WG performed the literature search, article selection, quality appraisal, and statistical analysis. YD and WG suggested improvements. All of the authors contributed to the final manuscript and submission.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.617001/full#supplementary-material

REFERENCES

Accortt, E. E., Cheadle, A. C., and Dunkel Schetter, C. (2015). Prenatal depression and adverse birth outcomes: an updated systematic review. *Mater. Child Health J.* 19, 1306–1337. doi: 10.1007/s10995-014-1637-2

Adamson, B., Letourneau, N., and Lebel, C. (2018). Prenatal maternal anxiety and children's brain structure and function: a systematic review of neuroimaging studies. *J. Affect Disord.* 241, 117–126. doi: 10.1016/j.jad.2018.08.029

Albrecht, S. A., and Rankin, M. (1989). Anxiety levels, health behaviors, and support systems of pregnant women. *Mater. Child Nurs. J.* 18, 49–60.

Asghari, E., Faramarzi, M., and Mohammmadi, A. K. (2016). The effect of cognitive behavioural therapy on anxiety, depression and stress in women with preeclampsia. *J. Clin. Diagn. Res.* 10:Qc04-qc07. doi: 10.7860/jcdr/2016/21245.8879

Ayaz, R., Hocaoğlu, M., Günay, T., Yardımcı, O. D., Turgut, A., and Karateke, A. (2020). Anxiety and depression symptoms in the same pregnant women before and during the COVID-19 pandemic. *J. Perinat. Med.* doi: 10.1515/jpm-2020-0380

Berthelot, N., Lemieux, R., Garon-Bissonnette, J., Drouin-Maziade, C., Martel, É., and Maziade, M. (2020). Uptrend in distress and psychiatric symptomatology in pregnant women during the coronavirus disease 2019 pandemic. *Acta Obstet. Gynecol. Scand.* 99, 848–855. doi: 10.1111/aogs.13925

Bunevicius, R., Kusminskas, L., Bunevicius, A., Nadisauskiene, R. J., Jureniene, K., and Pop, V. J. (2009). Psychosocial risk factors for depression during pregnancy. *Acta Obstet. Gynecol. Scand.* 88, 599–605. doi: 10.1080/00016340902846049

Ceulemans, M., Hompes, T., and Foulon, V. (2020). Mental health status of pregnant and breastfeeding women during the COVID-19 pandemic: a call for action. *Int. J. Gynaecol. Obstet.* 151, 146–147. doi: 10.1002/ijgo.13295

Ciesielski, T. H., Marsit, C. J., and Williams, S. M. (2015). Maternal psychiatric disease and epigenetic evidence suggest a common biology for poor fetal growth. *BMC Pregnan. Childbirth* 15:192. doi: 10.1186/s12884-015-0627-8

Coussons-Read, M. E. (2013). Effects of prenatal stress on pregnancy and human development: mechanisms and pathways. *Obstet. Med.* 6, 52–57. doi: 10.1177/1753495x12473751

Dennis, C. L., Falah-Hassani, K., and Shiri, R. (2017). Prevalence of antenatal and postnatal anxiety: systematic review and meta-analysis. *Br. J. Psychiatr.* 210, 315–323. doi: 10.1192/bjp.bp.116.187179

Ding, X. X., Wu, Y. L., Xu, S. J., Zhu, R. P., Jia, X. M., Zhang, S. F., et al. (2014). Maternal anxiety during pregnancy and adverse birth outcomes: a systematic review and meta-analysis of prospective cohort studies. *J. Affect Disord.* 159, 103–110. doi: 10.1016/j.jad.2014.02.027

Dipietro, J. A., Costigan, K. A., and Sipsma, H. L. (2008). Continuity in self-report measures of maternal anxiety, stress, and depressive symptoms from pregnancy through two years postpartum. *J. Psychosom. Obstet. Gynaecol.* 29, 115–124. doi: 10.1080/01674820701701546

Durankuş, F., and Aksu, E. (2020). Effects of the COVID-19 pandemic on anxiety and depressive symptoms in pregnant women: a preliminary study. *J. Matern. Fetal. Neonatal. Med.* 1–7. doi: 10.1080/14767058.2020.1763946

Farewell, C. V., Jewell, J., Walls, J., and Leiferman, J. A. (2020). A mixed-methods pilot study of perinatal risk and resilience during COVID-19. *J. Prim. Care Commun. Health* 11:2150132720944074. doi: 10.1177/2150132720944074

Figueiredo, B., and Conde, A. (2011). Anxiety and depression symptoms in women and men from early pregnancy to 3-months postpartum: parity differences and effects. *J. Affect Disord.* 132, 146–157. doi: 10.1016/j.jad.2011.02.007

Gilbert, L., Gross, J., Lanzi, S., Quansah, D. Y., Puder, J., and Horsch, A. (2019). How diet, physical activity and psychosocial well-being interact in women with gestational diabetes mellitus: an integrative review. *BMC Pregnan. Childbirth* 19:60. doi: 10.1186/s12884-019-2185-y

Glazier, R. H., Elgar, F. J., Goel, V., and Holzapfel, S. (2004). Stress, social support, and emotional distress in a community sample of pregnant women. *J. Psychosom. Obstet. Gynaecol.* 25, 247–255. doi: 10.1080/01674820400024406

Glover, V. (2014). Maternal depression, anxiety and stress during pregnancy and child outcome; what needs to be done. *Best Pract. Res. Clin. Obstet. Gynaecol.* 28, 25–35. doi: 10.1016/j.bpobgyn.2013.08.017

Grigoriadis, S., Graves, L., Peer, M., Mamisashvili, L., Tomlinson, G., Vigod, S. N., et al. (2018). Maternal anxiety during pregnancy and the association with adverse perinatal outcomes: systematic review and meta-analysis. *J. Clin. Psychiatr.* 79:17r12011. doi: 10.4088/JCP.17r12011

Grigoriadis, S., VonderPorten, E. H., Mamisashvili, L., Tomlinson, G., Dennis, C. L., Koren, G., et al. (2013). The impact of maternal depression during pregnancy on perinatal outcomes: a systematic review and meta-analysis. *J. Clin. Psychiatr.* 74, e321–341. doi: 10.4088/JCP.12r07968

Grote, N. K., Bridge, J. A., Gavin, A. R., Melville, J. L., Iyengar, S., and Katon, W. J. (2010). A meta-analysis of depression during pregnancy and the risk of preterm birth, low birth weight, and intrauterine growth restriction. *Arch. Gen. Psychiatr.* 67, 1012–1024. doi: 10.1001/archgenpsychiatry.2010.111

Gu, X. X., Chen, K., Yu, H., Liang, G. Y., Chen, H., and Shen, Y. (2020). How to prevent in-hospital COVID-19 infection and reassure women about the safety of pregnancy: Experience from an obstetric center in China. *J. Int. Med. Res.* 48:300060520939337. doi: 10.1177/0300060520939337

Harville, E., Xiong, X., and Buekens, P. (2010). Disasters and perinatal health:a systematic review. *Obstet. Gynecol. Surv.* 65, 713–728. doi: 10.1097/OGX.0b013e31820eddbe

He, Z., Chiu, W. T., Wu, H., and Ming, W. K. (2020). PMH4 the psychological and behavioral responses to Covid-19 epidemic in pregnant women in China: a nationwide survey. *Value Health Reg. Issues* 22:S62. doi: 10.1016/j.vhri.2020.07.326

Kannenberg, K., Weichert, J., Rody, A., and Banz-Jansen, C. (2016). Treatment-associated anxiety among pregnant women and their partners: what is the influence of sex, parity, age and education? *Geburtshilfe Frauenheilkd* 76, 809–813. doi: 10.1055/s-0042-101546

Kessler, R. C., Amminger, G. P., Aguilar-Gaxiola, S., Alonso, J., Lee, S., and Ustün, T. B. (2007). Age of onset of mental disorders: a review of recent literature. *Curr. Opin. Psychiatr.* 20, 359–364. doi: 10.1097/YCO.0b013e32816ebc8c

Krishnamoorthy, Y., Nagarajan, R., Saya, G. K., and Menon, V. (2020). Prevalence of psychological morbidities among general population, healthcare workers and COVID-19 patients amidst the COVID-19 pandemic: a systematic review and meta-analysis. *Psychiatr. Res.* 293:113382. doi: 10.1016/j.psychres.2020.113382

Lebel, C., MacKinnon, A., Bagshawe, M., Tomfohr-Madsen, L., and Giesbrecht, G. (2020). Elevated depression and anxiety symptoms among pregnant individuals during the COVID-19 pandemic. *J. Affect Disord.* 277, 5–13. doi: 10.1016/j.jad.2020.07.126

Lebel, C., Walton, M., Letourneau, N., Giesbrecht, G. F., Kaplan, B. J., and Dewey, D. (2016). Prepartum and postpartum maternal depressive symptoms are related to children's brain structure in preschool. *Biol. Psychiatr.* 80, 859–868. doi: 10.1016/j.biopsych.2015.12.004

Lechat, M. F. (1979). Disasters and public health. *Bull. World Health Organ.* 57, 11–17.

Lee, A. M., Lam, S. K., Sze Mun Lau, S. M., Chong, C. S., Chui, H. W., and Fong, D. Y. (2007). Prevalence, course, and risk factors for antenatal anxiety and depression. *Obstet. Gynecol.* 110, 1102–1112. doi: 10.1097/01.Aog.0000287065.59491.70

Li, X., Lu, P., Hu, L., Huang, T., and Lu, L. (2020). Factors associated with mental health results among workers with income losses exposed to COVID-19 in China. *Int. J. Environ. Res. Pub. Health* 17, 1–11. doi: 10.3390/ijerph17155627

Liu, X., Chen, M., Wang, Y., Sun, L., Zhang, J., Shi, Y., et al. (2020). Prenatal anxiety and obstetric decisions among pregnant women in Wuhan and Chongqing during the COVID-19 outbreak: a cross-sectional study. *Bjog* 127, 1229–1240. doi: 10.1111/1471-0528.16381

MacKinnon, N., Kingsbury, M., Mahedy, L., Evans, J., and Colman, I. (2018). The association between prenatal stress and externalizing symptoms in childhood: evidence from the avon longitudinal study of parents and children. *Biol. Psychiatr.* 83, 100–108. doi: 10.1016/j.biopsych.2017.07.010

Madigan, S., Oatley, H., Racine, N., Fearon, R. M. P., Schumacher, L., Akbari, E., et al. (2018). A meta-analysis of maternal prenatal depression and anxiety on child socioemotional development. *J. Am. Acad. Child Adolesc. Psychiatr.* 57, 645–657.e648. doi: 10.1016/j.jaac.2018.06.012

Mappa, I., Distefano, F. A., and Rizzo, G. (2020). Effects of coronavirus 19 pandemic on maternal anxiety during pregnancy: a prospectic observational study. *J. Perinat. Med.* 48, 545–550. doi: 10.1515/jpm-2020-0182

Matsushima, M., and Horiguchi, H. (2020). The COVID-19 pandemic and mental well-being of pregnant women in Japan: need for economic and social policy interventions. *Disaster Med. Pub. Health Prep.* 1–11. doi: 10.1017/dmp.2020.334

Moher, D., Liberati, A., Tetzlaff, J., and Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med*. 6:e1000097. doi: 10.1371/journal.pmed.1000097

Oskovi-Kaplan, Z. A., Buyuk, G. N., Ozgu-Erdinc, A. S., Keskin, H. L., Ozbas, A., and Moraloglu Tekin, O. (2020). The effect of COVID-19 pandemic and social restrictions on depression rates and maternal attachment in immediate postpartum women: a preliminary study. *Psychiatr. Q.* 1–8. doi: 10.1007/s11126-020-09843-1

Pappa, S., Ntella, V., Giannakas, T., Giannakoulis, V. G., Papoutsi, E., and Katsaounou, P. (2020). Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: a systematic review and meta-analysis. *Brain Behav. Immun.* 88, 901–907. doi: 10.1016/j.bbi.2020.05.026

Parra-Saavedra, M., Villa-Villa, I., Pérez-Olivo, J., Guzman-Polania, L., Galvis-Centurion, P., Cumplido-Romero, Á., et al. (2020). Attitudes and collateral psychological effects of COVID-19 in pregnant women in Colombia. *Int. J. Gynaecol. Obstet*. 151, 203–208. doi: 10.1002/ijgo.13348

Patabendige, M., Gamage, M. M., Weerasinghe, M., and Jayawardane, A. (2020). Psychological impact of the COVID-19 pandemic among pregnant women in Sri Lanka. *Int. J. Gynaecol. Obstet*. 151, 150–153. doi: 10.1002/ijgo.13335

Preis, H., Mahaffey, B., Heiselman, C., and Lobel, M. (2020). Pandemic-related pregnancy stress and anxiety among women pregnant during the coronavirus disease 2019 pandemic. *Am. J. Obstet. Gynecol. MFM* 2:100155. doi: 10.1016/j.ajogmf.2020.100155

Qiao, Y. X., Wang, J., Li, J., and Ablat, A. (2009). The prevalence and related risk factors of anxiety and depression symptoms among Chinese pregnant women in Shanghai. *Aust. N. Z. J. Obstet. Gynaecol.* 49, 185–190. doi: 10.1111/j.1479-828X.2009.00966.x

Qu, F., Wu, Y., Zhu, Y. H., Barry, J., Ding, T., Baio, G., et al. (2017). The association between psychological stress and miscarriage: a systematic review and meta-analysis. *Sci. Rep.* 7:1731. doi: 10.1038/s41598-017-01792-3

Rubertsson, C., Hellström, J., Cross, M., and Sydsjö, G. (2014). Anxiety in early pregnancy: prevalence and contributing factors. *Arch. Womens Ment. Health* 17, 221–228. doi: 10.1007/s00737-013-0409-0

Saccone, G., Florio, A., Aiello, F., Venturella, R., De Angelis, M. C., Locci, M., et al. (2020). Psychological impact of coronavirus disease 2019 in pregnant women. *Am. J. Obstet. Gynecol.* 223, 293–295. doi: 10.1016/j.ajog.2020.05.003

Sade, S., Sheiner, E., Wainstock, T., Hermon, N., Yaniv Salem, S., Kosef, T., et al. (2020). Risk for depressive symptoms among hospitalized women in high-risk pregnancy units during the COVID-19 pandemic. *J. Clin. Med.* 9:2449. doi: 10.3390/jcm9082449

Sandman, C. A., Buss, C., Head, K., and Davis, E. P. (2015). Fetal exposure to maternal depressive symptoms is associated with cortical thickness in late childhood. *Biol. Psychiatr.* 77, 324–334. doi: 10.1016/j.biopsych.2014.06.025

Sedov, I. D., Cameron, E. E., Madigan, S., and Tomfohr-Madsen, L. M. (2018). Sleep quality during pregnancy: a meta-analysis. *Sleep Med. Rev.* 38, 168–176. doi: 10.1016/j.smrv.2017.06.005

Shorey, S., Chee, C. Y. I., Ng, E. D., Chan, Y. H., Tam, W. W. S., and Chong, Y. S. (2018). Prevalence and incidence of postpartum depression among healthy mothers: a systematic review and meta-analysis. *J. Psychiatr. Res.* 104, 235–248. doi: 10.1016/j.jpsychires.2018.08.001

Silverman, M. E., Medeiros, C., and Burgos, L. (2020). Early pregnancy mood before and during COVID-19 community restrictions among women of low socioeconomic status in New York City: a preliminary study. *Arch. Womens Ment. Health* 1–4. doi: 10.1007/s00737-020-01061-9

Stein, A., Pearson, R. M., Goodman, S. H., Rapa, E., Rahman, A., McCallum, M., et al. (2014). Effects of perinatal mental disorders on the fetus and child. *Lancet* 384, 1800–1819. doi: 10.1016/s0140-6736(14)61277-0

Stroup, D. F., Berlin, J. A., Morton, S. C., Olkin, I., Williamson, G. D., Rennie, D., et al. (2000). Meta-analysis of observational studies in epidemiology: a proposal for reporting. Meta-analysis of Observational Studies in Epidemiology (MOOSE) group. *JAMA* 283, 2008–2012. doi: 10.1001/jama.283.15.2008

Tarabulsy, G. M., Pearson, J., Vaillancourt-Morel, M. P., Bussières, E. L., Madigan, S., Lemelin, J. P., et al. (2014). Meta-analytic findings of the relation between maternal prenatal stress and anxiety and child cognitive outcome. *J. Dev. Behav. Pediatr.* 35, 38–43. doi: 10.1097/dbp.0000000000000003

Van den Bergh, B. R., Mulder, E. J., Mennes, M., and Glover, V. (2005). Antenatal maternal anxiety and stress and the neurobehavioural development of the fetus and child: links and possible mechanisms. A review. *Neurosci. Biobehav. Rev.* 29, 237–258. doi: 10.1016/j.neubiorev.2004.10.007

Vesga-López, O., Blanco, C., Keyes, K., Olfson, M., Grant, B. F., and Hasin, D. S. (2008). Psychiatric disorders in pregnant and postpartum women in the United States. *Arch. Gen. Psychiatr.* 65, 805–815. doi: 10.1001/archpsyc.65.7.805

Woods-Giscombé, C. L., Lobel, M., and Crandell, J. L. (2010). The impact of miscarriage and parity on patterns of maternal distress in pregnancy. *Res. Nurs. Health* 33, 316–328. doi: 10.1002/nur.20389

Woody, C. A., Ferrari, A. J., Siskind, D. J., Whiteford, H. A., and Harris, M. G. (2017). A systematic review and meta-regression of the prevalence and incidence of perinatal depression. *J. Affect Disord.* 219, 86–92. doi: 10.1016/j.jad.2017.05.003

Wu, Y., Lu, Y. C., Jacobs, M., Pradhan, S., Kapse, K., Zhao, L., et al. (2020a). Association of prenatal maternal psychological distress with fetal brain growth, metabolism, and cortical maturation. *JAMA Netw. Open* 3:e1919940. doi: 10.1001/jamanetworkopen.2019.19940

Wu, Y., Zhang, C., Liu, H., Duan, C., Li, C., Fan, J., et al. (2020b). Perinatal depressive and anxiety symptoms of pregnant women during the coronavirus disease 2019 outbreak in China. *Am. J. Obstet. Gynecol.* 223:240.e241-240.e249. doi: 10.1016/j.ajog.2020.05.009

Xiang, Y. T., Yang, Y., Li, W., Zhang, L., Zhang, Q., Cheung, T., et al. (2020). Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. *Lancet Psychiatr.* 7, 228–229. doi: 10.1016/s2215-0366(20)30046-8

Yue, C., Liu, C., Wang, J., Zhang, M., Wu, H., Li, C., et al. (2020). Association between social support and anxiety among pregnant women in the third trimester during the coronavirus disease 2019 (COVID-19) epidemic in Qingdao, China: the mediating effect of risk perception. *Int. J. Soc. Psychiatr.* 20764020941567. doi: 10.1177/0020764020941567

Zanardo, V., Manghina, V., Giliberti, L., Vettore, M., Severino, L., and Straface, G. (2020). Psychological impact of COVID-19 quarantine measures in northeastern Italy on mothers in the immediate postpartum period. *Int. J. Gynaecol. Obstet.* 150, 184–188. doi: 10.1002/ijgo.13249

Zhang, S., Ding, Z., Liu, H., Chen, Z., Wu, J., Zhang, Y., et al. (2013). Association between mental stress and gestational hypertension/preeclampsia: a meta-analysis. *Obstet. Gynecol. Surv.* 68, 825–834. doi: 10.1097/ogx.0000000000000001

Zhang, Y., and Ma, Z. F. (2020). Psychological responses and lifestyle changes among pregnant women with respect to the early stages of COVID-19 pandemic. *Int. J. Soc. Psychiatr.* 20764020952116. doi: 10.1177/0020764020952116

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 22 January 2021
doi: 10.3389/fpsyg.2020.618509

Psychological Resilience as a Protective Factor for Depression and Anxiety Among the Public During the Outbreak of COVID-19

Shasha Song[1], Xin Yang[2], Hua Yang[2], Ping Zhou[2], Hui Ma[2], Changjun Teng[2], Haocheng Chen[1], Hongxia Ou[2], Jijun Li[2], Carol A. Mathews[3], Sara Nutley[4], Na Liu[2], Xiangyang Zhang[5]* and Ning Zhang[1]**

[1] Nanjing Brain Hospital Affiliated to Nanjing Medical University, Nanjing, China, [2] Department of Medical Psychology, The Affiliated Brain Hospital of Nanjing Medical University, Nanjing, China, [3] Department of Psychiatry, University of Florida, Gainesville, FL, United States, [4] Department of Epidemiology, University of Florida, Gainesville, FL, United States, [5] CAS Key Laboratory of Mental Health, Institute of Psychology, Chinese Academy of Sciences, Beijing, China

OPEN ACCESS

Edited by:
Fushun Wang,
Nanjing University of Chinese Medicine, China

Reviewed by:
Wei Deng,
Sichuan University, China
Ying Wang,
Wuhan University, China
Evangelos Fradelos,
University of Thessaly, Greece

***Correspondence:**
Na Liu
naliu_nbh@njmu.edu.cn
Xiangyang Zhang
zhangxy@psych.ac.cn
Ning Zhang
zn6360@126.com

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: 17 October 2020
Accepted: 31 December 2020
Published: 22 January 2021

Citation:
Song S, Yang X, Yang H, Zhou P, Ma H, Teng C, Chen H, Ou H, Li J, Mathews CA, Nutley S, Liu N, Zhang X and Zhang N (2021) Psychological Resilience as a Protective Factor for Depression and Anxiety Among the Public During the Outbreak of COVID-19. Front. Psychol. 11:618509. doi: 10.3389/fpsyg.2020.618509

Background: Psychological resilience may reduce the impact of psychological distress to some extent. We aimed to investigate the mental health status of the public during the outbreak of coronavirus disease 2019 (COVID-19) and explore the level and related factors of anxiety and depression.

Methods: From February 8 to March 9, 2020, 3,180 public completed the Zung's Self-Rating Anxiety Scale (SAS) for anxiety, Zung's Self-Rating Depression Scale (SDS) for depression, the Connor–Davidson resilience scale (CD-RISC) for psychological resilience, and the Simplified Coping Style Questionnaire (SCSQ) for the attitudes and coping styles.

Results: The number of people with depressive symptoms (SDS > 53) was 1,303 (the rate was 41.0%). The number of people with anxiety symptoms (SAS > 50) was 1,184 (the rate was 37.2%). The depressed group and anxiety group had less education, more unmarried and younger age, as well as had significant different in SDS total score ($P < 0.001$), SAS total score ($P < 0.001$), CD-RISC total score ($P < 0.001$), and SCSQ score ($P < 0.001$). The binary logistic regression showed that female ($B = -0.261$, $P = 0.026$), strength ($B = -0.079$, $P = 0.000$), and the subscales of active coping style in SCSQ ($B = -0.983$, $P = 0.000$) remained protective factors and passive coping style ($B = 0.293$, $P = 0.003$) and higher SAS score ($B = 0.175$, $P = 0.000$) were risk factors for depression. Optimism ($B = -0.041$, $P = 0.015$) in CD-RISC was a protective factor, and passive coping styles ($B = 0.483$, $P = 0.000$) and higher SDS score ($B = 0.134$, $P = 0.000$) were risk factors for anxiety.

Limitations: This study adopted a cross-sectional design and used self-report questionnaires.

Conclusion: The mental health of the public, especially females, the younger and less educational populations, and unmarried individuals, should be given more attention. Individuals with high level of mental resilience and active coping styles would have lower levels of anxiety and depression during the outbreak of COVID-19.

Keywords: COVID-19, depression, anxiety, related factors, public

INTRODUCTION

Since the start of the global pandemic caused by the novel coronavirus SARS-CoV-2 late in 2019 (COVID-19) pandemic, the total number of cases worldwide has already exceeded the number of confirmed cases in China (Liu J. J. et al., 2020). Although initially severely affected by the outbreak, China has since made significant progress in the prevention and control of the infection that causes COVID-19. To date, the country has returned to daily life, and production and traffic have resumed in an orderly manner. However, the coronavirus pandemic continues to escalate throughout the world. The control of the epidemic and efforts to prevent further spread in China has transitioned from anti-proliferation of the virus locally to anti-import of the virus from outside of China's borders (Ding et al., 2020), in addition to ongoing efforts to continue to prevent a rebound of infections domestically.

An increasing number of countries have indicated heightened public anxiety about being infected, and China is no exception (Bao et al., 2020). A recent survey on the psychological status of the population during the early stage of the epidemic by Qiu et al. (2020) showed that, among 52,730 individuals surveyed via questionnaire in mainland China, nearly 35% of the respondents reported experiencing psychological distress. Patients, health professionals, and the public are under insurmountable psychological pressure, which increases their risk for various psychological problems such as anxiety, fear, depression, and insomnia (Li W. et al., 2020). Surveys have shown us the pressures faced by medical staff, such as their responsibility to care for infected patients and their close contact with their families, sometimes in the face of public inquiries (Li W. et al., 2020). The public may be less psychologically prepared than medical workers and more fearful of the consequences of infection with a potentially lethal new virus. In addition, the persistent stress of the current situation has made people respond unpredictably and uncontrollably, while those in isolation may experience boredom, loneliness, and anger.

A meta-analysis examining the psychological state of individuals during the pandemic of COVID-19 in China showed increases in rates of anxiety and depression to 44.5 and 18.9%, respectively, and the rate of individuals experiencing negative psychological symptoms of comprehensive psychological symptoms was 72.9% (Wei et al., 2020). However, the psychological factors related to the development (or prevention) of symptoms such as anxiety and depression were not explored.

Given the ongoing nature of the COVID-19 pandemic and the profound and widespread effects on mental health worldwide, there is a need to identify factors (such as psychological resilience) that may protect against the development of anxiety, depression, and other psychological problems. Resilience is the psychological trait of having positive dispositions that enable individuals to effectively cope with stressful situations (Ehrich et al., 2017). Studies suggest both that the existence of psychological resilience is universal and that resilience has protective effects on the physical and mental status of individuals experiencing or facing adversity (Lee et al., 2018).

The most common way to assess psychological resilience is through self-report measures such as the Connor-Davidson Resilience Scale (CD-RISC; Sidheek et al., 2017). The CD-RISC assess three dimensions commonly associated with psychological resilience: tenacity, strength, and optimism. The tenacity dimension describes an individual's equanimity, promptness, perseverance, and sense of control when facing situations of hardship and challenge. The strength dimension reflects an individual's ability to recover from setbacks, including their propensity to become more (rather than less) energetic after experiencing setbacks. The optimism dimension measures an individual's perception of the positive aspects of situations. Individuals with higher scores on the optimism dimension show an enhanced ability to recover after experiencing ups and downs in their daily life relative to those who have lower scores on this dimension (Yu and Zhang, 2007).

The present study aimed to explore the impact and dynamic changes of the mental health of the public in China during the ongoing COVID-19 pandemic, and in particular, to explore the levels of anxiety, depression and related psychological factors, and their relationships to psychological resilience and coping styles. We predicted that high levels of psychological resilience would be associated with lower levels of anxiety and depression and increased abilities to cope with the ongoing stresses of daily life during the pandemic. If substantiated, the findings resulting from this study would provide a theoretical basis and suggest possible viable strategies for psychological interventions during COVID-19 (Li Z. et al., 2020).

MATERIALS AND METHODS

All data were collected by Department of Medical Psychology of the affiliated Brain Hospital of Nanjing Medical University. All participants signed informed consent documents, and all procedures were approved by the Institutional Review Board of the affiliated Nanjing Brain Hospital of Nanjing Medical University. Questionnaires were organized by two psychiatrists and psychologists and delivered online, then updated day by day, and after a month the questionnaires were collected and analyzed according to the conditions as follows.

Design and Procedures

The self-report questionnaire used in this study was designed to survey levels of anxiety, depression, psychological resilience, and coping styles in addition to basic demographic information (age, sex, marital status, and education level). Questionnaires were delivered to the public online via WenJuanXing software and the WeChat app, and the online official account of Nanjing Brain Hospital between February 8 to March 9, 2020, to avoid the risk of face-to-face infection during the peak period of the COVID-19 epidemic in mainland China.

Subjects

Participants included members of the public in China who did not have a current or ever diagnosis of COVID-19. Potential participants were excluded from the study if they had: (1) a

history of severe mental disorders which affect brain metabolism such as diabetes or thyroid disease, etc. (2) who had encountered a significant life event in the past 6 months, such as losing relatives, experiencing trauma, etc. (3) Those such as prevention and control frontline personnel including medical staff and their family members, diagnosed or suspected COVID-19 patient. Of the 3,960 questionnaires that were distributed, 3,180 were considered valid and were included in this study, while 780 were considered invalid and were excluded, for a validity rate of 80.30%. Questionnaires were considered to be invalid if they were not public. Questionnaires were considered to be invalid if they were completed in a very rapid time frame, had a very high repetition rate of responses, or were missing data for critical questions or sections.

Measurements of Psychological Distress

Depression and Anxiety

The Self-rating Depression Scale (SDS; Zhengyu and Yufen, 1984a) and Self-rating Anxiety Scale (SAS; Zhengyu and Yufen, 1984b) were used to assess levels of anxiety and depression. The depression scale is based on Zung's SDS, developed by W.K. Zung in 1965. The anxiety scale is based on Zung's SAS, developed by W.K. Zung in 1971. Both scales were translated into their Chinese versions, with a high reliability coefficient for different populations in China. Each scale includes 20 items each scored on a four point Likert scale that assesses frequency or severity of symptoms of either depression or anxiety. "1" means no or little time, "2" represents a small amount of time, "3" represents a lot of time, and "4" represents most or all of the time. Reverse scoring questions are rated "4, 3, 2, and 1." Self-assessment scale evaluation method: first explain the evaluation method, meaning and requirements to the pants participants, and the participants will fill in it according to the actual situation. Higher total scores indicate more severe depression or anxiety.

Psychological Resilience

Psychological resilience was measured using the CD-RISC (Connor and Davidson, 2003), translated from English into Chinese. The CD-RISC contains 25 items, each scored on a 5-point Likert scale and assesses three factors—Tenacity, Strength, and Optimism, The reliability coefficient of the Chinese version of CD-RISC is 0.91 (Yu and Zhang, 2007).

Coping Styles

Coping style was measured using the Simplified Coping Style Questionnaire (SCSQ). The scale was compiled by Xie Yaning using both domestic and foreign cognition theories about coping styles, combined with the characteristics of the Chinese population, The scale has excellent reliability 0.90 (Ya-ning, 1998). The SCSQ assesses both attitudes and coping styles of participants regarding specific life events or difficulties encountered in their daily lives. The scale consists of 20 items, each scored from 0 to 3 and divided into two dimensions: the positive response dimension is comprised of 12 items, and the negative response dimension is comprised of 8 items (Duanwei and Jingxuan, 2014). The higher the score is, the more habitually the coping style used.

Statistical Methods

The data were organized and analyzed using SPSS 22.0 software. Quantitative measures of anxiety and depression were converted into categorical depression/anxiety groups using cutoff scores. Depression and anxiety groups were not mutually exclusive. Individuals who scored above 53 on the SDS questionnaire were considered to be in the depressed group, while those who scored below were considered to be in the non-depressed group (Quan-quan and Li, 2012). Individuals who scored above 50 on the SAS questionnaire were considered to be in the anxiety group, while those who scored below were considered to be in the non-anxiety group (Xiaoyang, 2011).

We first compared the demographic and correlation variables between the depressed and non-depressed groups and between the anxious and non-anxious groups using ANOVA for continuous variables, and chi-square test for categorical variables. Binary logistic regression was used to jointly analyze the factors that potentially influences depression and anxiety $P < 0.05$ was considered statistically significant. Pearson or Spearman correlations were used to explore associations between SDS, SAS score and demographic or assessments. Bonferroni correction was performed to adjust for multiple tests ($\alpha = 0.05/9 = 0.006$). Quantitative data are reported as means ± standard deviation ($x \pm s$) and categorical data as numbers and percents (n, %).

RESULTS

Demographic Features

The survey comprised 3,180 individuals—886 men (27.9%) and 2,294 women (72.1%) and 886 men (27.9%). The whole sample average age was 34.09 ± 12.48 years, the education levels were the following: 824 (25.9%) with less than 12 years of education, 1,967 cases (61.9%) with 12 to 16 years of education, and 389 cases (12.3%) with more than 16 years of education. The marital statuses were as follows: 1,067 unmarried cases (33.6%), 1,953 married cases (61.4%), and 160 other cases (divorced/widowed; 5.0%).

From the point of view depression group, the average age was 29.16 ± 13.63 years. The education levels were the following: 401 (30.8%) participants had less than 12 years of education, 772 had (59.2%) 12 to 16 years of education, and 130 (10.0%) had more than 16 years of education. Forty four percent (n = 573) of participants were unmarried, 51% (n = 665) were married (51.0%), and 5% (n = 65) were divorced or widowed. The mean depression score for the overall sample was 52.89 ± 15.21, with 41% (n = 1,303) meeting cutoff criteria for depression (total score > 53).

From the point of view anxiety group, the average age was 30.91 ± 13.56 years. The education levels were the following: 346 (29.2%) participants had less than 12 years of education, 709 had (59.9%) 12 to 16 years of education, and 129 (10.9%) had more than 16 years of education. 39.2% (n = 464) of participants were unmarried, 55.3% (n = 655) were married (51.0%), and 5.5% (n = 65) were divorced or widowed. The mean anxiety score for the overall sample was 48.77 ± 11.45, with 37.2% (n = 1,184) meeting cutoff criteria for anxiety (total score > 50).

Demographic and psychological characteristics of the depressed and non-depressed groups are shown in **Table 1**. The depressed group was significantly more likely to be female, younger, and unmarried, and had lower educational attainment than the non-depressed group (**Table 1**). The same patterns were seen for the anxious and non-anxious groups, although there were no differences in the proportion of women in the anxious and non-anxious groups (**Table 2**).

Mental Health, Psychological Resilience, and Coping Styles

Depression

Compared with the non-depressed group, the depressed group had significantly higher SDS total scores (as expected), as well as significantly higher SAS total scores, and lower CD-RISC and SCSQ total scores (**Table 1**). The depressed group scored lower on all three dimensions of psychological resilience, including tenacity (F = -27.763, $P < 0.001$), strength (F = -30.820, $P < 0.001$), and optimism (F = -25.727, $P < 0.001$), in addition to lower total psychological resilience scores (F = -30.648, $P < 0.001$) as well lower scores as on the measure of active coping (F = -27.426, $P < 0.001$), and higher scores on the measure of passive coping (F = 3.806, $P < 0.001$).

After controlling for age, sex, marital status, education, and total SDS score, there were significant differences in resilience scores for tenacity (F = 17.897, $P < 0.001$), strength (F = 35.064, $P < 0.001$), optimism (F = 47.855, $P < 0.001$), CD-RISC total score (F = 11.834, $P < 0.001$), active coping style (F = 24.414, $P < 0.001$), and passive coping style (F = 2.712, $P < 0.001$) between the depressed and non-depressed groups. All comparisons remained significant following Bonferroni correction (Bonferroni corrected P value cutoff < 0.006).

Anxiety

Compared with the non-anxious group, the anxious group had significantly higher SAS total scores, as well as higher SDS total scores, lower CD-RISC total scores and lower SCSQ total scores (all $P < 0.001$; **Table 2**). Similar to the depressed group, the anxious group had lower scores than the non-anxious group on all three psychological resilience factors, including tenacity (F = -22.294, $P < 0.001$), strength (F = -24.534, $P < 0.001$), optimism (F = -21.176, $P < 0.001$), and total psychological resilience (F = -24.501, $P < 0.001$), as well as on the measure of active coping

TABLE 1 | Social demographics and psychological assessments of people with depression and non-depression.

	Depressed group (n = 1,303)		Non-depressed group (n = 1,877)			
	n	**%**	***n***	**%**	***F***	***p***
Gender					6.649	0.01
Male	331	25.4	555	29.6		
Female	972	74.6	1,322	70.4		
Age					64.923	<0.001
<18	251	19.3	188	10.0		
18–55	1,010	77.5	1,573	83.8		
>55	42	3.2	116	6.2		
Education					31.125	<0.001
<12 years	401	30.8	423	22.5		
12–16 years	772	59.2	1,195	63.7		
>16 years	130	10.0	259	13.8		
Marital status					81.377	<0.001
Unmarried	573	44.0	494	26.3		
Married	665	51.0	1,288	68.6		
Others	65	5.0	95	5.1		
	Mean	**SD**	**Mean**	**SD**	**F/t**	***p***
Age	29.16	13.63	37.52	10.31	64.923	<0.001
SDS total score	67.95	11.17	42.43	6.21	82.341	<0.001
SAS total score	57.22	11.41	42.91	6.92	43.940	<0.001
CD-RISC Total score	54.12	19.27	72.82	15.01	−30.648	<0.001
Tenacity	26.74	10.37	36.10	8.57	−27.763	<0.001
Strength	19.12	6.61	25.48	5.03	−30.820	<0.001
Optimism	8.26	3.53	11.24	2.97	−25.727	<0.001
SCSQ						
Active coping	1.75	0.60	2.26	0.45	−27.426	<0.001
Passive coping	1.42	0.60	1.34	0.56	3.806	<0.001

SAS, Self-rating Anxiety Scale; SDS, Self-rating Depression Scale; CD-RISC, Connor-Davidson Resilience Scale; and SCSQ, Simplified Coping Style Questionnaire.

TABLE 2 | Social demographics and psychological assessments of people with anxiety and non-anxiety.

	Anxious group (*n* = 1,184)		Non-anxious group (*n* = 1,996)			
	n	**%**	***n***	**%**	***F***	***p***
Gender					0.056	0.814
Male	327	27.6	559	28.0		
Female	857	72.4	1,437	72.0		
Age					9.920	0.005
<18	185	15.6	254	12.7		
18–55	955	80.7	1,628	81.6		
>55	44	3.7	114	5.7		
Education					11.270	0.003
<12 years	346	29.2	478	23.9		
12–16 years	709	59.9	1,258	63.0		
>16 years	129	10.9	260	13.0		
Marital status					16.682	<0.001
Unmarried	464	39.2	603	30.2		
Married	655	55.3	1,298	65.0		
Others	65	5.5	95	4.8		
	Mean	**SD**	**Mean**	**SD**	**F/t**	***p***
Age	30.91	13.56	35.98	11.38	9.920	<0.001
SDS total score	65.78	14.32	45.23	9.48	48.623	<0.001
SAS total score	60.40	9.51	41.88	5.24	70.738	<0.001
CD-RISC Total score	55.20	19.81	71.07	16.26	−24.501	<0.001
Tenacity	27.29	10.69	35.21	9.04	−22.294	<0.001
Strength	19.50	6.74	24.88	5.49	−24.534	<0.001
Optimism	8.41	3.58	10.98	3.13	−21.176	<0.001
SCSQ						
Active coping	1.80	0.61	2.20	0.50	−20.419	<0.001
Passive coping	1.45	0.59	1.32	0.57	6.509	<0.001

SAS, Self-rating Anxiety Scale; SDS, Self-rating Depression Scale; CD-RISC, Connor-Davidson Resilience Scale; and SCSQ, Simplified Coping Style Questionnaire.

style (F = -20.419, $P < 0.001$), and higher scores on the measure of passive coping style ($F = 6.509$, $P < 0.001$; **Table 2**).

After controlling for age, sex, marital status, education, and SAS score, there were significant differences in tenacity scores ($F = 11.829$, $P < 0.001$), strength scores ($F = 21.455$, $P < 0.001$), optimism scores ($F = 31.908$, $P < 0.001$), CD-RISC total scores ($F = 7.688$, $P < 0.001$), active coping style scores ($F = 13.355$, $P < 0.001$), and passive coping style scores ($F = 3.358$, $P < 0.001$) between the two groups. These differences remained significant following Bonferroni correction (Bonferroni corrected P value cutoff < 0.006).

Factors Affecting Depression and Anxiety

Factors associated with membership in the depressed or anxious groups were next examined using binomial conditional logistic regressions. Sex, age, education, marital status, the psychological resilience subscales tenacity, strength, optimism, SAS score, SDS score, as well as the active coping and passive coping subscale scores were entered into the regression models. As shown in **Table 3**, the results demonstrated that being female, strength in CD-RISC and active coping styles remained protective factors of depression. However, passive coping styles and SAS score were risk factors for depression.

The logistic regression models for membership in the anxious group included optimism, passive coping style, and SDS total score (**Table 3**). The psychological resilience optimism subscale were protective factors for anxiety. In contrast, passive coping styles and SDS score were risk factors for anxiety.

DISCUSSION

The aim of this study was to investigate potential protective and risk factors for depression and anxiety among the public during the COVID-19 outbreak in mainland China. First, we found a 41.0% prevalence of significant depressive symptoms and 37.2% prevalence of significant anxiety symptoms in this population. Second, we found that female sex, strength of psychological resilience and active coping style were protective against depression, while passive coping style and anxiety severity (as measured by SAS score) were risk factors for depression. Similarly, optimism of psychological resilience was a protective factor for anxiety while passive coping style and depression severity (as measured by SDS scores) were risk factors.

TABLE 3 | Logistic regression analyses examining factors associated with depression and anxiety.

	B	SE	Wald	*P*	OR	95% C.I.	
Depression (χ^2 = 6.064; *P* = 0.640)						**Lower limit**	**Upper limit**
Female sex	−0.261	0.118	4.929	0.026	0.770	0.612	0.970
Strength	−0.079	0.011	48.170	0.000	0.924	0.903	0.945
Active coping style score	−0.983	0.133	54.429	0.000	0.374	0.288	0.486
Passive coping style score	0.293	0.098	8.999	0.003	1.340	1.107	1.623
SAS score	0.175	0.008	517.244	0.000	1.191	1.173	1.209
Constant	−5.444	0.447	148.290	0.000	0.004		
Anxiety (χ^2 = 6.347; *P* = 0.608)							
Optimism score	−0.041	0.017	5.939	0.015	0.960	0.928	0.992
Passive coping style score	0.483	0.092	27.614	0.000	1.621	1.354	1.941
SDS score	0.134	0.005	667.068	0.000	1.144	1.132	1.155
Constant	−8.061	0.385	438.107	0.000	0.000		

The high depression and anxiety symptom severity scores in our sample (52.89 ± 15.21 and 48.77 ± 11.45, respectively), and the high rate of participants who met criteria for significant depression or anxiety (41.0 and 37.2%, respectively), confirm the previous work suggesting high rates of psychological symptoms in the context of the pandemic (Li S. et al., 2020; Qiu et al., 2020). There are multiple reasons why psychological symptoms such as depression and anxiety might be elevated in the context of the COVID-19 pandemic. First, the ongoing focus on physical health and risk of infection might itself increase the level of depression and anxiety. Uncontrollable fears associated with the unpredictability of the behavior of the virus and the actual risk of infection could cause healthy people, or those with previous subclinical symptoms, to experience anxiety and/or depression when they would not otherwise be at risk of such problems (Torales et al., 2020). Second, the uncertainty and limitations on daily life caused by the pandemic, including, but not limited to, restricted movement, need to quarantine or self isolate, limited or absent contact with friends or loved ones, supply chain shortages, could also contribute to increased rates of psychological stress, including depression and anxiety.

We found that rates of depression and anxiety were higher for women than for men, consistent with previous findings (Xiaochuan et al., 2012). Interestingly, as has also been found previously, average psychological resilience scores were lower among women were lower than those for men. For example, Wang Cui Yan (Wang C. et al., 2020) have previously reported that women experience more significant psychological distress as well as higher levels of stress, anxiety, and depression, during the COVID-19 outbreak. Considering that women have multiple roles in society (mother, wife, and professional woman) and are also affected by physical factors, psychological factors and social factors, all of which may increase the risk of depression for women (Lifen et al., 2015). However, our logistic regression analyses suggested that it was female sex that was protective against depression. From the **Supplementary Table 1**, it can be seen that the scores of active coping styles of women are higher than those of men. Studies have shown that active emotional regulation can not only affect the relationship between depression level and cognitive bias, but also help patients to treat life events correctly and reduce cognitive bias through certain cognitive correction and treatment to enhance their correct coping concepts (Xue, 2020). which illustrates the importance of positive coping styles in reducing the risk of depression. This result is consistent with the fact that active coping style is a protective factor for depression.

We also found that older participants in our study (>55 years) reported less anxiety and depression than did younger participants (<18 years). This result is similar to that reported in another study (Wang Y. et al., 2020) in which anxiety rates were higher in age groups below 40 years and less in age groups above 40 years. From the **Supplementary Table 1**, Furthermore, the average score of each psychological resilience for older participants (>55 years) was higher than that for the younger group (<18 years). First of all, Beck's cognitive theory holds that cognitive dysfunction, as a potential and deep cognition, often affects the maintenance and development of depression. Psychological resilience can affect cognitive bias through multiple factors, and its intermediary role in the regulation of positive emotions reaches 55.18% (Xue, 2020). The authors of this study suggested that the elderly have more life experiences, which may lead to stronger psychological adjustment abilities when compared to younger people (<18 years). Another possibility is that the elderly may have limited access to acquire a constant flow of information in real time using the internet and smartphones (Yang et al., 2020), thus reducing excessive exposure to epidemic information, and subsequently reducing stressors that may trigger depression.

Finally, individuals with higher educational achievement had lower rates of anxiety and depression, as did married individuals compared with those who were unmarried. Under the impact of information flow, people with higher education years can judge more rationally and cope with the impact of the epidemic in a more reasonable way, so the level of depression and anxiety is lower. For married people, these findings are consistent with the hypothesis that increased access to resources, increased family support and external support systems may increase one's ability to effectively cope with the life changes and emotional instability

that is often engendered by the COVID-19 outbreak (Haoyuan et al., 2019). Individuals who have good social support may also have higher levels of positive emotions and enhanced social adaptability, and be more effective in alleviating psychological pressure, thereby reducing the risk of depression (Li et al., 2017). It indicated that the marriage problem of the unmarried was worth paying attention to.

Perhaps most importantly, the findings that active coping style and, in the case of anxiety, optimism, appears to be protective against the development of psychological symptomatology, independent of demographic factors, suggests potential intervention or prevention strategies. Although psychological resilience is considered to be an inherent trait, allowing individuals to pursue internal harmony and effectively adapt to changing environments in the context of life events or stressful situations (Li and Guang-rong, 2012), characteristics such as optimism can also be nurtured in individuals who may not inherently tend toward optimism. Similarly, active rather than passive coping styles can be modeled and practiced in the context of a psychotherapeutic or similar intervention.

At least one study has provided some evidence-based recommendations for boosting mental resilience can help to successfully deal with the coronavirus pandemic. We suggest that, in addition to providing information and increasing knowledge about actual risk related to COVID-19, focusing on promoting optimism and active coping styles among the public could serve to mitigate the negative mental health effects of this pandemic. Psychologists or other professionals could be called on to provide psychological education or other online interventions, aimed at increasing resilience and coping in the face of this and other potential public health emergencies. In addition, the provision of online psychological services and hotlines could provide rapid and easy-to-access counseling or intervention services for those members of the public who experience excessive stress responses or problematic or severe psychiatric symptoms (Liu S. et al., 2020).

Although this study has several strengths, including the large sample size, the assessment of potential protective and risk factors for psychological symptomatology, it also has some limitations. First, one of the limitations of this study is that the sample of the online epidemic survey is under-represented. For example, the elderly (>80 years) and a small part of rural people have limited access to internet services and smart phones (Yang et al., 2020). Therefore, although our research involves the public in multiple regions, the elderly in the sample, a small part of rural people are not involved. Second, the questionnaire was distributed at the peak of the outbreak. The trajectory of the pandemic and knowledge of the potential impact of the coronavirus have changed substantially since then, and symptom levels may have also changed accordingly. Responses to the survey may have been affected by many factors that were specific to the timeframe in which it was administered, such as the environment, mood, and understanding of the questionnaire items at that time. However, it is unlikely that the relationships between anxiety, depression, coping style and resilience will have changed, as these are not thought to be directly related to the pandemic itself. Third, the surveys were all completed using self-report questionnaires; assessments and assignment of diagnoses by psychological professionals were not feasible, and thus the relevance of these findings may be somewhat limited. This is offset somewhat by the fact that the research surveys were all submitted anonymously and the sample size was very large, potentially increasing the validity and robustness of the responses. Finally, the study was designed to be cross-sectional rather than longitudinal in nature, and regional differences throughout mainland China were not assessed for feasibility reasons. It is possible that rates of depression and anxiety in response to the COVID-19 pandemic may differ among people in different regions, as these regions also differ with regard to the severity of the epidemic and perhaps also to the response.

We also have limitations in the study. The results of other factors are not significant, but it cannot be concluded that only these factors contribute. In the future work, we can continue to expand the sample size to observe the related factors of depression and anxiety during the epidemic period.

That said, taken together, the findings of this study do indicate that, for the public in mainland China, female, strength, optimism and active coping styles may act as protective factors against the development of depression and anxiety. It follows then, that early, active, and effective targeted psychological intervention may improve mental health and coping skills in the context of an ongoing pandemic, and perhaps also for other, future external environmental changes or traumatic events (Li Z. et al., 2020). This would include providing online psychological services and/or hotlines for those experiencing excessive stress responses or problematic symptomatology, in addition to identifying resources (such as ways of increasing psychosocial support) that may reduce stressors on an individual basis. The development of online mental health services and psychological hotlines in China and elsewhere could become an important tool in emergency intervention measures for public health emergencies such as the COVID-19 crisis (Liu S. et al., 2020).

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

This study was approved by the Institutional Review Board of the affiliated Nanjing Brain Hospital of Nanjing Medical University. All procedures complied with the ethical standards of the latest version of the Helsinki Declaration.

AUTHOR CONTRIBUTIONS

XY and HY prepared the setting for online survey of the psychological scale. PZ, HM, CT, and HC

collected data. HO and JL for the scale issuance and quality control. SS analyzed the data of the survey and wrote the manuscript. CM, SN, NL, XZ, and NZ contributed for suggestions on revision after review of the manuscript. All authors contributed to the article and approved the submitted version.

FUNDING

This study was supported by the National Natural Science Foundation of China (81901390).

ACKNOWLEDGMENTS

We would like to thank every author all of their hard work and significant contributions toward the study. We would like to thank all the participants for their time and efforts.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.618509/full#supplementary-material

REFERENCES

Bao, Y., Sun, Y., Meng, S., Shi, J., and Lu, L. (2020). 2019-nCoV epidemic: address mental health care to empower society. *Lancet* 395, e37–e38. doi: 10.1016/s0140-6736(20)30309-3

Connor, K. M., and Davidson, J. R. (2003). Development of a new resilience scale: the Connor-Davidson Resilience Scale (CD-RISC). *Depress Anxiety* 18, 76–82. doi: 10.1002/da.10113

Ding, K.-q, Yi, B., and Chen, Y. (2020). Epidemic cluster of novel coronavirus disease 2019 in Ningbo city of Zhejiang province. *Chin. J. Public Health* 36, 498–502. doi: 10.11847/zgggws1129099

Duanwei, W., and Jingxuan, Z. (2014). Factor analysis of the simplified coping style questionnaire. *J. Shandong Univ. Health Sci.* 52, 96–100. doi: 10.6040/j.issn.1671-7554.0.2013.380

Ehrich, J., Mornane, A., and Powern, T. (2017). Psychometric validation of the 10-item Connor-Davidson Resilience Scale. *J Appl Meas* 18, 122–136.

Haoyuan, S., Zhen, H., Baoan, W., and Al, e (2019). The research of resilience and related factors in depression patients. *J. Int. Psychiatry* 46, 75–77+87.

Lee, E. E., Martin, A. S., Tu, X., Palmer, B. W., and Jeste, D. V. (2018). Childhood adversity and Schizophrenia: the protective role of resilience in mental and physical health and metabolic markers. *J. Clin. Psychiatry* 79:17m11776. doi: 10.4088/JCP.17m11776

Li, L., and Guang-rong, X. (2012). The psychosocial and biological mechanism of resilience. *Med. Philos.* 33, 32–33+36.

Li, M., Jiang, X., and Ren, Y. (2017). Mediator effects of positive emotions on social support and depression among adolescents suffering from mobile phone addiction. *Psychiatr. Danub.* 29, 207–213. doi: 10.24869/psyd.2017.207

Li, S., Wang, Y., Xue, J., Zhao, N., and Zhu, T. (2020). The impact of COVID-19 epidemic declaration on psychological consequences: a study on active Weibo users. *Int. J. Environ. Res. Public Health* 17:2032. doi: 10.3390/ijerph17062032

Li, W., Yang, Y., Liu, Z. H., Zhao, Y. J., Zhang, Q., Zhang, L., et al. (2020). Progression of mental health services during the COVID-19 outbreak in China. *Int. J. Biol. Sci.* 16, 1732–1738. doi: 10.7150/ijbs.45120

Li, Z., Ge, J., Yang, M., Feng, J., Qiao, M., Jiang, R., et al. (2020). Vicarious traumatization in the general public, members, and non-members of medical teams aiding in COVID-19 control. *Brain Behav. Immun.* 88, 916–919. doi: 10.1016/j.bbi.2020.03.007

Lifen, Z., Xian, Z., and Ying, T. (2015). Influencing factors of female depression. *Health Vocat. Educ.* 33, 125–127.

Liu, J. J., Bao, Y., Huang, X., Shi, J., and Lu, L. (2020). Mental health considerations for children quarantined because of COVID-19. *Lancet Child Adolesc. Health* 4, 347–349. doi: 10.1016/S2352-4642(20)30096-1

Liu, S., Yang, L., Zhang, C., Xiang, Y., Liu, Z., Hu, S., et al. (2020). Online mental health services in China during the COVID-19 outbreak. *Lancet Psychiatry* 7, e17–e18. doi: 10.1016/s2215-0366(20)30077-8

Qiu, J., Shen, B., Zhao, M., Wang, Z., Xie, B., and Xu, Y. (2020). A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: implications and policy recommendations. *Gen. Psychiatr.* 33:e100213. doi: 10.1136/gpsych-2020-100213

Quan-quan, D., and Li, S. (2012). Differential validity of SAS and SDS among psychiatric non-psychotic outpatients and their partners. *Chin. Ment. Health J.* 26, 676–679. doi: 10.3969/j.issn.1000-6729.2012.09.007

Sidheek, K. P. F., Satyanarayana, V. A., Sowmya, H. R., and Chandra, P. S. (2017). Using the Kannada version of the Connor Davidson Resilience Scale to assess resilience and its relationship with psychological distress among adolescent girls in Bangalore, India. *Asian J. Psychiatr.* 30, 169–172. doi: 10.1016/j.ajp.2017.10.015

Torales, J., O'Higgins, M., Castaldelli-Maia, J. M., and Ventriglio, A. (2020). The outbreak of COVID-19 coronavirus and its impact on global mental health. *Int. J. Soc. Psychiatry* 66, 317–320. doi: 10.1177/0020764020915212

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., et al. (2020). Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *Int. J. Environ. Res. Public Health* 17:1729. doi: 10.3390/ijerph17051729

Wang, Y., Di, Y., Ye, J., and Wei, W. (2020). Study on the public psychological states and its related factors during the outbreak of coronavirus disease 2019 (COVID-19) in some regions of China. *Psychol. Health Med.* 26, 13–22. doi: 10.1080/13548506.2020.1746817

Wei, L., Cai-di, Z., Jin-jing, L., Hui-juan, Z., Hui, W., Bi-xi, Y., et al. (2020). Psychological status among different populations during COVID-19 epidemic: a systematic review and meta-analysis. *J. Tongji Univ. Med. Sci.* 41, 1–8.

Xiaochuan, Z., Guixlng, J., and Xueyi, W. (2012). The relevant risk factors of female depression. *Chin. J. Health Psychol.* 20, 165–167.

Xiaoyang, D. (2011). *Changyong Xinli Pinggu Liangbiao Shouce*. Beijing: *PEOPLES MILITARY MEDICAL PRESS*.

Xue, L. (2020). *Clinical Study on the Influencing Factors of Cognitive Bias in Patients with Unipolar and Depression*. Changchun: China Academic Journal Electronic Publishing House.

Yang, Y., Li, W., Zhang, Q., Zhang, L., Cheung, T., and Xiang, Y.-T. (2020). Mental health services for older adults in China during the COVID-19 outbreak. *Lancet Psychiatry* 7:e19. doi: 10.1016/s2215-0366(20)30079-1

Ya-ning, X. (1998). Preliminary study on simple coping style scale reliability and validity. *Chin. J. Clin. Psychol.* 02, 53–54.

Yu, X., and Zhang, J. (2007). Factor analysis and psychometric evaluation of the Connor-Davidson Resilience Scale (CD-RISC) with Chinese people. *Soc. Behav. Pers. Int. J.* 35, 19–30. doi: 10.2224/sbp.2007.35.1.19

Zhengyu, W., and Yufen, C. (1984a). Self–rating depression scale,SDS. *Shanghai Arch. Psychiatry* 02, 71–72.

Zhengyu, W., and Yufen, C. (1984b). Self—rating anxiety scale,SAS. *Shanghai Arch. Psychiatry* 02, 73–74.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 04 March 2021
doi: 10.3389/fpsyg.2021.618105

Social Support, Attachment Closeness, and Self-Esteem Affect Depression in International Students in China

Yawen Li[1†], Fei Liang[2†], Qiuyue Xu[3†], Simeng Gu[4], Yansong Wang[3], Yang Li[5] and Zhi Zeng[1*]*

[1] School of Health Economics and Management, Nanjing University of Chinese Medicine, Nanjing, China, [2] Institute of Brain and Psychological Science, Sichuan Normal University, Chengdu, China, [3] School of Medicine, Nanjing University of Chinese Medicine, Nanjing, China, [4] Department of Psychology, Jiangsu University Medical School, Zhenjiang, China, [5] Department of Psychology, Nanjing Forest Police College, Nanjing, China

With an increase in the number of international students in China, there has been a simultaneous increase in their emotional problems, such as depression, as well as the importance of their emotional well-being. This study aimed to investigate the influence of social support on depression and the mediation and moderation mechanisms of this relationship in international students. In total, 349 international students in China responded to a questionnaire survey comprising the Social Support Rating Scale, Self-rating Depression Scale, Adult Attachment Scale, and Self-Esteem Scale. The results showed that: (1) attachment closeness had a significant direct predictive effect on depression; (2) attachment closeness played a mediating role in the relationship between social support and depression; and (3) the direct effect of social support on depression and the mediating effect of attachment and closeness are regulated by self-esteem. Therefore, interventions aimed at improving the social support, attachment closeness, and self-esteem of international students in China can be effective in reducing their depressive symptoms.

Keywords: social support, depression, attachment and closeness, self-esteem, international students in China

OPEN ACCESS

Edited by:
Fang Pan,
Shandong University, China

Reviewed by:
Jianhui Song,
University of Alberta, Canada
Huihua Deng,
Southeast University, China

****Correspondence:***
Simeng Gu
gsm_2007@126.com
Zhi Zeng
zengzhinju@163.com

† These authors have contributed equally to this work

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *16 October 2020*
Accepted: *28 January 2021*
Published: *04 March 2021*

Citation:
Li Y, Liang F, Xu Q, Gu S, Wang Y, Li Y and Zeng Z (2021) Social Support, Attachment Closeness, and Self-Esteem Affect Depression in International Students in China. Front. Psychol. 12:618105. doi: 10.3389/fpsyg.2021.618105

INTRODUCTION

As the influence of China's international education continues to increase, the number of international students coming to China has also increased significantly. With the upsurge in the number of international students, the problem of depression among this group has become increasingly prominent. At the same time, international students in China need to adapt to the Chinese environment. Specifically, such adaptation is even more important during the current times as we face the coronavirus disease 2019 (COVID-19) pandemic. During the COVID-19 pandemic, international students can only avoid depression if they adapt well to the Chinese environment and culture. Even under regular circumstances, international students are more prone to mental disorders (e.g., depression) and less motivated to seek psychological service than their domestic peers (Alharbi and Smith, 2018; Brunsting et al., 2018). In this scenario, finding ways to effectively control depressive symptoms in international students is related not only to

students' interests and well-being but also to the international image of China's higher education system and social stability. Therefore, we deemed that examining the unique mechanism that affects depressive symptoms in international students in China can be of considerable importance, since such knowledge can allow stakeholders to propose, develop, and apply effective intervention strategies to deal with this issue.

Depression is a psychological disorder, with several implications for physical health as well, that has been seriously damaging human health in modern society (Chong et al., 2020). Its main clinical symptoms include marked and persistent depressive emotions, which are usually caused by the sudden occurrence of major life-changing events or long-term nervous and unpleasant emotional experiences. Previous studies have found that depressive symptoms are a key issue affecting cross-cultural adaptation in international students (Smith and Khawaja, 2011; Schofield et al., 2016), and compared with local students, international students showed more severe depression (Liu et al., 2016). Accordingly, these severe symptoms may not only affect the social and academic activities of international students (Kernan et al., 2008; Orth et al., 2014) but also lead to suicidal thoughts and behaviors if they develop to a serious stage (Ross, 2010).

Depression is closely related to the social environment (Rutter, 2005; Lev-Ran et al., 2014), and social support is an important environmental factor. Previous studies have shown that positive social support cannot only enhance self-awareness and reduce psychological stress responses (Sarason et al., 1991) but also buffer the negative effects of stressful events (Chiang et al., 2018; Lau et al., 2018). Some studies have also found that social support levels are significantly related to depression severity. A high level of social support can hinder the occurrence of depression (Shen et al., 2019; Scott et al., 2020); contrarily, low social support may lead to continuous and severe depressive symptoms (Morris et al., 1991). Therefore, in the real world, social support can reduce depression (Tham et al., 2020). From a theoretical point of view, social support cannot only provide direct help but also provide emotional support for international students, thereby facilitating the increase of positive emotional experiences and indirectly protecting their physical and mental health. However, access to social support for international students is different than that for native students, mostly because they tend to not have easy access to family members or close relatives in a foreign land. To examine this process, we explored the influence of social support on depression and the underlying mechanisms of this relationship in international students residing in Jiangsu, China.

Attachment is defined as a secure emotional bond between people over time and space (Bowlby, 1969; Ainsworth, 1979). The importance of attachment in adulthood has also been recognized; adults too turn to their attachment figures in times of stress (Robles and Kane, 2014). Attachment closeness refers to people's perceived comfort when sharing intimacy with others (Collins and Read, 1990). It can be considered that attachment closeness may influence people's future social support levels. Exemplifying this empirically, studies have shown that individuals with low social support experience lower relationship satisfaction, more interpersonal conflicts, and have a higher risk of depression (Lakey and Orehek, 2011; Hames et al., 2013). Moreover, many studies have confirmed the relationship between depression and low attachment (Aderka et al., 2009; Morley and Moran, 2011). Accordingly, we assumed that attachment closeness plays a mediating role in the relationship between social support and depression in international students in our sample.

Self-esteem refers to experiences of self-respect and self-love that are generated by individuals based on self-evaluation, and it requires perceived respect from others, collective support, and societal approval to function. Additionally, self-esteem is an important psychological component of self-regulation (Mruk, 2006). People's self-esteem reflects their perceived self-worth and belief in their abilities; for example, a study showed that high self-esteem played an important role in improving psychological adaptability, protecting established relationships, and promoting mental health, whereas low self-esteem was closely related to various issues in interpersonal relationships, adaptation, and psychosomatic problems (Korrelboom et al., 2012). Given the protective effect of self-esteem on mental and physical development, it can be assumed that a low level of social support may influence depression to a diminished extent in individuals with high self-esteem. Therefore, we hypothesized that the mediating effect of attachment closeness is moderated by self-esteem; specifically, compared with individuals with low self-esteem, those with high self-esteem will present a weaker mediating effect.

To summarize, this study aimed to investigate the influence of social support on depression and the mediation and moderation mechanisms of this relationship for international students in China. Despite the bulk of literature on the relationship between depression, social support, attachment closeness, and self-esteem, most studies have only focused on the relationship between two of these variables; few studies have analyzed the relationship between multiple variables, especially regarding the underlying mechanisms of their relationships. We hypothesized that: (1) attachment closeness plays a mediating role in the influence of social support on depression; (2) the mediating effect of attachment closeness is regulated by self-esteem; and (3) the mediating effect is stronger in high self-esteem than in low self-esteem conditions. The hypothetical model is shown in **Figure 1**.

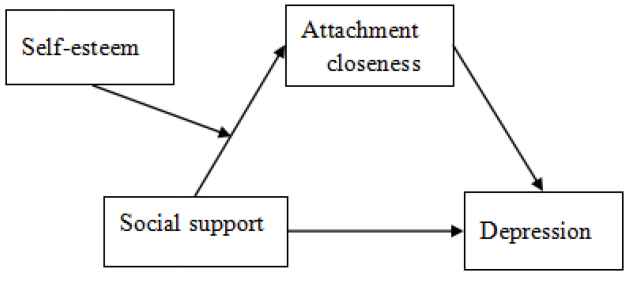


FIGURE 1 | Hypothetical model of the moderated mediation of self-esteem and attachment closeness for the relationship between social support and depression.

MATERIALS AND METHODS

Participants and Procedure

We used a paper-based questionnaire and a convenient sampling method to select international students from Nanjing University of Chinese Medicine and Jiangsu University. The questionnaires were distributed with the assistance of teachers in each institution and collected on the spot. We collected 396 questionnaires, among which 44 were invalid, resulting in a final sample of 349 valid questionnaires. The students' average age was 20.65 years (*SD* = 2.40); there were 183 (52.4%) men and 166 (47.6%) women. The study was approved by the ethics committee of Nanjing University of Chinese Medicine.

Measures

Self-Rating Depression Scale

We used the 20-item English version of the Self-rating Depression Scale (SDS), compiled by Zung (1965), to measure depression. It comprises four subscales: psycho-emotional symptoms, physical diseases, psychomotor disorders, and psychological symptoms of depression. Higher scores indicate greater depression severity. We conducted a confirmatory factor analysis of the questionnaire using Amos software, and the results were as follows: Goodness of Fit Index (GFI) = 0.950, Incremental Fit Index (IFI) = 0.956, Comparative Fit Index (CFI) = 0.954, Tucker-Lewis index (TLI) = 0.927, and Root Mean Square Error of Approximation (RMSEA) = 0.039. In this study, the Cronbach's α for the total scale was 0.768.

Social Support Rating Scale

We used the 10-item Social Support Rating Scale (SSRS), developed by Xiao (1994), to measure the degree of social support. It comprises three subscales: subjective support, objective support, and utilization of support. We conducted a confirmatory factor analysis of the questionnaire using Amos software, and the results were as follows: GFI = 0.973, IFI = 0.979, CFI = 0.978, Normed Fit Index (NFI) = 0.926, RMSEA = 0.033, and RMSEA = 0.039. In this study, the Cronbach's α was 0.695.

Adult Attachment Scale

We used the English version of the 18-item Adult Attachment Scale (AAS), compiled by Collins and Read (1990), to measure attachment type. It comprises three subscales: attachment closeness, attachment dependence, and attachment anxiety. We conducted a confirmatory factor analysis of the questionnaire using AMOS software, and the results were as follows: GFI = 0.954, IFI = 0.943, CFI = 0.939, TLI = 0.901, and RMSEA = 0.043. In this study, the Cronbach's α for the total scale was 0.628, and that for attachment closeness was 0.645.

Self-Esteem Scale

We used the English version of the 10-item Rosenberg Self-Esteem Scale (SES; Rosenberg, 1965) to measure self-esteem. It comprises two subscales: self-affirmation and self-denial. Higher scores represent higher self-esteem. We conducted a confirmatory factor analysis of the questionnaire using Amos software, and the results were as follows: GFI = 0.959, IFI = 0.935, CFI = 0.933, NFI = 0.911, and RMSEA = 0.085. In this study, the Cronbach's α for this scale was 0.710.

Statistical Analysis

We used SPSS 23.0 to perform descriptive statistics. Pearson correlation analysis was conducted, and Hayes SPSS macro program PROCESS was used to analyze the data. We also used Amos 22.0 to construct the structural equation model and test the bootstrap mediation effect. Due to the complexity of structural equation models, it is generally recommended to report detailed model fit indicators: absolute fit index GFI and RMSEA and relative fit index CFI, IFI, and CFI.

RESULTS

Common Method Biases

We employed the Harman single factor method and conducted the common method bias test. The results showed that there were 15 factors with eigenvalues greater than 1 and the first factor explained 11.57% of the variance; this was less than the critical standard of 40%. Thus, our results suggested that there was no serious common method bias in our data.

Correlation Analysis

Written informed consent was obtained before the experiments, and the study was approved by the committee of the ethnic board of Nanjing University of Chinese Medicine and the latest revision of the Declaration of Helsinki. With regard to the prevalence of depression, 99 (28.4%) out of the 349 students were mildly depressed, 94 (26.9%) were moderately depressed, 24 (6.9%) were severely depressed, and 132 (37.8%) were not depressed. According to past interviews, international students' depressive symptoms tend to change at 6 months; as in Lysgaard's U-curve theory, international students may face a cultural shock after a "honeymoon" period in a new country. This implies that international students residing in China for less than 6 months would have better psychological health than those residing for more than 6 months. Through this scheme, we tested the correlation between depression, social support, attachment closeness, and self-esteem (**Table 1**) and the mean and *SD* of all variables.

There was a significant negative correlation between depression and social support, between depression and attachment closeness, and between depression and self-esteem, and there was a significant positive correlation

TABLE 1 | Results of correlation analysis between all variables of interest.

Variables	Mean	*SD*	1	2	3	4
1. Depression	43.13	8.92	1			
2. Social support	33.99	6.20	−0.251**	1		
3. Attachment closeness	17.22	4.82	−0.198**	0.149**	1	
4. Self-esteem	29.98	5.35	−0.257**	0.116*	0.003	1

****P < 0.001 (two-tailed), **P < 0.01 (two-tailed), and *P < 0.05 (two-tailed).*

between social support and attachment closeness and between social support and self-esteem. Attachment closeness is not related to depression.

Construction of the Intermediary Model

The structural equation models of depression, social support, attachment closeness, and length of study abroad period are shown in **Figure 2**. The results yielded various fit indices: $x^2/df = 1.921$, GFI = 0.946, Adjusted Goodness of Fit Index (AGFI) = 0.920, IFI = 0.923, TLI = 0.901, CFI = 0.921, and RMSEA = 0.051. Thus, the proposed structural equation model showed a good fit for all indices, indicating that the model was reasonable and could be used.

Mediating Effect

The mediating effects of attachment closeness on the relationship between depression and social support are shown in **Table 2**. We used the bias-corrected non-parametric percentage bootstrap method to test this mediating effect. We calculated the 95% confidence interval (95% CI) and generated 5,000 repeat samples. The bias-corrected 95% CI for the direct effect was (−0.340, −0.049), and the percentile 95% CI was (−0.360, −0.059); namely, the results showed no zero value, indicating that there was a direct effect.

The bias-corrected 95% CI for the indirect effect was (−0.086, −0.005), and the percentile 95% CI was (−0.080, −0.002); namely, the results showed no zero value, indicating that there was an indirect effect. Accordingly, attachment closeness played a partial mediating role in the relationship between social support and depression. The direct (−0.150) and indirect effects (−0.032) accounted for 82.42 and 17.58% of the total effects (−0.182), respectively.

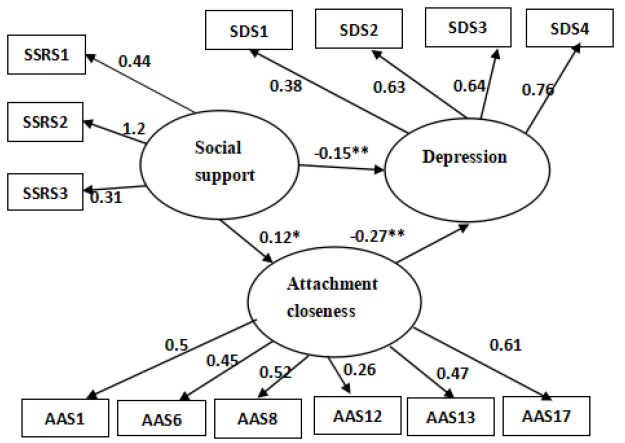


FIGURE 2 | Path diagram of the relationship between depression, social support, attachment closeness, and length of study abroad. The figure shows all the standardized path coefficients in the model. *$P < 0.05$ (two-tailed) and **$P < 0.01$ (two-tailed).

TABLE 2 | The standardized estimates based on the bootstrap tests.

	Effect size	Bias corrected (95% CI)	Percentile (95% CI)
Total effect	−0.182	(−0.265, −0.058)	(−0.268, −0.059)
Direct effect	−0.150	(−0.340, −0.049)	(−0.360, −0.059)
Indirect effect	−0.032	(−0.086, −0.005)	(−0.080, −0.002)

Moderating Effect

Regarding the moderating effect of self-esteem, the results showed that social support had a significant predictive effect on attachment closeness (β = 0.110, $P < 0.001$) and the interaction between social support and self-esteem had a significant effect on attachment closeness (β = 0.020, $P < 0.05$). The effect of social support on depression was significant (β = −0.325, $P < 0.001$), and the effect of attachment closeness on depression was also significant (β = −0.305, $P < 0.05$) (**Table 3**). Thus, we found that the moderated mediation model was supported, that is, the mediating effect of social support on depression was moderated by self-esteem.

To study the mediating effect value and 95% bootstrap confidence zone of attachment closeness under different self-esteem levels, we divided students based on their self-esteem scores into high, medium, and low self-esteem groups. To clarify the moderating effect of self-esteem, we conducted a simple slope test (Preacher et al., 2006). The results are illustrated in **Figure 3**. The results showed that, compared with students with low self-esteem, the predictive effect of social support on attachment closeness was enhanced in those with high self-esteem. We defined the cut-off points as follows: high self-esteem was defined as having a score higher than the average plus one standard deviation and low self-esteem was defined as having a score lower than the average minus one standard deviation. The 95% bootstrap CI of attachment closeness is shown in **Table 4**.

DISCUSSION

The Relationship Between Depression and Social Support

Our results showed that there was a significant negative correlation between social support and depression among international students in China; that is, the more social support they had, the less likely they were to become depressed. Conversely, those with low social support were more likely to feel uncomfortable with the Chinese/new environment and to have more severe depressive symptoms. These findings were consistent with previous studies on the effect of college students' social support on depression (Wang et al., 2014); for example, in one study, individuals with lower levels of social support were shown to be more likely to have depression (Reid et al., 2016). The authors of the current study have also conducted research on depression that produced results that concur with the current findings (Gu et al., 2019a,b; Zheng et al., 2019). Moreover, a recent report showed that there is a certain connection between depression and social support; specifically, individuals with less social support have more negative emotions (e.g., anxiety and depression). Together, these citations and our results underpin the fact that social support is closely related to depression, and that it plays a role in alleviating depression among international

TABLE 3 | Results of the moderating mediation model test.

Equation 1 (effect standard: attachment closeness)				Equation 1 (effect standard: depression)			
Variable	**β**	***SE***	***t***	**Variable**	**β**	***SE***	***t***
Social support	0.110	0.041	2.667***	Social support	−0.325	0.075	−4.363***
Self-esteem	−0.003	0.048	−0.065	Attachment closeness	−0.305	0.096	−3.173**
Social support × self-esteem	0.020	0.007	2.947**				
R^2		0.046				0.089	
F		5.591				16.986	

****P < 0.001 (two-tailed), **P < 0.01 (two-tailed), and *P < 0.05 (two-tailed).*

students. Since international students are far away from their homeland, family, and friends, their access to social support may be weakened, thereby making them more prone to depression.

The Mediating Role of Attachment

This study also showed that attachment closeness not only directly affects depression but also directly intermediates the impact of social support on depression; this result may provide new directions for future studies on coping with depression, among international students in China. In other words, international students with low attachment closeness are more likely to have depression due to the lack of social support. When the relationship between attachment and closeness in reality is not satisfactory, they are more likely to reduce depression through social support. Specifically, foreign students who had been in an environment with high levels of social support for a long time were more willing to come into contact with others and to establish close relationships; this could gradually increase attachment closeness, allow them to have an easier way to get along with people around them, and make it easier for them to adapt to the Chinese environment. Together, these factors may help reduce the risk for depression.

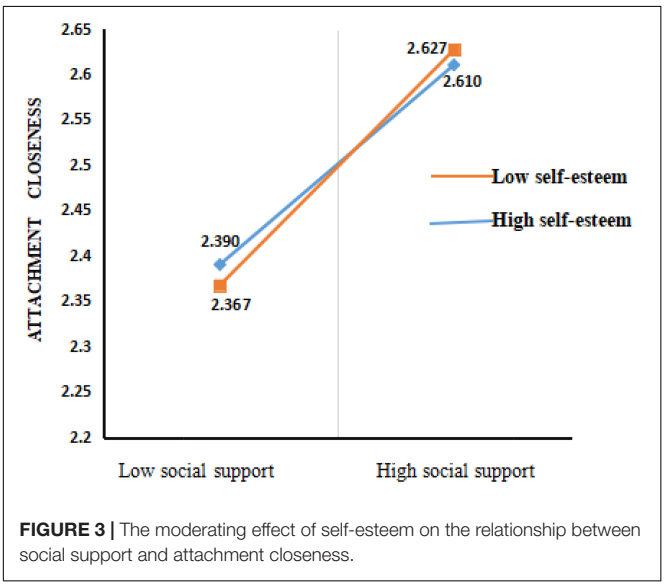


FIGURE 3 | The moderating effect of self-esteem on the relationship between social support and attachment closeness.

Our results highlight that attachment closeness can relieve depression to a certain extent, and that social support might affect depression through attachment closeness. Therefore, when international students in China suffer from depression, stakeholders should pay attention to their attachment and social support levels; moreover, when developing interventions aimed at training students' attachment closeness—which may improve students' social support, thereby allowing for alleviation of their depressive symptoms—stakeholders should first apply comprehensive assessment methodologies to analyze students' attachment issues.

To further explore the boundary value of the self-esteem moderation effect and the range of statistically different self-esteem values, we used the PROCESS program to carry out the Johnson–Neyman technique test; the results are shown in **Figure 4**. We found that when the value of self-esteem was greater than 28.793 in the 95% CI, the moderating effect was significant. Specifically, when the total score of self-esteem was less than this value, the moderating effect of self-esteem was significant.

TABLE 4 | The moderating effects of self-esteem on the mediation effect of attachment closeness.

Self-esteem level	Boot effect	Boot SE	Boot LLCI	Boot ULCI
M − *SD*	0.001	0.020	−0.046	0.035
M	−0.034	0.176	−0.791	−0.007
M + *SD*	−0.066	0.028	−0.136	−0.023

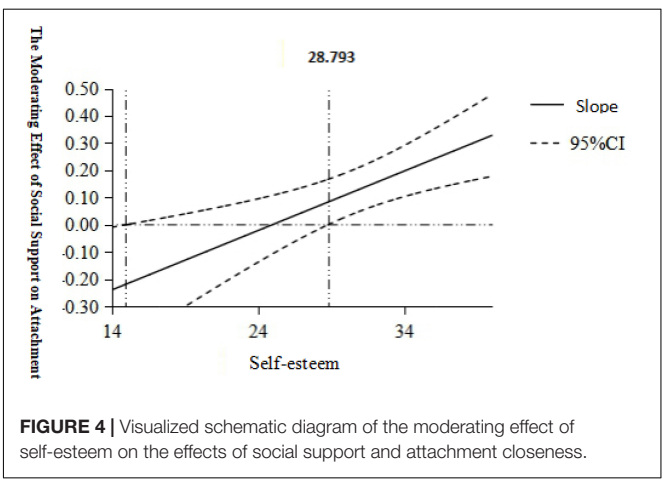


FIGURE 4 | Visualized schematic diagram of the moderating effect of self-esteem on the effects of social support and attachment closeness.

To conclude, our results denote that low social support can directly predict depression, and can also affect depression through the mediating effect of attachment closeness, in international students in China. Demonstrating this mediation model is significant because it shows that depression in this population is not only affected by internal (i.e., attachment closeness) but also affected by external factors (i.e., social support). Reflecting the ecological psychology theory, human behavior is the result of the interaction between individual internal and external factors.

The Moderating Effect of Self-Esteem

Previous studies have examined the relationship between self-esteem and depression (Sowislo and Orth, 2013; Li et al., 2019; Shen et al., 2019). Most studies on adult attachment are based on two dimensions of this construct, namely, attachment anxiety and avoidance, whereas there are few studies exploring the attachment closeness dimension (Valikhani et al., 2018). First, our results demonstrated that the direct effect of social support on depression and the mediating effect of attachment are regulated by self-esteem; then, further analyses showed that although self-esteem had a moderating effect on the first half of the pathway, it had an insignificant moderating effect on the second half (i.e., the interaction between self-esteem and social support). Moreover, our analyses showed that although moderate and high levels of self-esteem played an indirect role in the effect of social support on depression, low self-esteem did not affect the mediated relationship we analyzed.

Therefore, compared with individuals with low self-esteem, the mediating effect of attachment and closeness is stronger in international students with high self-esteem, which means that high self-esteem enhances the impact of depression. International students with high self-esteem are better able to cope with depression and take the initiative to adjust and relieve the problems caused by depressive symptoms, whereas international students with low self-esteem are more susceptible to depression and are, therefore, more likely to rely on the mediating role of attachment closeness to relieve depression. International students in China may be more prone to depression owing to having to deal concomitantly with cultural shock, new customs, and academic pressure. International students with high self-esteem can better cope with depressive emotions, and attachment closeness can have a certain buffer effect on the depressive symptoms of these students.

CONCLUSION

In this study, we proposed that attachment closeness would be a mediator in the relationship between social support and depression, and that this mediating effect would be moderated by self-esteem. In our results, the mediating effect was stronger in individuals with high self-esteem than in those with low self-esteem; therefore, this hypothesis was confirmed. To the best of our knowledge, this study is the first to demonstrate the moderating role of self-esteem for the mediation effect of attachment closeness in the relationship between social support and depression. Additionally, we found that if international students are exposed to environments in which they receive social support and feel comfortable, they may be more willing to establish good relationships with others and become attached to them; accordingly, such attachment may reduce depressive symptoms evoked by being away from their home and families, which may ultimately promote their physical and mental health. However, this study also has certain limitations. We did not inquire whether the students were in a relationship or were married; we did not investigate the cultural background of the foreign students in their home countries or their previous study abroad experience. Future studies should incorporate these variables in studying the relationship between depression and social support among international students in China.

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

YawL and SG designed the study. YawL, FL, and QX conducted the survey. YW, YanL, and ZZ analyzed the data. YawL, SG, and ZZ wrote the manuscript. All authors contributed to the article and approved the submitted version.

FUNDING

The manuscript was supported by the Layout Foundation of Humanities and Social Science from the Ministry of Education in China (19YJAZH083).

REFERENCES

Aderka, I. M., Weisman, O., Shahar, G., and Gilboa-Schechtman, E. (2009). The roles of the social rank and attachment systems in social anxiety. *Personal.* Individ. Differ. 47, 284–288. doi: 10.1016/j.paid.2009.03.014

Ainsworth, M. S. (1979). Infant-mother attachment. *Am. Psychol.* 34, 932–937.

Alharbi, E. S., and Smith, A. P. (2018). Review of the literature on stress and wellbeing of international students in english-speaking countries. *IES* 11:22. doi: 10.5539/ies.v11n6p22

Bowlby, J. (1969). *Attachment: Attachment and Loss*, Vol. 1. New York, NY: Basic Books.

Brunsting, N. C., Zachry, C., and Takeuchi, R. (2018). Predictors of undergraduate international student psychosocial adjustment to US universities: a systematic review from 2009- 2018. *Int. J. Intercult. Relat.* 66, 22–33. doi: 10.1016/j.ijintrel.2018.06.002

Chiang, J. J., Chen, E., and Miller, G. E. (2018). Midlife self-reported social support as a buffer against premature mortality risks associated with childhood abuse. *Nat. Hum. Behav.* 2, 261–268. doi: 10.1038/s41562-018-0316-5

Chong, P. S., Fung, M. L., Wong, K. H., and Lim, L. W. (2020). Therapeutic potential of *Hericium erinaceus* for depressive disorder. *Int. J. Mol. Sci.* 21:163. doi: 10.3390/ijms21010163

Collins, N. L., and Read, S. J. (1990). Adult attachment, working models, and relationship quality in dating couples. *J. Pers. Soc. Psychol.* 58, 644–683. doi: 10.1037/0022-3514.58.4.644

Gu, S., Wang, F., Cao, C., Wu, E., Tang, Y. Y., and Huang, J. H. (2019b). An integrative way for studying neural basis of basic emotions with fMRI. *Front. Neurosci.* 13:628. doi: 10.3389/fnins.2019.00628

Gu, S., Wang, F., Patel, N. P., Bourgeois, J. A., and Huang, J. H. (2019a). A model for basic emotions using observation of behavior in *Drosophila*. *Front. Psychol.* 10:781. doi: 10.3389/fpsyg.2019.00781

Hames, J. L., Hagan, C. R., and Joiner, T. E. (2013). Interpersonal processes in depression. *Annu. Rev. Clin. Psychol.* 9, 355–377. doi: 10.1146/annurev-clinpsy-050212-185553

Kernan, W. D., Wheat, M. E., and Lerner, B. A. (2008). Linking learning and health: a pilot study of medical students' perceptions of the academic impact of various health issues. *Acad. Psychiatry* 32, 61–64. doi: 10.1176/appi.ap.32.1.61

Korrelboom, K., Maarsingh, M., and Huijbrechts, I. (2012). Competitive memory training (COMET) for treating low self-esteem in patients with depressive disorders: a randomized clinical trial. *Depress. Anxiety* 29, 102–110. doi: 10.1002/da.20921

Lakey, B., and Orehek, E. (2011). Relational regulation theory: a new approach to explain the link between perceived social support and mental health. *Psychol. Rev.* 118, 482–495. doi: 10.1037/a0023477

Lau, E. Y. H., Chan, K. K. S., and Lam, C. B. (2018). Social support and adjustment outcomes of first-year university students in Hong Kong: self-esteem as a mediator. *J. Coll. Stud. Dev.* 59, 129–134. doi: 10.1353/csd.2018.0011

Lev-Ran, S., Roerecke, M., Le Foll, B., George, T. P., McKenzie, K., and Rehm, J. (2014). The association between cannabis use and depression: a systematic review and meta-analysis of longitudinal studies. *Psychol. Med.* 44, 797–810. doi: 10.1017/S0033291713001438

Li, C., Liu, D., and Dong, Y. (2019). Self-esteem and problematic smartphone use among adolescents: a moderated mediation model of depression and interpersonal trust. *Front. Psychol.* 10:2872. doi: 10.3389/fpsyg.2019.02872

Liu, Y., Chen, X., Li, S., Yu, B., Wang, Y., and Yan, H. (2016). Path analysis of acculturation stress components and their relationship with depression among international students in China. *Stress Health* 32, 524–532. doi: 10.1002/smi.2658

Morley, T. E., and Moran, G. (2011). The origins of cognitive vulnerability in early childhood: mechanisms linking early attachment to later depression. *Clin. Psychol. Rev.* 31, 1071–1082. doi: 10.1016/j.cpr.2011.06.006

Morris, P. L., Robinson, R. G., Raphael, B., and Bishop, D. (1991). The relationship between the perception of social support and post-stroke depression in hospitalized patients. *Psychiatry* 54, 306–316. doi: 10.1080/00332747.1991.11024559

Mruk, C. J. (2006). *Self-Esteem Research, Theory, and Practice: Toward a Positive Psychology of Self-Esteem*, 3rd Edn. New York, NY: Springer Publishing Company.

Orth, U., Robins, R. W., Widaman, K. F., and Conger, R. D. (2014). Is low self-esteem a risk factor for depression? Findings from a longitudinal study of Mexican-origin youth. *Dev. Psychol.* 50, 622–633. doi: 10.1037/a0033817

Preacher, K. J., Curran, P. J., and Bauer, D. J. (2006). Computational tools for probing interactions in multiple linear regression, multilevel modeling, and latent curve analysis. *J. Educ. Behav. Stat.* 31, 437–448. doi: 10.3102/10769986031004437

Reid, G. M., Holt, M. K., Bowman, C. E., Espelage, D. L., and Green, J. G. (2016). Perceived social support and mental health among first-year college students with histories of bullying victimization. *J. Child Fam. Stud.* 25, 3331–3341. doi: 10.1007/s10826-016-0477-7

Robles, T. F., and Kane, H. S. (2014). The attachment system and physiology in adulthood: normative processes, individual differences, and implications for health. *J. Pers.* 82, 515–527. doi: 10.1111/jopy.12052

Rosenberg, M. (1965). *Society and the Adolescent Self-Image*. Princeton, NJ: Princeton University Press.

Ross, S. M. (2010). Mild to moderate depression: a complementary and integrative therapies approach. *Holist. Nurs. Pract.* 24, 303–309. doi: 10.1097/HNP.0b013e3181f103e4

Rutter, M. (2005). How the environment affects mental health. *Br. J. Psychiatry* 186, 4–6. doi: 10.1192/bjp.186.1.4

Sarason, B. R., Pierce, G. R., Shearin, E. N., Sarason, I. G., Waltz, J. A., and Poppe, L. (1991). Perceived social support and working models of self and actual others. *J. Pers. Soc. Psychol.* 60, 273–287. doi: 10.1037/0022-3514.60.2.273

Schofield, M. J., O'Halloran, P., Mclean, S. A., Forrester-Knauss, C., and Paxton, S. J. (2016). Depressive symptoms among Australian university students: Who is at risk? *Aust. Psychol* 51, 135–144. doi: 10.1111/ap.12129

Scott, H. R., Pitman, A., Kozhuharova, P., and Loyd-Evans, B. L. (2020). A systematic review of studies describing the influence of informal social support on psychological wellbeing in people bereaved by sudden or violent causes of death. *BMC Psychiatry* 20:265. doi: 10.1186/s12888-020-02639-4

Shen, Q., Shi, Y., Zhang, S., Tsamlag, L., Wang, H., Chang, R., et al. (2019). How involuntary subordination and social support influence the association between self-esteem and depression: a moderated mediation model. *BMC Psychiatry* 19:390. doi: 10.1186/s12888-019-2330-1

Smith, R. A., and Khawaja, N. G. (2011). A review of the acculturation experiences of international students. *Int. J. Int. Relat.* 35, 699–713. doi: 10.1016/j.ijintrel.2011.08.004

Sowislo, J. F., and Orth, U. (2013). Does low self-esteem predict depression and anxiety? A meta-analysis of longitudinal studies. *Psychol. Bull.* 139, 213–240. doi: 10.1037/a0028931

Tham, S. M., Ellithorpe, M. E., and Meshi, D. (2020). Real-world social support but not in-game social support is related to reduced depression and anxiety associated with problematic gaming. *Addict. Behav.* 106:106377. doi: 10.1016/j.addbeh.2020.106377

Valikhani, A., Abbasi, Z., Radman, E., Goodarzi, M. A., and Moustafa, A. A. (2018). Insecure attachment and subclinical depression, anxiety, and stress: a three-dimensional model of personality self-regulation as a mediator. *J. Psychol.* 152, 548–572. doi: 10.1080/00223980.2018.1468727

Wang, X., Cai, L., Qian, J., and Peng, J. (2014). Social support moderates stress effects on depression. *Int. J. Ment. Health Syst.* 8:41. doi: 10.1186/1752-4458-8-41

Xiao, S. Y. (1994). Theoretical basis and research applications of Social Support Rating Scale (SSRS). *J. Clin. Psychiatry* 4, 98–100.

Zheng, Z., Han, W., Li, Y., Wand, D., Gu, S., and Wang, F. (2019). The mediating role of coping style in the relationship between depression and disordered eating among Chinese female undergraduates. *Front. Psychol.* 10:3011. doi: 10.3389/fpsyg.2019.03011

Zung, W. W. (1965). A self-rating depression scale. *Arch. Gen. Psychiatry* 12, 63–70. doi: 10.1001/archpsyc.1965.01720310065008

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

BRIEF RESEARCH REPORT
published: 24 March 2021
doi: 10.3389/fpsyg.2021.631979

Maladaptive Daydreaming in an Adult Italian Population During the COVID-19 Lockdown

Alessandro Musetti[1†], Christian Franceschini[2*†], Luca Pingani[3], Maria Francesca Freda[4], Emanuela Saita[5], Elena Vegni[6], Corrado Zenesini[7], Maria Catena Quattropani[8], Vittorio Lenzo[9], Giorgia Margherita[4], Daniela Lemmo[4], Paola Corsano[1], Lidia Borghi[6], Roberto Cattivelli[5,10], Giuseppe Plazzi[3,7], Gianluca Castelnuovo[5,10], Eli Somer[11] and Adriano Schimmenti[12]*

[1] Department of Humanities, Social Sciences and Cultural Industries, University of Parma, Parma, Italy, [2] Department of Medicine and Surgery, University of Parma, Parma, Italy, [3] Department of Biomedical, Metabolic and Neural Sciences, University of Modena and Reggio Emilia, Modena, Italy, [4] Department of Humanities, University of Naples Federico II, Naples, Italy, [5] Department of Psychology, Catholic University of the Sacred Heart, Milan, Italy, [6] Department of Health Sciences, Faculty of Medicine and Surgery, University of Milan, Milan, Italy, [7] IRCCS Institute of Neurological Sciences of Bologna (ISNB), Bologna, Italy, [8] Department of Clinical and Experimental Medicine, University of Messina, Messina, Italy, [9] Dipartimento di Scienze della Società e della Formazione d'Area Mediterranea, Università per Stranieri Dante Alighieri, Reggio Calabria, Italy, [10] Istituto Auxologico Italiano IRCCS, Psychology Research Laboratory, Milan, Italy, [11] Faculty of Social Welfare and Health Sciences, School of Social Work, University of Haifa, Haifa, Israel, [12] Faculty of Human and Society Sciences, Kore University of Enna, Enna, Italy

During the COVID-19 outbreak, individuals with or without mental disorders may resort to dysfunctional psychological strategies that could trigger or heighten their emotional distress. The current study aims to explore the links between maladaptive daydreaming (MD, i.e., a compulsive fantasy activity associated with distress and psychological impairment), psychological symptoms of depression, anxiety, and negative stress, and COVID-19-related variables, such as changes in face-to-face and online relationships, during the COVID-19 lockdown in Italy. A total of 6,277 Italian adults completed an online survey, including socio-demographic variables, COVID-19 related information, the 16-item Maladaptive Daydreaming Scale (MDS-16), and Depression, Anxiety, and Stress Scales-21 Items (DASS-21). Based on an empirically derived cut-off score, 1,082 participants (17.2%) were identified as probable maladaptive daydreamers (MDers). A binary logistic regression revealed that compared to controls, probable MDers reported that during the COVID-19 lockdown they experienced higher levels of anxiety and depression, decreased online social relationships, and, surprisingly, stable or increased face-to-face social relationships. Given the peculiar characteristics of the pandemic context, these findings suggest that the exposure to the risk of contagion had probably exacerbated the tendency of probable MDers to lock themselves inside their mental fantasy worlds, which in turn may have contributed to further estrangement from online social relationships and support, thus worsening their emotional distress.

Keywords: maladaptive daydreaming, depression, anxiety, stress, COVID-19

OPEN ACCESS

Edited by:
Yi-Yuan Tang,
Texas Tech University, United States

Reviewed by:
Erika Limoncin,
University of Rome Tor Vergata, Italy
Chiara Cerami,
University Institute of Higher Studies in Pavia, Italy

***Correspondence:**
Alessandro Musetti
alessandro.musetti@unipr.it
Christian Franceschini
christian.franceschini@unipr.it

†These authors share first authorship

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *21 November 2020*
Accepted: *25 February 2021*
Published: *24 March 2021*

Citation:
Musetti A, Franceschini C, Pingani L, Freda MF, Saita E, Vegni E, Zenesini C, Quattropani MC, Lenzo V, Margherita G, Lemmo D, Corsano P, Borghi L, Cattivelli R, Plazzi G, Castelnuovo G, Somer E and Schimmenti A (2021) Maladaptive Daydreaming in an Adult Italian Population During the COVID-19 Lockdown. Front. Psychol. 12:631979. doi: 10.3389/fpsyg.2021.631979

INTRODUCTION

The new coronavirus SARS-CoV-2 and its related syndrome, named COVID-19 by the World Health Organization (WHO), has evolved into a global health threat. In the early months of 2020, the infection showed extreme virulence (She et al., 2020), rapidly spreading from the city of Wuhan to most countries in the world. Subsequently, Italy became one of the major COVID-19 hotspots. On March 9th, 2020, the Italian Prime Minister announced a government lockdown decree featuring the slogan "I stay at home" (Italian Ministry of Health, 2020). The new regulations employed pandemic control policies based on social distancing aimed to minimize contacts with potentially infected individuals. However, while domestic lockdown may have helped to control the physical health emergency (Muggeo et al., 2020), the experience of forced isolation severely impaired people's social and economic well-being, resulting in a negative mental health impact (Marazziti, 2020) because of increased loneliness and anxiety (Schimmenti et al., 2020a). As described by Brooks et al. (2020), the psychological impact of prolonged quarantine included post-traumatic stress symptoms, confusion, and anger determined by the duration of lockdown, fear of infection, feelings of frustration and tedium, inadequate availability of supplies, inconsistent information, financial loss, and stigma.

Although the psychological impact of COVID-19 is not yet fully understood, the available empirical literature has provided some important clues. For instance, a prevalence of moderate to severe depression, anxiety, and stress levels ranging from 8.1% (for stress) to 28.8% (for anxiety) (Wang et al., 2020a), and no decrease in psychological symptoms 4 weeks after the initial outbreak (Wang et al., 2020b) were found in the Chinese population. Similar results were found in the Italian context, showing high levels of psychological distress experienced in the Italian population during the COVID-19 outbreak (Colizzi et al., 2020; Favieri et al., 2020; Mazza et al., 2020; Moccia et al., 2020; Schimmenti et al., 2020b). Moreover, a large-sample cross-sectional study by Rossi et al. (2020) on 18,147 individuals showed a high prevalence of negative mental health outcomes in the general Italian population, with elevated rates of post-traumatic stress symptoms (37%) (17.3%), anxiety (20.8%), insomnia (7.3%), high perceived stress (21.8%), and adjustment disorders (22.9%). However, it is important to consider that in the first phase of the COVID-19 outbreak (the most critical phase of this pandemic), the restrictive measures adopted in Italy were extreme and unprecedented, unlike other European and non-European countries. Specifically, the PsyCOVID longitudinal study by Cerami et al. (2020) showed that individuals living in Northern Italy—the area most affected by the COVID-19 epidemic in the whole of Europe—reported more detrimental effects on health due to the outbreak than individuals living in the Central and Southern regions. Furthermore, as highlighted by the same authors, increased levels of distress and loneliness associated with social isolation and the profound destabilization of life, may exacerbate the risk of mental health problems, even in the general population. It is plausible, therefore, that under the threat of a highly contagious and untreatable disease, maladaptive psychological strategies may develop in healthy individuals, as well as aggravate the pre-existing psychiatric conditions (Mucci et al., 2020). For example, recent evidence has shown that to ease COVID-19-related distress individuals were more prone to using psychoactive substances and engage in potentially addictive behaviors, such as social networking, surfing the Internet, and gaming (King et al., 2020; Mestre-Bach et al., 2020). Furthermore, Seçer and Ulaş (2020) showed that COVID-19-related avoidance responses, such as distraction or denial, may play a pivotal role in the development and maintenance of negative psychological outcomes. People in quarantine may also be more prone to employing mental escapism in response to a distressful external reality, by becoming absorbed in their inner worlds (Mucci et al., 2020).

A growing body of literature deals with a newly emerging absorption disorder, known as maladaptive daydreaming (MD) and conceptualized as a dysfunctional form of imaginative involvement, defined as "extensive fantasy activity that replaces human interaction and/or interferes with academic, interpersonal, or vocational functioning" (Somer, 2002, p. 199). In the first seminal work on six maladaptive daydreamers (MDers) (Somer, 2002), the central MD themes included a description of captivity, rescue and escape, and idealized self. MDers can spend hours completely absorbed in vivid and highly structured fantasies experiencing a high sense of presence in the daydream (Somer et al., 2016a), often engaging in stereotypical movements, such as swinging, or pacing to facilitate their absorption in fantasy (Bigelsen and Schupak, 2011; Somer et al., 2016b). Although daydreaming is a widespread (Singer, 1966; Klinger, 1990) and normal mental experience (Killingsworth and Gilbert, 2010; Bigelsen et al., 2016), MD is a clinical phenomenon in which an individual is extensively, often compulsively, absorbed in an internal fantasy world that is associated with impairment in a variety of important areas of functioning (Somer et al., 2017a).

Given the association with adverse childhood experiences, Somer initially theorized that MD is a coping strategy gone awry, originally aimed at attenuating feelings of emotional pain and loneliness, and mentally escaping from adverse environments (2002; Somer and Herscu, 2017). Although daydreaming could be a pleasant activity, as a coping strategy it is dysfunctional because it can generate a vicious cycle of social isolation and distress, which in turn may further increase the need to self-soothe by daydreaming (Bigelsen and Schupak, 2011). Growing evidence indicates that MD is a valid, reliable, and distinct clinical construct characterized by repeated unsuccessful efforts to control fantasy activity, intense shame, and exhaustive efforts to conceal this behavior, which leads to impairment in social, family, and work-related activities (Somer et al., 2017b). Since these clinical features resemble those observed in addictive behaviors, MD has been nosographically framed by some authors as a behavioral addiction (Somer et al., 2016b; Pietkiewicz et al., 2018; Schimmenti et al., 2020c; Soffer-Dudek et al., 2020).

The abnormality of MD is evident by its comorbidity with other psychiatric conditions and with global psychopathology (Bigelsen et al., 2016; Somer and Herscu, 2017; Somer et al., 2017a; Soffer-Dudek and Somer, 2018; Schimmenti et al., 2020c).

The most frequent comorbid DSM-5 disorders are attention-deficit hyperactivity disorder, anxiety disorders, depressive disorder, obsessive-compulsive or related disorder (Somer et al., 2017a). Specifically, many MDers with anxiety and depression were more likely to engage in MD as a means to flee from their unpleasant circumstances (Somer, 2002; Alenizi et al., 2020). Conversely, comorbidity with psychosis was rare. Despite the serious clinical manifestations of MD, reality testing among MDers remained intact as they reported an intact ability to distinguish between fantasy and reality (Bigelsen and Schupak, 2011; Schimmenti et al., 2019).

As for etiopathogenesis, Soffer-Dudek and Somer (2018) proposed a stress-diathesis model for MD, in which individuals who have an innate predisposition to immerse themselves in an internal fantasy world may become MDers if they are exposed to stressful or traumatic life events. In line with this perspective, several studies have suggested that individuals are likely to take shelter in comforting daydreams in the context of stressful circumstances and mental pain (e.g., Greenwald and Harder, 1994, 2003). Importantly, beyond traumatic life events, current social isolation has also been indicated as one of the most relevant factors affecting the development and maintenance of MD (Somer et al., 2016b; Somer and Herscu, 2017). Again, a circular dynamic is triggered: MDers frequently report childhood aloneness as a prelude to their immersion in their compensatory inner world, which in turn exacerbates their isolation from the real social world (Somer et al., 2016b). Hence, considering that social isolation might represent an important risk factor for MD, the COVID-19 lockdown is an unprecedented model with which to examine the interrelationships between MD and psychopathological symptoms in real-time.

The current report aims to explore the relationships between MD, psychological symptoms (depression, anxiety, and negative stress), and COVID-19-related variables (e.g., changes in face-to-face and online relationships) in a large sample of Italian adults from 10th March to 4th May 2020, the first COVID-19 lockdown period in Italy employed during an unprecedented mass disaster. In view of the reviewed literature, we expected a pattern of positive associations between decreased face-to-face and online social relationships, and MD as well as between psychological symptom levels and MD.

MATERIALS AND METHODS

Participants

We circulated a call for research participants in several Italian universities. We surveyed an online convenience sample of 6,277 participants (1,685 males, 26.8%; 4,592 females, 73.2%) aged from 18 to 82 years ($M = 33.62$ years, $SD = 13.46$). All the questions were mandatory, and so there were no missing cases. The socio-demographic characteristics of the sample are described in **Tables 1A,B**.

Procedures

This study is part of a larger research project named "Resilience and the COVID-19: reacting to perceived stress. Effects on sleep quality and diurnal behavior/thoughts." The first data from the larger survey were published elsewhere (Franceschini et al., 2020; Lenzo et al., 2020). Ethical clearance was obtained from the Ethics Committee of the Center for Research and Psychological Intervention (CERIP) of the University of Messina. The study adhered to the Ethical Code of the Italian Association of Psychology (AIP) and the American Psychological Association (APA). The inclusion criteria were being an adult (i.e., at least 18 years old), being an Italian speaker, and living in Italy during the COVID-19 lockdown. Participants provided informed consent and completed an anonymous questionnaire that addressed socio-demographic information, COVID-19-related data, maladaptive daydreaming, and psychopathological symptoms (depression, anxiety, and negative stress). Anonymity was guaranteed, as no data on the participants' identification, or their Internet Protocol address, were collected. Participants did not receive any fee for their involvement in the study.

Measures

Socio-Demographics

To obtain a profile of the respondents' demographic features we asked about age, gender, education level, occupation, marital status, having children, number of family members, employment, house size, having a garden, and area of residence.

The Maladaptive Daydreaming Scale (MDS–16)

The 16-item Maladaptive Daydreaming Scale (MDS–16; Somer et al., 2016c; Italian version by Schimmenti et al., 2020c) was used to measure the degree of maladaptive daydreaming among participants. The Italian version of the MDS–16 includes two subscales: Interference with life (8 items, e.g., "Some people experience difficulties in controlling or limiting their daydreaming. How difficult has it been for you to keep your daydreaming under control?") and Somato-sensory retreat (8 items, e.g., "Some people notice that certain music can trigger their daydreaming. To what extent does music activate your daydreaming?"; see **Supplementary Table 1** for the questionnaire). Participants were asked to respond to each item on an 11-point Likert-type scale ranging from 0% (*never/none of the time*) to 100% (*extremely frequent/all of the time*), with 10% increments. There are no reversed items. Overall MDS-16 scores are the average of each item, with higher scores indicating higher levels of MD. Scores of 51 or above (Schimmenti et al., 2020c) have been used to discriminate between MDers and non-MDers with excellent sensitivity (90.37%). The MDS-16 showed excellent psychometric properties not only in the Italian version of the instrument (Schimmenti et al., 2020c), but also in the English (Somer et al., 2016c), Hebrew (Jopp et al., 2019), and Arabic (Abu-Rayya et al., 2020), and Hungarian versions (Sándor et al., 2020). In the present study, Cronbach's alpha was 0.92.

The Depression Anxiety Stress Scale-21 (DASS-21)

The short form of the Depression, Anxiety, and Stress Scale-21 Items (DASS-21—Lovibond and Lovibond, 1995; Italian version by Bottesi et al., 2015) was used to assess the psychological symptoms among participants. The DASS-21 is a self-report tool in which participants rate the frequency and the severity of depression (e.g., "I felt that life was meaningless"), anxiety

TABLE 1 | Socio-demographic characteristics the participants.

A	
	N = 6,277
Demographic data	
Gender, n (%)	
Males	1,685 (26.8)
Females	4,592 (73.2)
Age (years old), n (%)	
18–25	2,538 (40.4)
26–30	1,019 (16.2)
31–40	902 (14.4)
41–50	771 (12.3)
51–60	806 (12.8)
>60	241 (3.8)
Education level, n (%)	
Elementary/Middle school	213 (3.4)
High school	2,948 (47.0)
Bachelor's degree	1,191 (19.0)
Master's degree	1,418 (22.6)
Doctoral degree	507 (8.1)
Marital status, n (%)	
Single	2,192 (34.9)
Married or re-married	1,581 (25.2)
Cohabitant	577 (9.2)
In a relationship	1,645 (26.2)
Divorced/separated/widowed	282 (4.5)
Children (yes), n (%)	
Yes	1,797 (28.6)
No	4,480 (71.4)
Number of people with whom the participant lived with during the lockdown, n (%)	
0	461 (7.3)
1	1,345 (21.4)
2	1,531 (24.4)
3	1,885 (30.0)
4	802 (12.8)
5+	253 (4.0)
Occupation, n (%)	
Retired	114 (1.8)
Student	1,803 (28.7)
Working student	830 (13.2)
Healthcare employee (public/private)	360 (5.7)
Police/military	52 (0.8)
Artisan, laborer, farmer	100 (1.6)
Employee/manager/owner of business activity	587 (9.4)
Employee/manager/owner of industrial activity	394 (6.3)
Intellectual profession	521 (8.3)
Unemployed/searching	287 (4.6)
Office executive job	32 (0.5)
Technical profession	317 (5.1)
Unskilled job	776 (12.4)
Other	104 (1.6)
Job loss during the lockdown	
Yes	2,963 (47.2)
No	3,314 (52.8)
Work in direct contact with the public during the lockdown	
Yes	3,993 (63.6)
No	2,284 (36.4)
Residence area	
North	4,239 (65.5)
Centre	457 (7.3)
South	1,581 (25.2)
B	
	N = 6,277
COVID-19 related data	
COVID-19 positive, n (%)	
No	6,029 (96.0)
Yes	48 (0.8)
Had symptoms but no swab test	88 (1.4)
No answer/other	85 (1.4)
Forced quarantine, n (%)	
No	5,725 (91.2)
Yes	532 (8.5)
No answer	20 (0.3)
Someone close positive, n (%)	
Yes	924 (14.7)
No	5,353 (85.3)
Someone close died, n (%)	
Yes	412 (6.6)
No	5,865 (93.4)
Changes in face-to-face relationships, n (%)	
Decreased	5,526 (88.0)
Stable	347 (5.5)
Increased	404 (6.4)
Changes in online relationships, n (%)	
Decreased	334 (5.3)
Stable	1,975 (31.5)
Increased	3,968 (63.2)

(e.g., "I felt I was close to panic"), and negative stress (e.g., "I found it hard to relax") for the previous week. Each of the three DASS-21 scales includes seven items, where each item is ranged on a 4-point scale (0 = "Did not apply to me at all," to 3 = "Applied to me very much, or most of the time"). Subscale total scores are multiplied by 2 to suit the original version of the DASS and ranged from 0 to 42, with higher scores indicating a more severe level of depression, anxiety, and negative stress. The cut-off values for severe depression, anxiety, and negative stress were ≥21, ≥15, and ≥26, respectively (Lovibond and Lovibond, 1995). The Cronbach's α values for each subscale

in this study were 0.89 (depression), 0.83 (anxiety), and 0.91 (negative stress), respectively.

COVID-19 Lockdown Related Information

The following variables related to the COVID-19 outbreak were investigated: COVID-19 diagnosis (yes, no, had symptoms but no swab test), forced quarantine (yes or no), someone close was positive for COVID-19 (yes or no), mourning related to COVID-19 (yes or no), face-to-face and online social relationship changes (decreased, stable, increased).

Data Analyses

Descriptive statistics were calculated for all the study variables. A multi-categorical logistic regression analysis was used to define possible predictors of MD. We employed the Hosmer and Lemeshow Test to verify whether the model fits the data. The dependent variable was obtained by dichotomizing MDers and non-MDers via the MDS-16 cut-off value of 51 to identify positive cases (see Schimmenti et al., 2020c). Independent variables were gender, age, education, residence area, having children, marital status, job loss during the lockdown, working in direct contact with the public during the lockdown, having been infected by the coronavirus, having been in quarantine, having someone close infected by the coronavirus, loss of a loved one due to the pandemic, number of people with whom the participant was living with during the lockdown, house size (in square meters) of the location in which the respondent was living during the lockdown, the availability of a garden in that location, perceived changes in the frequency of the respondent's face-to-face and online relationships, negative stress, anxiety and depression levels as measured by DASS-21 variables.

RESULTS

Of the total sample of 6,277 participants, 1,082 (17.2%) reported clinical levels of MD (MDS-16 mean score > 50) and were identified as self-reported MDers. The logistic regression model was statistically significant ($\chi^2 = 569.35$; df $= 40$; $p < 0.001$) while the Hosmer and Lemeshow Test was not significant ($\chi^2 = 10.606$; df $= 48$; $p = 0.23$): thus, the model fits the data and could be further interpreted. The model explained 15.2% of pseudovariance (Nagelkerke R^2) and correctly classified 82.60% of cases. As **Table 2** shows, MD was not associated with gender ($p = 0.14$) and was negatively associated with two categories of marital status: being in a romantic relationship ($p = 0.02$; OR: 0.70; 95% CI: 0.52–0.95) and non-marital cohabitation with the partner ($p > 0.001$; OR: 0.67; 95% CI: 0.56–0.79). MDers were less likely to have a doctorate or a professional diploma ($p = 0.002$; OR: 0.44; 95% CI: 0.27–0.74). Furthermore, age was negatively associated with MD ($p > 0.001$; OR: 0.98; 95% CI: 0.97–0.99). While negative stress was not associated with MD, we found that MD was significantly correlated at a $p < 0.001$ level with mild (OR: 1.59; 95% CI: 1.23–2.09), moderate (OR: 1.75; 95% CI: 1.42–2.16), severe (OR: 1.68; 95% CI: 1.26–2.25), or extremely severe (OR: 2.60; 95% CI: 2.00–3.48) anxiety. Our data also show that MD was significantly linked with mild (OR: 1.90; 95% CI: 1.52–2.37), moderate (OR: 2.18; 95% CI: 1.74–2.74), severe (OR: 2.87; 95% CI: 2.16– 3.83), or extremely severe (OR: 3.23; 95% CI: 2.35–4.43) depression. Furthermore, MD was associated with stable ($p < 0.001$; OR: 1.84; 95%, CI: 1.39–2.43) and elevated ($p = 0.045$; OR: 1.31; 95%, CI: 1.01–1.69) frequencies of face-to-face relationships. In contrast, MD was negatively associated with stable ($p = 0.001$; OR: 0.59, 95% CI: 0.44–0.80) and elevated ($p = 0.02$; OR: 0.70, 95% CI: 0.52–0.94) frequencies of online relationships. The number of people in the respondents' households during the lockdown and the characteristics of their work did not predict MD.

DISCUSSION

The current study aimed to explore the associations between contextual factors related to the COVID-19 lockdown, mental health variables, and MD in a large sample ($N = 6{,}277$) of Italian adults during the first COVID-19 lockdown period in Italy: 1,082 participants (17.2%) met the cut-off score for probable MD. This prevalence is quite high, considering that previous studies found similar incidence rates of MD in clinical groups (e.g., Somer et al., 2019a). Our data thus deserve some consideration. First, it has already been noted that public health emergencies, such as the COVID-19 outbreak, may deeply affect the well-being and mental health of individuals in the affected community (Pfefferbaum and North, 2020). Hence, this finding may be partially explained by the heightened levels of psychological symptoms already reported in the context of this global mass disaster and reflect a general peri-traumatic deterioration in mental health. Further caution should be employed when interpreting our results because we cannot claim universality for our findings.

The demographic data we collected were in line with previous studies that reported higher levels of MD among young adults (Zsila et al., 2019), no gender differences (although female participants are more represented among MDers; see Schimmenti et al., 2020c), low levels of MD in individuals with higher education (Somer et al., 2016c) and among those who are not in a romantic relationship (Somer et al., 2016b).

MDers endorsed higher levels of anxiety and depression symptoms. This is consistent with previous studies showing that MD is associated with other psychological disorders (Somer et al., 2016a,c; Somer et al., 2017a). Specifically, this finding is supported by a recent multi-country study by Somer et al. (2020) that reported high levels of depression and anxiety symptoms among probable MDers during the COVID-19 lockdown. Interestingly, mild-to-severe levels of anxiety and depression were equally associated with MDers' mental distress. This finding is in line with previous reports showing that MD can become a dysfunctional coping strategy to avoid negative affect, such as anxiety and depression even if not of such a level as to be considered frank disorders (Somer, 2002; Somer et al., 2020). Hence, to lower the risk of exacerbating their disorder during such adverse situations as the COVID-19 outbreak, it may be important for MDers to gain an awareness of their broader mental condition, particularly when immersion in fantasy is associated with concurrent psychological symptoms.

TABLE 2 | Multivariable logistic regression analysis of the probable MDers sample.

		Estimate	E.S.	Wald	gl	*p*	OR	95% C. I.	
								Lower	Upper
Demographic data									
Male gender		−0.13	0.09	2.17	1	0.14	0.88	0.74	1.04
Level of education	Elementary/middle school			11,51	4	0.02			
	High school graduation	−0.26	0.19	1.75	1	0.19	0.78	0.53	1.13
	Bachelor's degree	−0.23	0.20	1.31	1	0.25	0.79	0.53	1.18
	Master's or specialist degree	−0.32	0.20	2.43	1	0,12	0.73	0.49	1.09
	Doctorate or graduate school	−0.81	0.26	9,87	1	0.002	0.44	0.27	0.74
Residence area	North			4.48	2	0,11			
	Centre	0.27	0.14	3.88	1	0.05	1.31	1.00	1.71
	South	0.10	0.09	1.32	1	0.25	1.10	0.93	1.31
Having children		0.20	0.17	1.43	1	0.23	1.22	0.88	1.69
Marital status	Single			23.66	4	>0.001			
	Married or re-married	−0.29	0.17	2.87	1	0.09	0.75	0.54	1.05
	In a sentimental relationship	−0.35	0.15	5.34	1	0.02	0.70	0.52	0.95
	Living with the partner but not married	−0.41	0.09	21.01	1	<0.001	0.67	0.56	0.79
	Divorced or Separated or Widowed	−0.10	0.24	0.16	1	0.69	0.91	0.56	1.46
Age		−0.19	0.01	13.26	1	<0.001	0.98	0.97	0.99
		Estimate	**E.S.**	**Wald**	**gl**	***p***	**OR**	**95% C. I.**	
								Lower	**Upper**
Housing condition									
Square meters of the house where he/she spent the lockdown		≤80			4.68	3	0.20		
	81–100	−0.10	0.11	0.79	1	0.37	0.91	0.74	1.12
	101–150	0.12	0.11	1.27	1	0.26	1.3	0.92	1.38
	>150	−0.02	0.11	0.03	1	0.86	0.98	0.79	1.23
Number of people with whom the participant lived with during the lockdown		0.01	0.03	0.09	5	0.77	1.01	0.95	1.07
The respondent's house has a garden		0.05	0.13	0.15	1	0.69	1.05	0.82	1.35
Professional condition									
Job loss during the lockdown		−0.04	0.08	0.29	1	0.60	0.96	0.83	1.11
Work in direct contact with the public during the lockdown		0.03	0.08	0.16	1	0.69	1.03	0.89	1.20
		Estimate	E.S.	Wald	gl	*p*	OR	95% C. I.	
								Lower	Upper
COVID-19 related data									
The respondent has lost loved ones		−0.11	0.16	0.46	1	0.50	0.90	0.66	1.23
The respondent was in quarantine		0.21	0.13	2.90	1	0.09	1.24	0.97	1.58

(Continued)

TABLE 2 | Continued

		Estimate	E.S.	Wald	gl	*p*	OR	95% C. I.	
								Lower	Upper
The respondent was infected with the coronavirus		0.38	0.39	0.95	1	0.33	1.47	0.68	3.16
The respondent had someone close infected		−0.01	0.11	0.02	1	0.90	0.99	0.80	1.22
Changes in the frequency of the face-to-face relationship	Decreased			20.97	2	<0.001			
	Stable	0.61	0.14	18.26	1	<0.001	1.84	1.39	2.43
	Increased	0.27	0.13	4.02	1	0.045	1.31	1.01	1.69
Changes in the frequency of online relationship	Decreased			12.45	2	0.002			
	Stable	−0.53	0.16	11.53	1	0.001	0.59	0.44	0.80
	Increased	−0.36	0.15	5.83	1	0.02	0.70	0.52	0.94
Mental health data									
Negative stress	Normal			5.27	4	0.26			
	Mild	0.17	0.12	1.85	1	0.17	1.18	0.93	1.50
	Moderate	−0.13	0.12	1.17	1	0.30	0.88	0.69	1.11
	Severe	−0.04	0.14	0.07	1	0.79	0.96	0.73	1.27
	Extremely severe	0.002	0.19	0.001	1	0.99	1.00	0.70	1.44
Anxiety	Normal			56.08	4	<0.001			
	Mild	0.47	0.14	12.13	1	<0.001	1.59	1.23	2.09
	Moderate	0.56	0.11	27.67	1	<0.001	1.75	1.42	2.16
	Severe	0.52	0.15	12.44	1	<0.001	1.68	1.26	2.25
	Extremely severe	0.97	0.14	46.93	1	<0.001	2.60	2.00	3.48
Depression	Normal			75.21	4	<0.001			
	Mild	0.64	0.11	31.53	1	<0.001	1.90	1.52	2.37
	Moderate	0.78	0.12	46.07	1	<0.001	2.18	1.74	2.74
	Severe	1.06	0.15	51.93	1	<0.001	2.87	2.16	3.83
	Extremely severe	1.17	0.16	52.48	1	<0.001	3.23	2.35	4.43

Surprisingly, negative stress symptoms did not predict MD in our study. This result is in contrast with previous studies that indicated a generally high level of distress in probable MDers compared to non-MDers (Bigelsen et al., 2016). This finding could be partially explained by the fact that during the same period, the Italian population at large reported a high level of distress (Cellini et al., 2020; Moccia et al., 2020; Schimmenti et al., 2020a). Therefore, COVID-19-related contextual factors might have suppressed the significant differences between the two groups of participants.

Interestingly, contrary to our expectations, we found that stable or increased face-to-face relationships and a decreased frequency of online contacts during the COVID-19 lockdown were positively linked with MD. These findings can be interpreted in view of the peculiar characteristics of the pandemic circumstances. During data collection, social relationships in the physical world could represent a potential source of contagion and, therefore, a source of anxiety, whereas online relationships constitute a safe place to engage in meaningful ties with others (Moore and March, 2020). Indeed, it could be argued that some individuals who have been more exposed to the risks of contagion may have displayed excessive absorption in their fantasy world to shield their minds from dysregulated internal states (Ferrante et al., 2020). Consequently, a vicious cycle could evolve in which the withdrawal into an inner world, to avoid the worries associated with the external upheaval, may have contributed to further estrangement from online social relationships and support. Hence, to understand maladaptive outcomes during an enforced social distancing period such as the COVID-19 lockdown, it is important to distinguish between different dimensions of social experience (i.e., face-to-face vs. online social relationships) allowing us to understand the effects that relational variables can have on MD. Consistent with our findings, Somer et al. (2019b, p. 104) already found that the MD acts as a "protective bubble" for some MDers who utilize it to isolate themselves from the external world (Bigelsen and Schupak, 2011). Moreover, the Italian study by Schimmenti et al. (2020c) suggested that detachment, characterized by withdrawal from other people and avoidance of intimate relationships, was a relevant personality feature of MDers. Thus, individuals with

probable MD who display this personality feature may have been dissuaded from safely maintaining online social relationships during the COVID-19 lockdown.

As with every research, the present study comes with several limitations. Although our sample size was large, we again acknowledge that our findings are not representative of the entire Italian population. Two main reasons prevent generalizability: first, we employed a convenience snowball rather than a representative method of sampling. We have therefore not defined a priori a minimum number of administrations but only the period useful for the compilation. In fact, our sample included mostly young female adults who are more likely to participate in online surveys (Dillman, 2000). Furthermore, at the time of data collection, a large majority of participants (65.5%) lived in northern Italy, which was a geographical area much more affected by the health emergency than the rest of Italy. This could have led us to overestimate the detrimental psychological effects of the COVID-19 lockdown among the general population in Italy. Second, readers should consider the possibility of potential false positives in our data associated with the screening procedure we adopted. In this study, we used a measure empirically known for its good sensitivity and specificity (Schimmenti et al., 2020c). However, we did not administer the diagnostic "gold standard" structured clinical interview for MD proposed by Somer et al. (2017b). However, the urgent need to complete our data collection in this unfunded study during the time-limited lockdown prevented the interviewing of 1,082 participants.

Additionally, the utilization of self-report measures may have contributed to a response bias. Nevertheless, the tools we used have previously displayed good psychometric properties in worldwide research. Furthermore, due to the cross-sectional nature of the study design, causal inferences cannot be made. Specifically, MD changes during the COVID-19 lockdown were not assessed due to the unpredictable nature of this event and budget limitations. Moreover, retrospective self-reported diagnoses about MDers' condition before the COVID-19 lockdown were not included in this study because they were deemed to be too biased in several studies, especially for mood and anxiety disorders (e.g., Lobato et al., 2012). Hence, we were unable to determine the specific impact of this context on MD levels. Moreover, our cross-sectional data do not allow us to determine whether MD was a dysfunctional coping strategy already used before the COVID-19 lockdown. Longitudinal studies are needed to confirm our findings and to unravel any effects attributable to environmental factors or individuals' pre-existing psychopathology. Specifically, future studies should include a non-lockdown in-depth assessment of MDers to longitudinally evaluate the specific role played by social restriction measures on their psychological functioning.

Notwithstanding these drawbacks, our cross-sectional findings revealed that beyond the distressing effect of the COVID-19 lockdown on the general population, vulnerable individuals, such as probable MDers, may have suffered from psychiatric symptoms that have probably gone beyond the predictable annoyance and distress to be expected in a community sample. Specifically, concerns about contagion or infecting others during the COVID-19 outbreak might exacerbate the tendency of MDers to withdraw into their inner worlds, worsening their mental state and estranging themselves even further from available online social support. Consequently, our findings imply the potential usefulness of Internet-based support platforms for individuals with MD during times of crisis that may require self-isolation. Such emergencies may include natural and environmental disasters, war, and terrorism. These kinds of online platforms should aim at establishing and promoting important coping resources such as enhanced relational security and connectedness. Moreover, from a clinical point of view, we believe that prevention and tailored interventions for MDers should take into account the relationship between social isolation, depression, and anxiety, variables that we suggest are potential triggers and facilitators of the disorder.

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 the Center for Research and Psychological Intervention (CERIP). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

AM and CF provided substantial contributions to the conception of the work, deep analysis of the literature, study design, development, and final approval of the manuscript. LP contributed to data analysis and agreement for final approval of the manuscript. MF, ES, EV, CZ, MQ, VL, GM, DL, PC, LB, RC, GP, and GC contributed to the revision of the work and agreement for final approval of the manuscript. ES and AS contributed to the development and deep revision of the work, with literature analysis and agreement for final approval of the manuscript. 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/fpsyg.2021.631979/full#supplementary-material

REFERENCES

Abu-Rayya, H. M., Somer, E., and Knane, H. (2020). Maladaptive daydreaming is associated with intensified psychosocial problems experienced by female survivors of childhood sexual abuse. *Viol. Against Women* 26, 825–837. doi: 10.1177/1077801219845532

Alenizi, M. M., Alenazi, S. D., Almushir, S., Alosaimi, A., Alqarni, A., Anjum, I., et al. (2020). Impact of maladaptive daydreaming on grade point average (GPA) and the association between maladaptive daydreaming and generalized anxiety disorder (GAD). *Cureus* 12:e10776. doi: 10.7759/cureus.10776

Bigelsen, J., Lehrfeld, J. M., Jopp, D. S., and Somer, E. (2016). Maladaptive daydreaming: evidence for an under-researched mental health disorder. *Conscious. Cogn*. 42, 254–266. doi: 10.1016/j.concog.2016.03.017

Bigelsen, J., and Schupak, C. (2011). Compulsive fantasy: proposed evidence of an under-reported syndrome through a systematic study of 90 self-identified non-normative fantasizers. *Conscious. Cogn*. 20, 1634–1648. doi: 10.1016/j.concog.2011.08.013

Bottesi, G., Ghisi, M., Altoè, G., Conforti, E., Melli, G., and Sica, C. (2015). The Italian version of the depression anxiety stress scales-21: factor structure and psychometric properties on community and clinical samples. *Compr. Psychiatry* 60, 170–181. doi: 10.1016/j.comppsych.2015.04.005

Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., et al. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *Lancet* 395, 912–920. doi: 10.1016/S0140-6736(20)30460-8

Cellini, N., Canale, N., Mioni, G., and Costa, S. (2020). Changes in sleep pattern, sense of time and digital media use during COVID-19 lockdown in Italy. *J. Sleep Res*. 29, 1–5. doi: 10.1111/jsr.13074

Cerami, C., Santi, G. C., Galandra, C., Dodich, A., Cappa, S. F., Vecchi, T., et al. (2020). Covid-19 outbreak in Italy: are we ready for the psychosocial and the economic crisis? Baseline findings from the PsyCovid study. *Front. Psychiatry* 11:556. doi: 10.3389/fpsyt.2020.00556

Colizzi, M., Bortoletto, R., Silvestri, M., Mondini, F., Puttini, E., Cainelli, C., et al. (2020). Medically unexplained symptoms in the times of Covid-19 pandemic: a case-report. *Brain Behav. Immunity Health* 5:100073. doi: 10.1016/j.bbih.2020.100073

Dillman, D. A. (2000). *Mail and Internet Surveys: The Tailored Design Method*. New York, NY: John Willey and Sons.

Favieri, F., Forte, G., Tambelli, R., and Casagrande, M. (2020). The Italians in the time of coronavirus: psychosocial aspects of unexpected COVID-19 pandemic. *Lancet* doi: 10.2139/ssrn.3576804

Ferrante, E., Marino, A., Guglielmucci, F., and Schimmenti, A. (2020). The mediating role of dissociation and shame in the relationship between emotional trauma and maladaptive daydreaming. *Psychol. Conscious. Theory Res. Pract*. doi: 10.1037/cns0000253

Franceschini, C., Musetti, M., Zenesini, C., Palagini, L., Scarpelli, S., Quattropani, M. C., et al. (2020). Poor sleep quality and its consequences on mental health during the COVID-19 lockdown in Italy. *Front. Psychol*. 11:574475. doi: 10.3389/fpsyg.2020.574475

Greenwald, D. F., and Harder, D. W. (1994). Sustaining fantasies and psychopathology in a normal sample. *J. Clin. Psychol*. 50, 707–710.

Greenwald, D. F., and Harder, D. W. (2003). Fantasies, coping behavior, and psychopathology. *J. Clin. Psychol*. 59, 1089–1095. doi: 10.1002/jclp.10201

Italian Ministry of Health (2020). *Covid-19, in Gazzetta Ufficiale il Decreto #Iorestoacasa*. Available online at: http://www.salute.gov.it/portale/news/p3_2_1_1_1.jsp?lingua=italianoandmenu=notizieandp=dalministeroandid=4186 (accessed March 10, 2020).

Jopp, D. S., Dupuis, M., Somer, E., Hagani, N., and Herscu, O. (2019). Validation of the Hebrew version of the Maladaptive Daydreaming Scale (MDS-H): evidence for a generalizable measure of pathological daydreaming. *Psychol. Conscious. Theory Res. Pract*. 6, 242–261. doi: 10.1037/cns0000162

Killingsworth, M. A., and Gilbert, D. T. (2010). A wandering mind is an unhappy mind. *Science* 330:932. doi: 10.1126/science.1192439

King, D. L., Delfabbro, P. H., Billieux, J., and Potenza, M. N. (2020). Problematic online gaming and the COVID-19 pandemic. *J. Behav. Addict*. 9, 184–186. doi: 10.1556/2006.2020.00016

Klinger, E. (1990). *Daydreaming: Using Waking fantasy and Imagery for Self-Knowledge and Creativity*. New York, NY: St. Martin's Press.

Lenzo, V., Quattropani, M. C., Musetti, M., Zenesini, C., Freda, M. F., Lemmo, D., et al. (2020). Resilience contributes to low emotional impact of the COVID-19 outbreak among the general population in Italy. *Front. Psychol*. 11:576485. doi: 10.3389/fpsyg.2020.576485

Lobato, G., Moraes, C. L., Dias, A. S., and Reichenheim, M. E. (2012). Alcohol misuse among partners: a potential effect modifier in the relationship between physical intimate partner violence and postpartum depression. *Soc. Psychiatry Psychiatr. Epidemiol*. 47, 427–438. doi: 10.1007/s00127-011-0346-z

Lovibond, P. F., and Lovibond, S. H. (1995). The structure of negative emotional states: comparison of the Depression Anxiety Stress Scales (DASS) with the beck depression and anxiety inventories. *Behav. Res. Ther*. 33, 335–343. doi: 10.1016/0005-7967(94)00075-U

Marazziti, D. (2020). The COVID-19 outbreak: the latest challenge to psychological and psychiatric intervention. *Neuropsychiatry* 17, 39–40. doi: 10.36131/clinicalnpsych20200201

Mazza, C., Ricci, E., Biondi, S., Colasanti, M., Ferracuti, S., Napoli, C., et al. (2020). A nationwide survey of psychological distress among Italian people during the COVID-19 pandemic: immediate psychological responses and associated factors. *Int. J. Environ. Res. Public Health* 17:3165. doi: 10.3390/ijerph17093165

Mestre-Bach, G., Blycker, G. R., and Potenza, M. N. (2020). Pornography use in the setting of the COVID-19 pandemic. *J. Behav. Addict*. 9, 181–183. doi: 10.1556/2006.2020.00015

Moccia, L., Janiri, D., Pepe, M., Dattoli, L., Molinaro, M., De Martin, V., et al. (2020). Affective temperament, attachment style, and the psychological impact of the COVID-19 outbreak: an early report on the Italian general population. *Brain Behav. Immun*. 87, 75–79. doi: 10.1016/j.bbi.2020.04.048

Moore, K. A., and March, E. (2020). *Socially Connected During COVID-19: Online Social Connections Mediate the Relationship Between Loneliness and Positive Coping Strategies*. Available online at: https://www.researchsquare.com/article/rs-35835/v1 (accessed November 10, 2020).

Mucci, F., Mucci, N., and Diolaiuti, F. (2020). Lockdown and isolation: psychological aspects of COVID-19 pandemic in the general population. *Clin. Neuropsychiatry* 17, 63–64. doi: 10.36131/CN20200205

Muggeo, V., Sottile, G., and Porcu, M. (2020). Modelling covid-19 outbreak: Segmented regression to assess lockdown effectiveness. *ResearchGate* doi: 10.13140/RG.2.2.32798.28485

Pfefferbaum, B., and North, C. S. (2020). Mental health and the Covid-19 pandemic. *N. Engl. J. Med*. 383, 510–512. doi: 10.1056/NEJMp2008017

Pietkiewicz, I. J., Necki, S., Bańbura, A., and Tomalski, R. (2018). Maladaptive daydreaming as a new form of behavioral addiction. *J. Behav. Addict*. 7, 838–843. doi: 10.1556/2006.7.2018.95

Rossi, R., Socci, V., Talevi, D., Mensi, S., Niolu, C., Pacitti, F., et al. (2020). COVID-19 pandemic and lockdown measures impact on mental health among the general population in Italy. *Front. Psychiatry* 11:790. doi: 10.3389/fpsyt.2020.00790

Sándor, A., Münnich, Á., and Molnár, J. (2020). Psychometric properties of the Maladaptive Daydreaming Scale in a sample of Hungarian daydreaming-prone individuals. *J. Behav. Addict*. 9, 853–862. doi: 10.1556/2006.2020.00050

Schimmenti, A., Billieux, J., and Starcevic, V. (2020a). The four horsemen of fear: an integrated model of understanding fear experiences during the COVID-19 pandemic. *Clin. Neuropsychiatry* 17, 41–45. doi: 10.36131/CN20200202

Schimmenti, A., Sideli, L., La Marca, L., Gori, A., and Terrone, G. (2020c). Reliability, validity, and factor structure of the maladaptive daydreaming scale (MDS−16) in an Italian sample. *J. Pers. Assess*. 102, 689–701. doi: 10.1080/00223891.2019.1594240

Schimmenti, A., Somer, E., and Regis, M. (2019). Maladaptive daydreaming: towards a nosological definition. *Ann. Méd. Psychol. Rev. Psychiatr*. 177, 865–874. doi: 10.1016/j.amp.2019.08.014

Schimmenti, A., Starcevic, V., Giardina, A., Khazaal, Y., and Billieux, J. (2020b). Multidimensional assessment of COVID-19-related fears (MAC-RF): a theory-based instrument for the assessment of clinically relevant fears during pandemics. *Front. Psychiatry* 11:748. doi: 10.3389/fpsyt.2020.00748

Seçer, I., and Ulaş, S. (2020). An investigation of the effect of COVID-19 on OCD in youth in the context of emotional reactivity, experiential avoidance, depression and anxiety. *Int. J. Ment. Health Addict*. 1–14. doi: 10.1007/s11469-020-00322-z

She, J., Jiang, J., Ye, L., Hu, L., Bai, C., and Song, Y. (2020). 2019 novel coronavirus of pneumonia in Wuhan, China: emerging attack and management strategies. *Clin. Transl. Med*. 9:19. doi: 10.1186/s40169-020-00271-z

Singer, J. L. (1966). *Daydreaming*. New York, NY: Random House.

Soffer-Dudek, N., and Somer, E. (2018). Trapped in a daydream: daily elevations in maladaptive daydreaming are associated with daily psychopathological symptoms. *Front. Psychiatry* 9:194. doi: 10.3389/fpsyt.2018.00194

Soffer-Dudek, N., Somer, E., Abu-Rayya, H. M., Metin, B., and Schimmenti, A. (2020). Different cultures, similar daydream addiction? An examination of the cross-cultural measurement equivalence of the Maladaptive Daydreaming Scale. *J. Behav. Addict*. 9, 184–186. doi: 10.1556/2006.2020.00080

Somer, E. (2002). Maladaptive daydreaming: a qualitative inquiry. *J. Contemp. Psychother*. 32, 197–212. doi: 10.1023/A:1020597026919

Somer, E., Abu-Raya, H. M., and Simaan, Z. N. (2019a). Maladaptive daydreaming among recovering substance use disorder patients: prevalence and mediation of the relationship between childhood trauma and dissociation. *Int. J. Ment. Health Addict*. 17, 206–216. doi: 10.1007/s11469-018-0011-9

Somer, E., Abu-Rayya, H. M., Schimmenti, A., Metin, B., Brenner, R., Ferrante, E., et al. (2020). Heightened levels of maladaptive daydreaming are associated with COVID-19 lockdown, pre-existing psychiatric diagnoses, and intensified psychological dysfunctions: a multi-country study. *Front. Psychiatry* 11:1146. doi: 10.3389/fpsyt.2020.587455

Somer, E., and Herscu, O. (2017). Childhood trauma, social anxiety, absorption and fantasy dependence: two potential mediated pathways to maladaptive daydreaming. *J. Addict. Behav. Ther. Rehabil*. 6:3. doi: 10.4172/2324-9005.1000170

Somer, E., Lehrfeld, J., Bigelsen, J., and Jopp, D. S. (2016c). Development and validation of the maladaptive daydreaming scale (MDS). *Conscious. Cogn*. 39, 77–91. doi: 10.1016/j.concog.2015.12.001

Somer, E., Soffer-Dudek, N., and Ross, C. A. (2017a). The comorbidity of daydreaming disorder (maladaptive daydreaming). *J. Nerv. Ment. Dis*. 205, 525–530. doi: 10.1097/NMD.0000000000000685

Somer, E., Soffer-Dudek, N., Ross, C. A., and Halpern, N. (2017b). Maladaptive daydreaming: proposed diagnostic criteria and their assessment with a structured clinical interview. *Psychol. Conscious. Theory Res. Pract*. 4, 176–189. doi: 10.1037/cns0000114

Somer, E., Somer, L., and Halpern, N. (2019b). Representations of maladaptive daydreaming and the self: a qualitative analysis of drawings. *Arts Psychother*. 63, 102–110. doi: 10.1016/j.aip.2018.12.004

Somer, E., Somer, L., and Jopp, D. S. (2016b). Parallel lives: a phenomenological study of the lived experience of maladaptive daydreaming. *J. Trauma Dissoc*. 17, 561–576. doi: 10.1080/15299732.2016.1160463

Somer, E., Somer, L., and Jopp, S. D. (2016a). Childhood antecedents and maintaining factors in maladaptive daydreaming. *J. Nerv. Ment. Dis*. 204, 471–478. doi: 10.1097/NMD.0000000000000507

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., et al. (2020a). Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *Int. J. Environ. Res. Public Health* 17:1729. doi: 10.3390/ijerph17051729

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., McIntyre, R. S., et al. (2020b). A longitudinal study on the mental health of general population during the COVID-19 epidemic in China. *Brain Behav. Immun* 87, 40–48. doi: 10.1016/j.bbi.2020.04.028

Zsila, Á., Urbán, R., McCutcheon, L. E., and Demetrovics, Z. (2019). A path analytic review of the association between psychiatric symptoms and celebrity worship: the mediating role of maladaptive daydreaming and desire for fame. *Pers. Individ. Dif*. 151:109511. doi: 10.1016/j.paid.2019.109511

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 16 April 2021
doi: 10.3389/fpsyg.2021.646435

From Resilience to Burnout in Healthcare Workers During the COVID-19 Emergency: The Role of the Ability to Tolerate Uncertainty

Michela Di Trani[1]*, *Rachele Mariani*[1], *Rosa Ferri*[1], *Daniela De Berardinis*[2] and *Maria G. Frigo*[3]

[1] Department of Dynamic and Clinical Psychology, and Health Studies, Sapienza University of Rome, Rome, Italy, [2] U.O. of Clinical Psychology, Fatebenefratelli Hospital, Rome, Italy, [3] U.O. of Obstetric Anesthesia, Clinical Risk, Fatebenefratelli Hospital, Rome, Italy

The COVID-19 outbreak has placed extraordinary demands upon healthcare systems worldwide. Italy's hospitals have been among the most severely overwhelmed, and as a result, Italian healthcare workers' (HCWs) well-being has been at risk. The aim of this study is to explore the relationships between dimensions of burnout and various psychological features among Italian healthcare workers (HCWs) during the COVID-19 emergency. A group of 267 HCWs from a hospital in the Lazio Region completed self-administered questionnaires online through Google Forms, including the Maslach Burnout Inventory (MBI), Resilience Scale, and Intolerance of Uncertainty Scale Short Form (IU). Cluster analysis highlighted two opposite burnout risk profiles: low burnout and high-risk burnout. The high-risk group had lower resilience and greater difficulties in tolerating the uncertainty than the low-burnout group. A set of general linear models confirmed that both IU subscales, prospective and inhibition, moderated the relationship between resilience and burnout (specifically in the depersonalization dimension). In conclusion, the results showed that individual levels of resilience and one's ability to tolerate uncertainty have been significant factors in determining the impact of the COVID-19 emergency on HCWs. The use of emotional strategies that allow individuals to stay in a critical situation without the need to control it appears to protect against burnout in these circumstances.

Keywords: COVID-19, healthcare workers, resilience, burnout, tolerance of uncertainty

OPEN ACCESS

Edited by:
Jason H. Huang, Baylor Scott and White Health, United States

Reviewed by:
Alberto Crescentini, University of Applied Sciences and Arts of Southern Switzerland (SUPSI), Switzerland
Federica Andrei, University of Bologna, Italy

***Correspondence:**
Michela Di Trani
michela.ditrani@uniroma1.it

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *05 January 2021*
Accepted: *08 March 2021*
Published: *16 April 2021*

Citation:
Di Trani M, Mariani R, Ferri R, De Berardinis D and Frigo MG (2021) From Resilience to Burnout in Healthcare Workers During the COVID-19 Emergency: The Role of the Ability to Tolerate Uncertainty. Front. Psychol. 12:646435. doi: 10.3389/fpsyg.2021.646435

INTRODUCTION

The World Health Organization (WHO) declared COVID-19 as a pandemic on March 11, 2020, when infections and deaths began to increase exponentially worldwide. The first cases were reported during December, 2019, in Wuhan, China (World Health Organization, 2020); Italy was the next country to experience a severe impact. As of December, 2020, the situation continues to deteriorate, with the World Health Organization (2020) receiving reports of 66,422,058 confirmed cases of COVID-19 worldwide, including 1,532,418 deaths. Previous studies of epidemics and quarantine suggest that such an extraordinary event will have long-term effects on mental health (Maunder et al., 2006; Kisely et al., 2020).

Now nearly a year into its impact, COVID-19 has been having a tremendous impact on the quality of life for the Italian population. The nature of individual experience of the pandemic for Italians has varied depending in part on socio-demographic factors, with women and those with previously diagnosed medical conditions bearing a particularly intense burden (Epifanio et al., 2021). The mental state of the Italian population has been severely tested, and multiple studies have found a marked increase in psychological symptoms in the non-clinical population. Furthermore, the incidence of high mortality in Italy has considerably aggravated the situation by perpetuating the traumatic dimension of grieving (Bruno et al., 2020; Forte et al., 2020; Mariani et al., 2020; Castellini et al., 2021; Velotti et al., 2021).

Correspondingly, the Italian National Health System received a severe blow with personnel infected and lost. Healthcare workers (HCWs) were the first to experience this unprecedented situation of exposure to this newly identified, contagious, and serious illness and to care for the individuals who were suffering from it. In the epicenter in the Lombardy region, they very quickly began presenting with symptoms of stress, depression, and burnout (Rapisarda et al., 2020). At the end of June, 2020, Istituto Superiore di Sanità (ISS; Italy's higher institute of health) reported that 29,476 HCWs had been infected with COVID-19, which was 12.3% of the national total of 240,578 people. From the beginning of the pandemic to November, 233 doctors died from COVID-19; this data is continuously updated day by day. Since June, almost 90% of infected people in Italy have been concentrated between hospital (70.9%) and local (18.5%) settings, while the remaining 10.6% is divided between nursing homes, residences for the elderly, and other residential or outpatient care settings. The average age of infected individuals in Italy is 58.6 years; the most affected group, with a percentage of 30%, is between 60 and 69. Beyond the personal risks that HCWs are facing, they are a potential vehicle for the spread of COVID-19 (Anelli et al., 2020; Di Monte et al., 2020; Istituto Superiore di Sanità, 2020; Galbraith et al., 2021).

During the pandemic, lockdown rules have required people to reduce social interaction in order to reduce the possibility of new infections, but HCWs have been required to continue with their daily activities. While performing intensely challenging work, they have faced concerns about family members becoming infected and have been limited in their ability to find comfort among family members who may be unable or unwilling to see them due to infection concerns (Marchetti et al., 2020). Due to the exponential increase in the demand for healthcare, they face long work shifts, often with few resources and precarious infrastructure (Kisely et al., 2020; Shigemura et al., 2020) and with the requirement of wearing personal protective equipment (PPE) that may cause physical discomfort and difficulty breathing. Moreover, many HCWs were unprepared to carry out clinical interventions for patients infected with a new virus, about which little is known and for which there are no well-established clinical protocols or treatments (Di Monte et al., 2020). A substantial percentage of healthcare staff reached the cutoff values for mental disorder concerns related to distress, depression, and anxiety. The higher the incidence of COVID-19 is, the more stressed the healthcare workers have felt (Barello et al., 2020; Chen et al., 2020; Di Tella et al., 2020; Xiao et al., 2020).

Burnout, a state of depleted psychological resources, is a strong consequence of chronic exposure to stress for HCWs (Kumar, 2016; Callahan, 2019). Risk factors for clinician burnout include stressful professional experiences, increased work load, reduced quality of work, social isolation, and younger age and career stage (Murali et al., 2018). The consequences of burnout in clinicians are important both in terms of personal well-being and patient care. Burnout has been associated with a predisposition to depression and anxiety, substance abuse, increased risk of medical errors, and poor clinical decision-making (Lapa et al., 2017). In the context of the COVID-19 pandemic, HCWs will deal with traumatic patient experiences and the unexpected loss of family, friends, and colleagues. These critical events contribute to the psychological distress clinicians will face in the COVID-19 health crisis. Several studies carried out during the initial spread of COVID-19 analyzed the risk factors of job satisfaction and mental health symptoms on health workers, showing interesting cultural differences among countries. In the USA, the findings showed that burnout levels among physicians were moderate; the critical variable was job satisfaction. No specific differences emerged for gender or marital status among physicians. However, younger physicians showed less burnout than older physicians. In China, an interesting result has been found related to individuals' proximity to the epicenter of COVID-19 spread and burnout. In fact, Zhang et al. (2020a) found a strong correlation between nearness to the epicenter and level of burnout among working adults. Their results suggest that a ripple effect or a typhoon eye effect dominates, depending on an area's distance from the epicenter. The high burnout level result strictly correlated to low distance of maximum COVID-19 diffusion. However, in Turkey, Dinibutun (2020) found a different result—burnout levels among physicians who were actively involved in the fight against COVID-19 were lower than the burnout levels of the physicians who were not actively involved. In Spain, HCWs in the areas with a higher number of cases showed a higher degree of stress globally. Workers who had been in contact directly with COVID-19 patients, like those working in respiratory medicine and those with family exposure, were predominant among the most highly stressed individuals (Portero de la Cruz et al., 2020; Romero et al., 2020).

In Italy, HCWs reported relevant work-related psychological pressure, emotional burnout, and somatic symptoms (Barello et al., 2020; Marton et al., 2020). Professionals who are directly involved in the care of patients with COVID-19 reported significant work-related psychological pressure (Rapisarda et al., 2020). Even in Italy, the impact of working in the epicenter or with COVID-19 patients presented contrasting results. In fact, Trumello et al. (2020) found no interaction effects between working (or not) with patients affected by COVID-19 and working (or not) in areas with a more severe diffusion of this pandemic. In general, levels of emotional exhaustion appeared higher than the norm, and the percentage of workers with high levels of exhaustion was significantly higher than the one found in other Italian samples before the COVID-19 outbreak (Bressi et al., 2008) or in other healthcare settings during

the SARS pandemic (Maunder et al., 2006). The research by Marton et al. (2020) on Italian HCWs linked psychological symptoms and burnout to primary emotions with a cognitive component including a lack of perceived control, fear for patients and for families, feeling alone, and anger. Stress and negative emotions, together with the perceived difficulties in controlling the situation, were related to mental health.

Previous researchers in pandemic situations have identified specific variables considered likely to mediate stress responses. These were as follows: confidence in support and training, pandemic self-efficacy (ability to respond adaptively), social support, and interpersonal problems (Kang et al., 2020). Provision of assistance in developing practical competencies to face the pandemic and provision of psychological support can help to prevent psychological symptoms and increase job satisfaction (Maunder et al., 2008; Aiello et al., 2011). Ramaci et al. (2020) showed that stigma positively impacts fatigue and burnout and negatively impacts satisfaction. They also found that self-efficacy appears to relate more to the processes of discrimination and satisfaction than to those of emotional reaction (fear) and negative outcomes.

Given the severity of the COVID-19 pandemic and its potential impact on HCWs, specific psychological interventions have been and continue to be developed to provide support. Specific emergency phone lines have been planned to handle requests for psychological support in the United States (Feinstein et al., 2020), as have online Balint support groups for professionals in several countries as UK and Iran (Haude, 2020; Kiani Dehkordi et al., 2020). The Chinese government has also implemented strategies to reduce the psychological burden on HCWs. These include psychological intervention teams, use of shift duties, and online platforms with medical advice (Kang et al., 2020). All research results demonstrated the importance of regular screening of medical personnel involved in treating and diagnosing patients with COVID-19, with particular focus on stress, depression, and anxiety and provision of psychological strategies for all front-line HCWs (Folkman and Greer, 2000; Xiang et al., 2020). It is clear that the critical workers who provide care during this pandemic are highly at risk in a situation with no immediate resolution. The continuous pressure of a prolonged traumatic situation has the capacity to put the entire health system in crisis.

Aim

The general aim of this study was to explore burnout dimensions among Italian HCWs during the COVID-19 emergency and to evaluate their relationships with some psychological features (resilience and intolerance of uncertainty). We also analyzed the relationships between burnout and socio-demographic characteristics (such as gender, age, marital status, and presence of children) and some work characteristics (such as years of experience and professional activities), which can—positively or negatively—affect one's level of work stress.

Moreover, we hypothesized that intolerance of uncertainty would serve as a moderator in the relationship between resilience and burnout, since the unpredictability of the COVID-19 experience generated a great sense of uncertainty, especially in hospital workplaces.

TABLE 1 | Socio-demographic and work characteristics of the sample.

	Mean *N*	SD %
Age	45.170	11.990
Gender		
Male	103	39
Female	164	61
Marital status		
Single	86	32.21
Married/cohabiting	142	53.18
Separated/divorced/widower	39	14.61
Number of children	1.410	0.920
Work sector		
Emergency group	114	43
Chronicity and services group	153	57
Years of work experience	18.980	11.920

MATERIALS AND METHODS

Participants

The study examined HCWs from the Fatebenefratelli Hospital in Rome between March 2020 and May 2020. Fatebenefratelli Hospital was not a COVID-19-dedicated hospital at the time of the observation, but it is an important birth center with neonatal intensive care in the capital territory serving the entire Lazio region.

The sample included 111 doctors, 88 nurses, 16 midwives, 6 psychologists, 26 laboratory technicians, and 20 administrative workers, for a total of 267 participants. In order to reduce the number of variables related to participants' departmental assignments, the HCWs were divided into two subgroups, based on their assignment to emergency services or to the chronicity management and technical services of the hospital. **Table 1** reports the socio-demographic and work characteristics of the sample.

Procedure

The self-report questionnaires were made available online through Google Forms. The hospital's health management office (Bioethics Service, Fatebenefratelli Hospital), after approving the research protocol, urged employees to participate in the study. The HCWs of different services accepted voluntarily and completed the informed consent and the privacy policy disclosure before beginning the questionnaires. Data collection was anonymous. The study was carried out in accordance with the code of ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans. Ethical approval was granted by the ethics committee of the Department of Dynamic and Clinical Psychology and Health Studies of Sapienza University.

Measures

Socio-Demographic and Work Characteristics

The self-administered questionnaire collected data on demographic variables (age, gender, marital status, and number of children) and on characteristics of HCWs' professional activities (hospital department in which the participant works and years of work experience).

Maslach Burnout Inventory

The questionnaire adopted in this study to measure burnout is the Italian validation of the Maslach Burnout Inventory (Maslach et al., 1986; Sirigatti and Stefanile, 1993; MBI), composed of 22 items with a Likert scale from 0 (never) to 6 (daily). It defines burnout in three dimensions: emotional exhaustion (EE), depersonalization (DP), and personal accomplishment (PA). EE represents the depletion of one's emotional resources (e.g., "I feel used up at the end of workday"). The dimension of DP involves viewing coworkers and clients as dehumanized objects instead of people (e.g., "I feel I treat some patients as if they were impersonal objects"). Finally, PA reflects feelings of competence, productivity, and successful achievement in one's work (e.g., "I feel I'm positively influencing other people's lives through my work"). For this dimension only, a high score indicates low burnout level. In this study, Cronbach's alpha was satisfactory for all subscales: EE ($\alpha = 0.92$), DP ($\alpha = 0.80$), and PA ($\alpha = 0.79$).

Fourteen-Item Resilience Scale

The 14-item Resilience Scale (RS-14) used in this study is an assessment (Wagnild, 2009) derived from the original Resilience Scale (Wagnild and Young, 1993) that is widely used in literature. Respondents were asked to state the degree to which they agree or disagree with each item on a 7-point Likert-type scale from 1 (strongly disagree) to 7 (strongly agree). In this research, we adopted the Italian version (Callegari et al., 2016; Cronbach's alpha = 0.89).

Intolerance of Uncertainty Scale Short Form

The Italian validation of the Intolerance of Uncertainty Scale Short Form (IUS; Lauriola et al., 2016) is composed of 12 items measured on a Likert scale from 1 (not at all agree) to 5 (totally agree). In this questionnaire, uncertainty is conceptualized as a psychological stressor that can threaten an individual's capacity to cope effectively with situations when there is little or no information. The IUS has two scales: prospective IU and inhibitory IU. The prospective scale measures both the desire for predictability and an individual's active engagement in seeking information to increase certainty. The inhibitory scale reflects avoidance of uncertainty and paralysis in the face of uncertainty. In this study, Cronbach's alpha was 0.86 for prospective IU and 0.91 for inhibitory IU.

Data Analysis

The statistical analyses were conducted using the Statistical Package for Social Science (SPSS) version 25 for Windows (IBM, Armonk, NY, USA). Data were reported as frequencies and percentages for discrete variables and as means and standard deviations for continuous variables.

As a first step, in order to describe burnout levels of the sample, means and SD of the different MBI dimensions were reported, and frequencies of low, medium, and clinical levels were shown based on cutoff scores of the questionnaire. We also conducted a cluster analysis, which enables the categorization of participants on the basis of their profiles of responses on a selected set of variables (dimensions on the MBI in this case). This approach allows researchers to identify groups that may not emerge via classical categorizations (i.e., low, medium, or high), but that nevertheless occur and do have a meaning for participants.

Afterwards, Pearson's correlations were performed to explore the association between burnout dimensions (emotional exhaustion, depersonalization, and personal accomplishment) and psychological features (resilience and intolerance of uncertainty). Even the groups identified by the cluster analysis were compared on psychological variables and on socio-demographic and work characteristics, through one-way ANOVAs for continuous variables (intolerance of uncertainty and resilience levels, age, number of children, and years of work experience) and chi-square analysis for categorical variables (gender, marital status, emergency vs. chronicity, and services groups).

The relationships between burnout and demographic variables, such as between burnout and characteristics of HCWs' professional activities, were also analyzed using Pearson's correlation analysis for continuous variables (age, number of children, and years of work experience) and one-way ANOVAs for categorical variables (gender, marital status, emergency vs. chronicity, and services operators; in these cases, burnout dimensions were used as dependent variables).

Finally, in order to analyze whether intolerance of uncertainty had a moderating effect on the relationship between resilience and burnout, several general linear models were tested to verify principal effects and interactions between resilience and intolerance of uncertainty—total and factor scores—(as covariates) on the different dimensions of burnout (as dependent variables).

RESULTS

Burnout—Levels and Profiles

Means and SD of the dimensions evaluated are reported in **Table 2**. Regarding MBI levels based on cutoff criteria, for emotional exhaustion, 56% of the sample showed low levels, 24% medium levels, and 20% high levels; for MBI depersonalization, 67% showed low levels, 26% medium levels, and 7% high levels, whereas on MBI personal accomplishment, 44% showed low levels, 32% medium levels, and 24% high levels.

In order to provide a description of burnout profiles adhering to the specific research context, a hierarchical cluster analysis using Ward's method was run. We then adopted the squared Euclidean distance to determine profiles of participants according to their z scores on each subscale of the MBI (Hair et al., 2009; Berjot et al., 2017). The hierarchical cluster analysis suggested a two-cluster solution as shown by the dendrogram. The Bayesian index criterion (Schwarz, 1978) confirmed the

TABLE 2 | Mean and SD for each dimension evaluated.

	Mean	SD
MBI emotional exhaustion	17.553	11.330
MBI depersonalization	4.261	4.576
MBI personal accomplishment	37.786	6.661
Resilience	79.407	10.591
IU prospective	10.865	5.304
IU inhibition	3.613	3.871
IU total	14.391	8.130

MBI, Maslach Burnout Inventory; IU, intolerance of uncertainty.

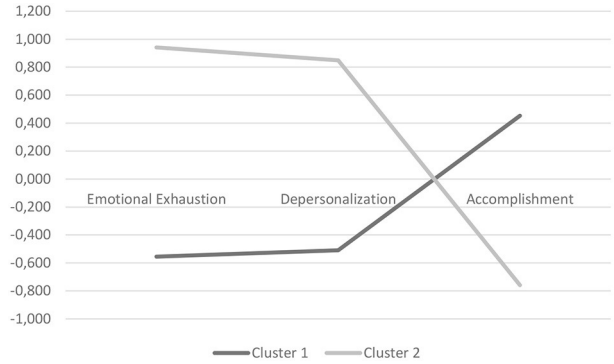


FIGURE 1 | Plot of means for each variable according to clusters. Cluster 1, low burnout; cluster 2, high-risk burnout.

two-cluster solution, as the lowest value was observed for this solution. In a second step, to validate the two-cluster solution, we ran a *k*-mean cluster analysis on the numbers of clusters emerging in the hierarchical cluster analysis (Blashfield and Aldenderfer, 1988; Ransom and Fisher, 1995).

As shown in **Figure 1**, cluster 1 (labeled "low burnout" profile, $N = 161$) included healthcare personnel who had relatively low levels of emotional exhaustion and depersonalization and a higher level of personal accomplishment. Cluster 2 ("high-risk burnout" profile, $N = 97$) included healthcare personnel who had concomitantly high levels of emotional exhaustion and depersonalization and low levels of personal accomplishment.

Means and SD for each dimension of the MBI scale according to the clusters are reported in **Table 3**.

Burnout and Psychological Variables

Correlations between burnout dimensions, resilience, and intolerance of uncertainty are reported in **Table 4**.

Next, we ran a series of one-way ANOVAs and chi-squares with clusters as independent variables. As shown in **Table 5**, significant differences emerged in both resilience and IU prospective and inhibitory. The high-risk burnout group showed significantly lower levels of resilience ($p < 00$) and higher levels of IU prospective ($p < 00$) and inhibitory ($p < 00$) than the low-risk burnout group. No differences between cluster groups emerged based on socio-demographic and work variables.

TABLE 3 | Mean scores and standard deviations for each dimension of the MBI scale according to clusters.

	N	Mean	SD
Emotional exhaustion			
Low burnout	166	−0.555	0.567
High risk of burnout	101	0.941	0.808
Depersonalization			
Low burnout	166	−0.509	0.514
High risk of burnout	101	0.849	1.045
Personal accomplishment			
Low burnout	166	0.453	0.712
High risk of burnout	101	−0.759	0.973

Burnout, Resilience, Intolerance of Uncertainty, and Socio-Demographic/Work Variables

One-way ANOVAs showed a higher level of MBI emotional exhaustion (women: $m = 19.11$, SD = 12.05; men: $m = 15.15$, SD = 9.75; $F = 7.815$, $p = 0.006$) and IU inhibition (women: $m = 4.24$, SD = 4.13; men: $m = 2.63$, SD = 3.22; $F = 11.25$, $p = 0.001$) in women than in men; whereas, men showed higher levels of resilience (women: $m = 78.24$, SD = 11.22; men: $m = 81.09$, SD = 9.27; $F = 4.315$, $p = 0.039$). No differences were found in psychological features based on marital status. Regarding the characteristics of HCWs' professional activities, we compared emergency operators vs. chronicity and services operators: a higher level of MBI personal accomplishment was found in emergency professionals than the other group (emergency group: $m = 38.94$, SD = 5.95; chronicity/service group: $m = 35.81$, SD = 8.34; $F = 4.18$, $p = 0.006$).

Correlation analysis also showed a significant negative correlation between the MBI depersonalization and age ($r = -0.22$; $p = 0.000$) and years of work experience ($r = -0.19$; $p = 0.003$) and a significant (but weak) positive correlation between MBI personal accomplishment and age ($r = 0.16$; $p = 0.01$). No significant data emerged related to number of children.

Moderator Effect of Intolerance of Uncertainty in the Relationship Between Resilience and Burnout

Regarding the question of whether intolerance of uncertainty may moderate the relationship between resilience and burnout, results (see **Table 6**) showed a significant interactive effect of intolerance of uncertainty (total score) and resilience on MBI depersonalization ($B = -0.23$; $t = -3.56$; $p = 0.00$).

Specifically, another set of analyses—including resilience and IU factors as covariates and MBI depersonalization as dependent variable—showed a significant interactive effect of both IU prospective × resilience ($B = -0.26$; $t = -4.02$; $p = 0.00$) and IU inhibition × resilience ($B = -0.16$; $t = -2.29$; $p = 0.02$) on MBI depersonalization (see **Table 7**). No significant results emerged using MBI emotional exhaustion and personal accomplishment as dependent variables.

TABLE 4 | Pearson's correlations between burnout dimensions, resilience, and intolerance of uncertainty.

	Resilience	IU prospective	IU inhibition	IU total
MBI emotional exhaustion	−0.317**	0.264**	0.345**	0.330**
MBI depersonalization	−0.355**	0.262**	0.299**	0.307**
MBI personal accomplishment	0.473**	−0.102	−0.256**	−0.183**

$^{**}p \leq 0.01$. MBI, Maslach Burnout Inventory; IU, intolerance of uncertainty. Relations between burnout, demographic variables, and characteristics of the professional activity.

TABLE 5 | One-way ANOVAs between cluster profiles on resilience and intolerance of uncertainty.

	Low burnout		High-risk burnout				
	Mean	SD	Mean	SD	*F*	*p*	df
Resilience	82.58	9.31	74.27	10.66	40.98	0.00	266
IU prospective	9.79	5.30	12.61	4.89	17.59	0.00	266
IU inhibitory	2.52	2.94	5.49	4.54	40.34	0.00	266

IU, intolerance of uncertainty.

TABLE 6 | General linear models: principal and interactive effects of resilience and intolerance of uncertainty (total score) on burnout dimensions.

	B	*t*	*P*
MBI emotional exhaustion			
Resilience	−0.274	−4.511	0.000
IU total	0.281	4.728	0.000
Resilience × IU total	−0.078	−1.141	0.255
MBI depersonalization			
Resilience	−0.334	−5.736	0.000
IU total	0.246	4.312	0.000
Resilience × IU total	−0.232	−3.56	0.000
MBI personal accomplishment			
Resilience	0.435	7.613	0.000
IU total	−0.101	−1.803	0.073
Resilience × IU total	−0.082	−1.273	0.204

IU, intolerance of uncertainty.

TABLE 7 | General linear models: principal and interactive effects of resilience and intolerance of uncertainty (factor scores) on MBI depersonalization.

	B	*t*	*P*
MBI depersonalization			
Resilience	−0.360	−6.356	0.000
IU prospective	0.270	4.766	0.000
Resilience × IU prospective	−0.261	−4.018	0.000
MBI depersonalization			
Resilience	−0.324	−5.308	0.000
IU inhibition	0.162	2.671	0.008
Resilience × IU inhibition	−0.159	−2.291	0.023

IU, intolerance of uncertainty.

DISCUSSION

The COVID-19 outbreak has placed extraordinary demands upon healthcare systems worldwide. Italy is among the most severely impacted nations in terms of hospital patient overload, and its healthcare workforce struggles to cope with challenges that can threaten their well-being. The physical and psychological well-being of our HCWs are being tested as patient loads continue to increase and their fellow co-workers become infected with COVID-19, contributing significantly to burnout among healthcare workers (Patti et al., 2018; Barello et al., 2020; Di Monte et al., 2020). HCWs are also enduring significant social stigma, as they are viewed as potential transmitters of COVID-19 and therefore isolated from others (Ramaci et al., 2020). This increase in workload in the dangerous atmosphere of this pandemic has caused declining mental health among HCWs (Ayanian, 2020; Blekas et al., 2020; Lai et al., 2020; Luo et al., 2020; Marton et al., 2020; Nochaiwong et al., 2020; Pappa et al., 2020; Romero et al., 2020; Trumello et al., 2020). Thus, it is imperative that we understand the health-related consequences of the COVID-19 outbreak on HCWs to employ productive strategies to care for their mental health (Feinstein et al., 2020; The Lancet, 2020).

The general aim of this study is to explore the relationship between burnout dimensions and some psychological features, such as resilience and intolerance of uncertainty, among Italian healthcare workers during COVID-19 emergency.

Regarding burnout levels, in contrast to Barello et al. (2020) that reported a large percentage of Italian healthcare professionals with high scores in at least one of the MBI domains, in our study, only 20% of the sample had high levels of emotional exhaustion and 7% had high levels of depersonalization, whereas 44% of the sample showed high levels of personal accomplishment. HCWs still seemed to be capable of finding some gratification from their jobs, which may be considered as a relevant protective factor for the professionals'

mental health, as demonstrated in previous studies (Zwack and Schweitzer, 2013; Bonetti et al., 2019). These results can be seen as part of controversial results of the impact of being in an epicenter. The hospital examined was neither a frontline treatment center for COVID-19 nor was it in the epicenter region, but it was still open for all other pathologies for a significant catchment area and for neonatal emergency care for nursing. Our results seemed consistent with previous findings that burnout is less common farther from the epicenter. However, numerous organizational changes had impacted the hospital, including the displacement of staff to other centers and the reduction of access due to the interruption of outpatient activities. The HCWs were therefore not particularly busy with the management of the pandemic, and this paradoxically may have had a frustrating effect, so that those who were most involved in the emergency (but not in an area with higher rates of contagion) reported higher personal accomplishment. In fact, the "emergency group" expressed more feelings of competence, productivity, and successful achievement in one's work than the "service operators." These results can be compared to Dinibutun (2020) that detected lower gratification in HCWs far from the frontline. This result is consistent with the Karasek's Demand–Control theory model. According to this model, HCWs with higher level of job strain and greater decision-making responsibilities were found to be significantly more empowered, more committed to the organization, and more satisfied with their work, with lower levels of illness (Theorell and Karasek, 1996). In other words, HCWs not directly involved in the active and containing strategy of the virus presented greater stress and less control of their activities, reducing their chances of receiving gratification and dealing with the stress that the situation of uncertainty created.

Moreover, consistent with other literature (e.g., Blekas et al., 2020; Zhang et al., 2020b), burnout was more prominent in women than in men, whereas resilience was higher in men than in women. Age and years of work experience were negatively correlated with MBI depersonalization: probably, differently from other conditions, in the pandemic situation, experience played a protective role against the risk of dehumanization. These results are coherent with results from Spain where seniority was shown to be a protective factor (Romero et al., 2020).

In order to overcome the classical categorizations of participants based on cutoff scores identified in generic conditions, a cluster analysis was conducted on the MBI dimensions to identify groups with characteristics specifically related to the context examined (Berjot et al., 2017). This allowed for the identification of specific at-risk groups, which may enable the selection and deployment of specific prevention and intervention programs (Clatworthy et al., 2005). Two groups emerged, with opposite characteristics, namely, "low burnout" (low depersonalization and emotional exhaustion and high personal accomplishment) and "high-risk burnout" (high depersonalization and emotional exhaustion and low personal accomplishment). In contrast with the study of Di Monte et al. (2020) examining general practitioners, in which a third intermedial group emerged (with moderate burnout), our sample seemed to be split in two extreme groups. These two groups did not differ on socio-demographic and work-related variables, but the high-risk burnout group showed lower resilience levels and higher difficulties in tolerating uncertainty than the low-burnout group. Specifically, workers with a profile at risk of burnout presented both a tendency to desire predictability and an active engagement in seeking information to increase certainty, as well as an attitude to avoid uncertainty and to be paralyzed in the face of it. These data confirmed the previous correlation analysis, and they are consistent with findings from Di Monte et al. (2020), which reported a negative correlation between burnout and the ability to tolerate uncertainty. Results from a study by Shacham et al. (2020) of dentists and dental hygienists seem relevant to our findings as well. It may be that the between subjective overload and psychological distress could be clarified by Karasek's work demand–control–support model that claims individuals with low levels of control (along with social anxiety) are characterized by a state of confusion. It's likely that dental workers are struggling with a higher-than-normal degree of isolation, which prevents teamwork, where the unpredictable situation and unfamiliar scenarios had a strong impact on emotional distress and raised psychological defenses.

The splitting results of the cluster analysis could also indicate an effect in this population of the COVID-19 impact. The result of the cluster analysis, seen in relation to the data on resilience and uncertainty management, shows how the population reacted in facing the pandemic, increasing the fork between the risk group and the burnout-resilient group. In other words, those who were probably already in a condition of work fatigue and less personal gratification experienced the impact of the pandemic by increasing their symptomatic responses. Meanwhile, those who were more resilient and more gratified took this as an opportunity to fight the virus and cope with the situation more effectively. In this sense, the hypothesized middle groups emerged in other studies have been polarized in two more extreme reactions.

Moreover, in this condition, an individual's ability to stay in the critical situation without needing to control it and without feeling anguish in the face of uncertainty can serve as a protective factor for health. These specific characteristics can be used as indications for differentiated interventions in support of HCWs, focusing on specific individual features and pandemic reaction patterns. Strengthening individual skills is even more relevant in conditions in which the organizational level is not controllable, since, as in the case of the current pandemic, it is also in a phase of crisis and reorganization. The protective role of the ability to tolerate uncertainty is also highlighted by the interactive effect that this variable has shown with resilience in predicting burnout, in particular depersonalization. Highlighting individual resource factors, and supporting these resources through focused psychological interventions, prevents not only workers' distress but also the consequences of professional stress on work quality and on their relationships with patients.

There are several limitations inherent in the present study. First, the use of self-report questionnaires through online platform may have affected the collected data. At the time of data collection, it was not possible to recruit participants in person and have the measures administered by a clinician.

Also, since the COVID-19 pandemic affected regions of Italy in different ways, it would be interesting to have a larger sample

from a wider geographic area to be able to verify whether the relationships between burnout and psychological characteristics are different depending on the severity of the health emergency in a given area. This is especially true because the study was conducted out of epicentral area.

A third limitation involves the absence of a control group, which would be useful in future investigations for performing comparative analysis with staff of COVID-19 hospitals, rather than general practitioners. The analysis was conducted in a general hospital facility that was not specifically focused on COVID-19 interventions.

In addition, long-term follow-up to collect further data on HCWs' health status would help to verify the predictive role of burnout on the long-term psycho-physical health of participants.

In conclusion, HCWs who are dealing with the current emergency in healthcare settings are the pillars of the COVID-19 epidemic response. It is therefore essential to invest as much as possible to protect their physical and mental health. Implementing psychological support resources to help those who are tackling the emergency on a daily basis and ensuring their continued availability when the emergency is over can improve coping skills and promote personal empowerment. Focusing interventions, both training and psychological support, on enhancing resilience and the ability to act in conditions of uncertainty without needing to establish control could help to provide concrete suggestions to direct actions for our HCWs.

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 the Department of Dynamic and Clinical Psychology, and Health Studies, Sapienza University of Rome. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

MDT contributed to all the phases of the study from conception and design of the study, results interpretation, and writing manuscript. RM performed the statistical analysis, contributed to results interpretation, and in writing the manuscript. RF contributed to conception and design of the study results interpretation. DD contributed to conception of the study, data collection and implementation of dataset, writing manuscript. MGF contributed data collection and supervision. All authors contributed to manuscript revision, read, and approved the submitted version.

REFERENCES

Aiello, A., Khayeri, M. Y., and Raja, S. (2011). Resilience training for hospital workers in anticipation of an influenza pandemic. *J. Continuing Educ. Health Profes.* 31, 15–20. doi: 10.1002/chp.20096

Anelli, F., Leoni, G., Monaco, R., Nume, C., Rossi, R. C., Marinoni, G., et al. (2020). Italian doctors call for protecting healthcare workers and boosting community surveillance during covid-19 outbreak. *BMJ* 368:m1254. doi: 10.1136/bmj.m1254

Ayanian, J. Z. (2020). Mental Health Needs of Health Care Workers Providing Frontline COVID-19 Care. *JAMA Network* 3:e203976. doi: 10.1001/jamahealthforum.2020.0397

Barello, S., Plamenchi, L., and Graffigna, G. (2020). Burnout and somatic symptoms among frontline healthcare professionals at the peak of the Italian COVID-19 pandemic. *Psychiatry Res.* 290, 0165–1781, doi: 10.1016/j.psychres.2020.113129

Berjot, S., Altintas, E., Grebot, E., and Lesage, F. X. (2017). Burnout risk profiles among French psychologists. *Burn. Res.* 7, 10–20. doi: 10.1016/j.burn.2017.10.001

Blashfield, R. K., and Aldenderfer, M. S. (1988). "The methods and problems of cluster analysis" in *Handbook of Multivariate Experimental Psychology,* eds. J. R. Nesselroade and R. B. Cattell (New York, NY: Plenum Press), 447–473. doi: 10.1007/978-1-4613-0893-5_14

Blekas, A., Voitsidis, P., Athanasiadou, M., Parlapani, E., Chatzigeorgiou, A. F., Skoupra, M., et al. (2020). COVID-19: PTSD symptoms in Greek health care professionals. *Psychol. Trauma* 12, 812–819. doi: 10.1037/tra0000914

Bonetti, L., Tolotti, A., Valcarenghi, D., Pedrazzani, C., Barello, S., Ghizzardi, G., et al. (2019). Burnout precursors in oncology nurses: apreliminary cross-sectional study with a systemic organizational analysis. *Sustainability* 11:1246. doi: 10.3390/su11051246

Bressi, C., Manenti, S., Porcellana, M., Cevales, D., Farina, L., Felicioni, I., et al. (2008). Haemato-oncology and burnout: an Italian survey. *Br. J. Cancer* 98, 1046–1052. doi: 10.1038/sj.bjc.6604270

Bruno, G., Panzeri, A., Granziol, U., Alivernini, F., Chirico, A., Galli, F., et al. (2020). The Italian COVID-19 Psychological Research Consortium (IT C19PRC): general overview and replication of the UK Study. *J. Clin. Med.* 10:52. doi: 10.3390/jcm10010052

Callahan, M. J. (2019). Pediatric radiologists and burnout: identifying stressors and moving forward. *Pediatr. Radiol* 49, 710–711. doi: 10.1007/s00247-019-04398-1

Callegari, C., Bertu, L., Lucano, M., Ielmini, M., Braggio, E., and Vender, S. (2016). Reliability and validity of the Italian version of the 14-item resilience scale. *Psychol. Res. Behav. Manag.* 9, 277–284. doi: 10.2147/PRBM.S115657

Castellini, G., Rossi, E., Cassioli, E., Sanfilippo, G., Innocenti, M., Gironi, V., et al. (2021). A longitudinal observation of general psychopathology before the COVID-19 outbreak and during lockdown in Italy. *J. Psychosom. Res.* 141:110328. doi: 10.1016/j.jpsychores.2020.110328

Chen, Q., Liang, M., Li, Y., Guo, J., Fei, D., Wang, L., et al. (2020). Mental health care for medical staff in China during the COVID-19 out- break. *Lancet Psychiatry* 7, 15–16. doi: 10.1016/S2215-0366(20)30078-X

Clatworthy, J., Buick, D., Hankins, M., Weinman, J., and Horne, R. (2005). The use and reporting of cluster analysis in health psychology: a review. *Br. J. Health Psychol.* 10, 329–358. doi: 10.1348/135910705X25697

Di Monte, C., Monaco, S., Mariani, R., and Di Trani, M. (2020). From resilience to burnout: psychological features of italian general practitioners during COVID-19 emergency. *Front. Psychol.* 11:567201. doi: 10.3389/fpsyg.2020.567201

Di Tella, M., Romeo, A., Benfante, A., and Castelli, L. (2020). Mental health of healthcare workers during the COVID-19 pandemic in Italy. *Authorea.* 26, 1583–1587. doi: 10.22541/au.158878917.77777713

Dinibutun, S. R. (2020). Factors associated with burnout among physicians: an evaluation during a period of COVID-19 Pandemic. *J. Healthc. Leadersh.* 12, 85–94. doi: 10.2147/JHL.S270440

Epifanio, M. S., Andrei, F., Mancini, G., Agostini, F., Piombo, M. A., Spicuzza, V., et al. (2021). The impact of COVID-19 pandemic and lockdown measures on quality of life among Italian general population. *J. Clin. Med.* 10:289. doi: 10.3390/jcm10020289

Feinstein, R. E., Kotara, S., Jones, B., Shanor, D., and Nemeroff, C. B. (2020). A health care workers mental health crisis line in the age of COVID-19. *Depress. Anxiety*. 37, 822–826. doi: 10.1002/da.23073

Folkman, S., and Greer, S. (2000). Promoting psychological well-being in the face of serious illness: when theory, research and practice inform each other. *Psychooncology* 9, 11–19. doi: 10.1002/(sici)1099-1611(200001/02)9:1

Forte, G., Favieri, F., Tambelli, R., and Casagrande, M. (2020). COVID-19 pandemic in the Italian population: validation of a post-traumatic stress disorder questionnaire and prevalence of PTSD symptomatology. *Int. J. Environ. Res. Public Health* 17:4151. doi: 10.3390/ijerph17114151

Galbraith, N., Boyda, D., McFeeters, D., and Hassan, T. (2021). The mental health of doctors during the COVID-19 pandemic. *BJPsych. Bull*. 45, 93–97. doi: 10.1192/bjb.2020.44

Hair, J., Black, W., Babin, B., and Anderson, R. E. (2009). *Multivariate Data Analysis: Pearson New International Edition, 7th Edition*. London: Pearson

Haude, V. (2020). "Intercultural balint work," in *Intercultural Psychotherapy*, eds M. Schouler-Ocak, and M. Kastrup, eds M. Schouler-Ocak, and M. Kastrup (Cham: Springer). doi: 10.1007/978-3-030-24082-0_11

Istituto Superiore di Sanità (2020). *Sorveglianza Integrata COVID 19 in Italia. Epicentro Website*. Available online at: https://www.epicentro.iss.it/coronavirus/sars-cov-2-sorveglianza-dati (accessed April 5, 2020).

Kang, L., Ma, S., and Chen, M. (2020). Impact on mental health and perceptions of psychological care among medical and nursing staff in Wuhan during the 2019 novel coronavirus disease outbreak: a cross-sectional study. *Brain Behav. Immun*. 87, 11–17. doi: 10.1016/j.bbi.2020.03.028

Kiani Dehkordi, M., Sakhi, S., Gholamzad, S., Azizpour, M., and Shahini, N. (2020). Online Balint groups in healthcare workers caring for the COVID-19 patients in Iran. *Psychiatry Res.* 290:113034. doi: 10.1016/j.psychres.2020.113034

Kisely, S., Warren, N., McMahon, L., Dalais, C., Henry, I., and Siskind, D. (2020). Occurrence, prevention, and management of the psychological effects of emerging virus outbreaks on healthcare workers: rapid review and meta-analysis. *Br. Med. J*. 369:1642. doi: 10.1136/bmj.m1642

Kumar, S. (2016). Burnout and doctors: prevalence, prevention and intervention. *Healthcare* 4:37. doi: 10.3390/healthcare4030037

Lai, J., Ma, S., Wang, Y., Cai, Z., Hu, J., Wei, N., et al. (2020). Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. *JAMA Network Open* 3:e203976. doi: 10.1001/jamanetworkopen.2020.3976

Lapa, T. A., Madeira, F. M., Viana, J. S., and Pinto-Gouveia, J. (2017). Burnout syndrome and wellbeing in anesthesiologists: the importance of emotion regulation strategies. *Minerva Anestesiol.* 83, 191–199. doi: 10.23736/S0375-9393.16.11379-3

Lauriola, M., Mosca, O., and Carleton, R. N. (2016). Hierarchical factor structure of the Intolerance of Uncertainty Scale short form (IUS-12) in the Italian version. *Appl. Psychol*. 23, 377–394. doi: 10.4473/TPM23.3.8

Luo, M., Guo, L., Yu, M., Jiang, W., and Wange, Y. (2020). The psychological and mental impact of coronavirus disease 2019 (COVID-19) on medical staff and general public – a systematic review and meta-analysis. *Psychiatry Res.* 291:113190. doi: 10.1016/j.psychres.2020.113190

Marchetti, D., Fontanesi, L., Mazza, C., Di Giandomenico, S., Roma, P., and Verrocchio, M. C. (2020). Parenting-related exhaustion during the Italian COVID-19 lockdown. *J. Pediatric Psychol.* 45, 1114–1123. doi: 10.1093/jpepsy/jsaa093

Mariani, R., Renzi, A., Di Trani, M., Trabucchi, G., Danskin, K., and Tambelli, R. (2020). the impact of coping strategies and perceived family support on depressive and anxious symptomatology during the coronavirus pandemic (COVID-19) lockdown. *Front. Psychiatry* 11:587724. doi: 10.3389/fpsyt.2020.587724

Marton, G., Vergani, L., Mazzocco, K., Garassino, M. C., and Pravettoni, G. (2020). 2020s heroes are not fearless: the impact of the COVID-19 pandemic on wellbeing and emotions of italian health care workers during Italy Phase 1. *Front. Psychol*. 11:588762. doi: 10.3389/fpsyg.2020.588762

Maslach, C., Jackson, S. E., Leiter, M. P., Schaufeli, W. B., and Schwab, R. L. (1986). *Maslach Burnout Inventory Manual*. Palo Alto: Consulting Psychologists Press.

Maunder, R. G., Lancee, W. J., Balderson, K. E., Bennett, J. P., Borgundvaag, B., Evans, S., et al. (2006). Long-term psychological and occupational effects of providing hospital healthcare during SARS outbreak. *Emerg. Infect. Dis*. 12, 1924–1932. doi: 10.3201/eid1212.060584

Maunder, R. G., Leszcz, M., and Savage, D. (2008). Applying the lessons of SARS to pandemic influenza: an evidence-based approach to mitigating the stress experienced by healthcare workers. *Canad. J. Public Health* 99, 486–488. doi: 10.1007/BF03403782

Murali, K., Makker, V., Lynch, J., Banerjee, S. (2018). From burnout to resilience: an update for oncologists. *Am. Soc. Clin. Oncol. Educ. Book* 38, 862–872. doi: 10.1200/EDBK_201023

Nochaiwong, S., Ruengorn, C., Awiphan, R., Ruanta, Y., Boonchieng, W., Nanta, S., et al. (2020). Mental health circumstances among health care workers and general public under the pandemic situation of COVID-19 (HOME-COVID-19). *Medicine* 99:e20751. doi: 10.1097/MD.0000000000020751

Pappa, S., Ntella, V., Giannakas, T., Giannakoulis, V. G., Papoutsi, E., and Katsaounou, P. (2020). Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: a systematic review and meta-analysis. *Brain Behav. Immun*. 88, 901-907. doi: 10.1016/j.bbi.2020.05.026

Patti, M. G., Schlottmann, F., and Sarr, M. G. (2018). The problem of burnout among surgeons. *JAMA Surg.* 153, 403–404. doi: 10.1001/jamasurg.2018.0047

Portero de la Cruz, S., Cebrino, J., Herruzo, J., and Vaquero-Abellán, M. (2020). A multicenter study into burnout, perceived stress, job satisfaction, coping strategies, and general health among emergency department nursing staff. *J. Clin. Med.* 9:E1007. doi: 10.3390/jcm9041007

Ramaci, T., Barattucci, M., Ledda, C., and Rapisarda, V. (2020). Social stigma during COVID-19 and its impact on HCWs outcomes. *Sustainability* 12:3834. doi: 10.3390/su12093834

Ransom, D. C., and Fisher, L. (1995). An empirically derived typology of families: II. relationships with adolescent health. *Fam. Process* 34, 183–197. doi: 10.1111/j.1545-5300.1995.00183.x

Rapisarda, F., Vallarino, M., Cavallini, E., Barbato, A., Brousseau-Paradis, C., De Benedictis, L., et al. (2020). The early impact of the Covid-19 emergency on mental health workers: a survey in Lombardy, Italy. *Int. J. Environ. Res. Public Health* 17:8615. doi: 10.3390/ijerph17228615

Romero, C., Delgado, C., Catalá, J., Ferrer, C., Errando, C., Iftimi, A., et al. (2020). COVID-19 psychological impact in 3109 healthcare workers in Spain: the PSIMCOV group. *Psychol. Med*. 1–7. doi: 10.1017/S0033291720001671

Schwarz, G. (1978). Estimating the dimension of a model. *Ann. Stat*. 6, 461–464. doi: 10.1214/aos/1176344136

Shacham, M., Hamama-Raz, Y., Kolerman, R., Mijiritsky, O., Ben-Ezra, M., and Mijiritsky, E. (2020). COVID-19 factors and psychological factors associated with elevated psychological distress among dentists and dental hygienists in Israel. *Int. J. Environ. Res. Public Health* 17:2900. doi: 10.3390/ijerph17082900

Shigemura, J., Ursano, R. J., Morganstein, J. C., Kurosawa, M., and Benedek, D. M. (2020). Public responses to the novel 2019 coronavirus (2019-nCoV) in Japan: mental health consequences and target popula-tions. *Psychiatry Clin. Neurosci*. 74, 281–282 doi: 10.1111/pcn.12988

Sirigatti, S., and Stefanile, C. (1993). "Adattamento e taratura per l'Italia," in *MBI Maslach Burnout Inventory*, eds C. Maslach and S. Jackson (Firenze: Organizzazioni Speciali), 33–42.

The Lancet (2020). COVID-19: protecting health-care workers. *Lancet* 395:922. doi: 10.1016/S0140-6736(20)30644-9

Theorell, T., and Karasek, R. A. (1996). Current issues relating to psychosocial job strain and cardiovascular disease research. *J. Occup. Health Psychol*. 1, 9–26. doi: 10.1037/1076-8998.1.1.9

Trumello, C., Bramanti, S. M., Ballarotto, G., Candelori, C., Cerniglia, L., Cimino, S., et al. (2020). Psychological adjustment of healthcare workers in Italy during the COVID-19 pandemic: differences in stress, anxiety, depression, burnout, secondary trauma, and compassion satisfaction between frontline and non-frontline professionals. *Int. J. Environ. Res. Public Health* 17:8358. doi: 10.3390/ijerph17228358

Velotti, P., Rogier, G., Beomonte, Z. S., Castellano, R., and Tambelli, R. (2021). Loneliness, emotion dysregulation, and internalizing symptoms during coronavirus disease 2019: a structural equation modeling approach. *Front. Psychiatry* 11:1498. doi: 10.3389/fpsyt.2020.581494

Wagnild, G. (2009). *The Resilience Scale User's Guide for the US English Version Of The Resilience Scale and the 14-Item Resilience Scale (RS-14)*. Worden, IL: The Resilience Center.

Wagnild, G. M., and Young, H. M. (1993). Development and psychometric evaluation of the resilience scale. *Nurs. J. Meas*. 1, 165–178.

World Health Organization (2020). *Mental Health and Psychosocial Considerations During COVID-19 Outbreak*.

Xiang, Y.-T., Yang, Y., Li, W., Zhang, L., Zhang, Q., Cheung, T., et al. (2020). Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. *Lancet Psychiatry* 7, 228–229. doi: 10.1016/S2215-0366(20)30046-8

Xiao, H., Zhang, Y., Kong, D., Li, S., and Yang, N. (2020). The Effects of social support on sleep quality of medical staff treating patients with coronavirus disease 2019 (COVID-19) in January and February 2020 in China. *Med. Sci. Monit.* 26:e923549. doi: 10.12659/MSM.923549

Zhang, S. X., Huang, H., and Wei, F. (2020a). Geographical distance to the epicenter of Covid-19 predicts the burnout of the working population: ripple effect or typhoon eye effect? *Psychiatry Res.* 288:112998. doi: 10.1016/j.psychres.2020.112998

Zhang, S. X., Wang, Y., Rauch, A., and Wei, F. (2020b). Unprecedented disruption of lives and work: health, distress and life satisfaction of working adults in China one month into the COVID-19 outbreak. *Psychiatry Res.* 288:112958. doi: 10.1016/j.psychres.2020.112958

Zwack, J., and Schweitzer, J. (2013). If every fifth physician is affected by burnout, what about the other four? Resilience strategies of experienced physicians. *Acad. Med.* 88, 382–389. doi: 10.1097/ACM.0b013e318281696b

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

PERSPECTIVE
published: 20 April 2021
doi: 10.3389/fpsyg.2021.657814

Focus on the Mental Health of Pediatric Medical Workers in China After the COVID-19 Epidemic

Hui Liu[1,2†] *and Li Wang*[1*]

[1] *Department of Pediatrics, University-Town Hospital of Chongqing Medical University, Chongqing, China,* [2] *Department of Pediatrics, Daping Hospital, Army Medical University, Chongqing, China*

As was previously known, pediatric medical staff in China faced several hurdles including high occupational risk, multiple contradictions, heavy workload, and long working hours. After the outbreak of 2019 novel coronavirus, facing the overload of work and the potential risk of infection, pediatric medical workers may be under great psychological pressure. The purpose of this article was to call attention to the impact of the epidemic on the mental health of Chinese pediatric workers, and developing psychological intervention program that are tailored to them. The experiences from this public health emergency should inform the efficiency and quality of future crisis intervention of the Chinese government and authorities around the world.

Keywords: mental health, pediatric medical workers, COVID-19, epidemic, China

OPEN ACCESS

Edited by:
Jason H. Huang, Baylor Scott and White Health, United States

Reviewed by:
Alessandro Musetti, University of Parma, Italy
Chiara Buizza, University of Brescia, Italy

***Correspondence:**
Li Wang
liwang8771@126.com

[†] *This author share first authorship*

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *24 January 2021*
Accepted: *25 March 2021*
Published: *20 April 2021*

Citation:
Liu H and Wang L (2021) Focus on the Mental Health of Pediatric Medical Workers in China After the COVID-19 Epidemic. Front. Psychol. 12:657814. doi: 10.3389/fpsyg.2021.657814

INTRODUCTION

The outbreak of the coronavirus disease 2019 (COVID-19) that started in Wuhan, China, in December 2019, quickly spread across the whole country and has attracted worldwide attention. To quickly control the epidemic and save the lives of infected patients, Chinese medical workers have been extremely busy working hard over the past 1 year and have made great sacrifices. However, according to incomplete statistics, up to now, more than 3,380 medical staff from 476 medical institutions in China have been infected with novel coronavirus [Bureau for Disease Control and Prevention (BDCP), 2020].

Due to the dangerous epidemic situation, medical resources were once very tight. Facing overwork, frustration, isolation, a lack of contact with their families and other stressors, medical staff have been exhausted and borne enormous pressure, most of them have experienced anxiety, depression, insomnia, denial, anger, fear, and other related negative emotions during the epidemic (Kang et al., 2020a). Therefore, psychological crisis intervention has become another important task in the fight against COVID-19. The Chinese government incorporated psychological crisis intervention into the overall efforts for epidemic prevention and control, and the National Health Commission of China published a national guideline for psychological crisis intervention for COVID-19 on January 27, 2020 [National Health Commission of the People's Republic of China (NHCPRC), 2020]. However, the psychological intervention for pediatric medical staff has not attracted the attention of the government and relevant departments because of the relatively low incidence in children. Thus far, there is no relevant report on the protective measures for the mental health of pediatric medical workers.

Here, we list three important reasons for calling on the relevant departments to pay attention to the psychological intervention of pediatric medical workers during and after the epidemic. First, according to the "White Paper on The Current Situation of Pediatric Resources in China," issued by the pediatric branch of Chinese Medical Association [Pediatric Branch of Chinese Medical Association [PBCMA], and Paediatric Branch of Chinese Medical Doctor Association [PBCMDA], 2017], the number of pediatric medical staff in China is seriously insufficient, one pediatrician must serve more than 2,000 children (Li et al., 2017), and they usually are associated with high occupational risk, conflicts between doctors and patients, heavy workload, long working hours, low pay, and other negative factors. It can be seen that Chinese pediatric medical staff are under greater mental pressure than those in other developed countries. These pediatric staff members have suffered a higher incidence of physical violence and psychological pressure than other Chinese medical workers (Li et al., 2017). Second, respiratory disease is one of the most common pediatric diseases, 73.11% of pediatric outpatients in China are inclined to respiratory disease (Xiong et al., 2017). However, it is very difficult to distinguish COVID-19 from common respiratory disease in the early stage. With students gradually returning to school, the chance of cross-infection among children increased. As a result, common respiratory disease showed a small outbreak trend in the early stage of returning to school. Furthermore, parents expressed more anxiety and panic than usual once children had fever, cough, and other symptoms. A single center study in China showed that 25.7% of parents in the pediatric outpatient had anxiety symptoms, especially, women and people over the age of 50 showed higher anxiety (34.8 and 54.1%, respectively) (Li and Wu, 2021). Although the morbidity of COVID-19 in children was not high, the above behaviors indirectly brought an increased workload, a high risk of infection and psychological distress to pediatric medical workers who bore new psychological pressure again. Third, it was reported that the health-related quality of life of pediatric medical workers declined during the COVID-19 epidemic (Huang et al., 2020), 10.3% of respondents represented moderate or severe psychological impact, and 4.0% showed severe anxiety symptoms (Zhang et al., 2020), which was higher than the general Chinese population prevalence of severe anxiety symptoms (2.3%) during the epidemic (Wang S. et al., 2020). Also, our investigation (Liu et al., 2020) found that depression (14.8%) and anxiety (18.3%) were present to varying degrees among pediatric medical workers across the country. By contrast, 11.0 and 12.2% of participants had depression symptoms and anxiety symptoms, respectively in the general Chinese population during the COVID-19 epidemic (Wang S. et al., 2020). Moreover, the rate of depression in pediatric medical staff (14.8%) was even higher than that in general medical staff (12.10%) (Liu et al., 2020; Lu et al., 2020).

In conclusion, timely psychological intervention for pediatric medical workers is very urgently needed. Although victory has been declared against the initial stage of the COVID-19 epidemic in China, the psychological stress and trauma suffered by pediatric medical staff in this epidemic will not disappear immediately with the end of the epidemic. Those who performed epidemic-related tasks are at risk of experiencing posttraumatic stress disorder symptoms, which have been proved in similar international outbreaks in recent years, such as severe acute respiratory syndrome (SARS) in 2003 (Chong et al., 2004), Ebola virus disease (EVD) in 2014 (Shultz et al., 2015), and Middle East respiratory syndrome coronavirus (MERS-CoV) in 2015 (Lee et al., 2018). Therefore, we call for the relevant departments to carry out extensive research on the psychological status of pediatric medical workers, as well as targeted psychological interventions, which mainly cover the following several areas. First, formulating psychological intervention guidelines for below high-risk pediatric medical workers, and carrying out targeted psychological intervention. According to the previous studies, those who had high education (master and above), senior titles or aged between 30 years old and 60 years old were prone to psychological problems (Huang et al., 2020; Liu et al., 2020). Compared with nurses, doctors suffered from more stress due to first physical examination and medical decisions (Huang et al., 2020). Meanwhile, those who had been exposed to confirmed or suspected COVID-19 patients or worked in Hubei province faced a greater psychological burden (Huang et al., 2020; Liu et al., 2020). These pediatric medical staff whose hospitals did not have fever clinics and isolated observation areas experienced lower health-related quality of life (Huang et al., 2020). Second, a psychological intervention medical team should be built to provide face-to-face psychological counseling and various group activities for medical workers with moderate and severe mental disorders, who than those with subthreshold and mild mental distress are more eager to receive one-on-one assistance or group psychotherapy from psychologists or psychiatrists (Kang et al., 2020b). Third, psychological interventions should provide various psychological self-help brochures or media publicity to release stress. A study found that medical staff with subthreshold and mild psychological disturbances preferred to these methods to rescue themselves, and were willing to use these skills to help others (Kang et al., 2020b), which have been proven to be beneficial to their later mental health (Maunder et al., 2006). Fourth, it is necessary to establish a psychological assistance hotline and online mental health services which could provide guidance and supervision to solve psychological problems. Online consulting is an effective way to reduce the risk of face-to-face contact because of providing initial screening for those who need face-to-face counseling, and is applicable to medical staff of various departments (Geoffroy et al., 2020). Fifth, training on the knowledge of protective measures against COVID-19 can be arranged for parents and children to relieve their anxiety and prevent COVID-19 infection. Some studies showed that the mastering of preventive measures (e.g., wearing masks, hand hygiene) was related to lower levels of stress, anxiety and depression (Wang C. et al., 2020), meanwhile, the understanding of knowledge of COVID-19 was associated with reduction of psychological disorders (Galić et al., 2020). Sixth, online medical services and outpatient appointment systems should be optimized to alleviate the aggregation of pediatric outpatients. During the peak of the COVID-19 epidemic, online medical services were feasible for pediatric rehabilitation and non-emergency pediatric patients, which could reduce the risk of

cross-infection and the waste of medical resources (Tanner et al., 2020; Yang et al., 2021), and online appointment systems could save patients' time and improve patients' satisfaction (Cao et al., 2011). Seventh, hospital security staff can be made available to be sent to help deal with uncooperative patients. A study from a pediatric outpatient in China found that some parents refused their children to accept nucleic acid testing (10.39%) and transfer to fever clinic (1.17%), asked for earlier access (4.43%) (Li and Wu, 2021), which increased the incidence of conflicts between doctors and patients. These measures to reduce the psychological pressure of pediatric medical staff would have a profound impact on the fight against the epidemic and partly alleviate the current situation of pediatric medical resources shortage in China. The experiences from this public health emergency should inform the efficiency and quality of future crisis intervention by the Chinese government and authorities around the world.

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

Both authors conceptualized and designed the study, drafted the manuscript, and approved the final manuscript as submitted.

REFERENCES

Bureau for Disease Control and Prevention [BDCP] (2020). *The Joint Expedition Report of China and WHO on the Coronavirus Disease 2019(COVID-19)*. Available online at: http://www.nhc.gov.cn/jkj/s3578/202002/87fd92510d094e4b9bad597608f5cc2c.shtml (accessed February 29, 2020).

Cao, W., Wan, Y., Tu, H., Shang, F., Liu, D., Tan, Z., et al. (2011). A web-based appointment system to reduce waiting for outpatients: a retrospective study. *BMC Health Serv. Res.* 11:318. doi: 10.1186/1472-6963-11-318

Chong, M. Y., Wang, W. C., Hsieh, W. C., Lee, C. Y., Chiu, N. M., Yeh, W. C., et al. (2004). Psychological impact of severe acute respiratory syndrome on health workers in a tertiary hospital. *Br. J. Psychiatry* 185, 127–133. doi: 10.1192/bjp.185.2.127

Galić, M., Mustapić, L., Šimunić, A., Sić, L., and Cipolletta, S. (2020). COVID-19 Related knowledge and mental health: case of Croatia. *Front. Psychol.* 11:567368. doi: 10.3389/fpsyg.2020.567368

Geoffroy, P. A., Le Goanvic, V., Sabbagh, O., Richoux, C., Weinstein, A., Dufayet, G., et al. (2020). Psychological support system for hospital workers during the Covid-19 outbreak: rapid design and implementation of the Covid-Psy hotline. *Front. Psychiatry* 11:511. doi: 10.3389/fpsyt.2020.00511

Huang, F., Yang, Z., Wang, Y., Zhang, W., Lin, Y., Zeng, L. C., et al. (2020). Health-Related quality of life and influencing factors of pediatric medical staff during the COVID-19 outbreak. *Front. Public Health* 8:565849. doi: 10.3389/fpubh.2020.565849

Kang, L., Li, Y., Hu, S., Chen, M., Yang, C., Yang, B. X., et al. (2020a). The mental health of medical workers in Wuhan, China dealing with the 2019 novel coronavirus. *Lancet Psychiatry* 7:e14. doi: 10.1016/S2215-0366(20)30047-X

Kang, L., Ma, S., Chen, M., Yang, J., Wang, Y., Li, R., et al. (2020b). Impact on mental health and perceptions of psychological care among medical and nursing staff in Wuhan during the 2019 novel coronavirus disease outbreak: a cross-sectional study. *Brain Behav. Immun.* 87, 11–17. doi: 10.1016/j.bbi.2020.03.028

Lee, S. M., Kang, W. S., Cho, A. R., Kim, T., and Park, J. K. (2018). Psychological impact of the 2015 MERS outbreak on hospital workers and quarantined hemodialysis patients. *Compr. Psychiatry* 87, 123–127. doi: 10.1016/j.comppsych.2018.10.003

Li, X., and Wu, X. (2021). Psychological characteristics of parents in a Paediatric Outpatient during the SARS-CoV-2 Epidemic. *Psychol. Health Med.* 26, 114–118. doi: 10.1080/13548506.2020.1849747

Li, Z., Yan, C. M., Shi, L., Mu, H. T., Li, X., Li, A. Q., et al. (2017). Workplace violence against medical staff of Chinese children's hospitals: a cross-sectional study. *PLoS One* 12:e0179373. doi: 10.1371/journal.pone.0179373

Liu, Y., Wang, L., Chen, L., Zhang, X., Bao, L., and Shi, Y. (2020). Mental health status of paediatric medical workers in China during the COVID-19 outbreak. *Front. Psychiatry* 11:702. doi: 10.3389/fpsyt.2020.00702

Lu, W., Wang, H., Lin, Y., and Li, L. (2020). Psychological status of medical workforce during the COVID-19 pandemic: a cross-sectional study. *Psychiatry Res.* 288:112936. doi: 10.1016/j.psychres.2020.112936

Maunder, R. G., Lancee, W. J., Balderson, K. E., Bennett, J. P., Borgundvaag, B., Evans, S., et al. (2006). Long-term psychological and occupational effects of providing hospital healthcare during SARS outbreak. *Emerg. Infect. Dis.* 12, 1924–1932. doi: 10.3201/eid1212.060584

National Health Commission of the People's Republic of China [NHCPRC]. (2020). *The Guideline of Psychological Crisis Intervention for 2019-nCoV Pneumonia*. Available online at: http://www.nhc.gov.cn/jkj/s3577/202001/6adc08b966594253b2b791be5c3b9467.shtml (accessed January 27, 2020).

Pediatric Branch of Chinese Medical Association [PBCMA], and Paediatric Branch of Chinese Medical Doctor Association [PBCMDA] (2017). White paper on the current situation of pediatric resources in China. *China Health Vision* 11:9.

Shultz, J. M., Baingana, F., and Neria, Y. (2015). The 2014 Ebola outbreak and mental health: current status and recommended response. *JAMA* 313, 567–568. doi: 10.1001/jama.2014.17934

Tanner, K., Bican, R., Boster, J., Christensen, C., Coffman, C., Fallieras, K., et al. (2020). Feasibility and acceptability of clinical pediatric telerehabilitation services. *Int. J. Telerehabil.* 12, 43–52. doi: 10.5195/ijt.2020.6336

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., et al. (2020). Immediate psychological responses and associated factors during the initial stage of the 2019 Coronavirus Disease (COVID-19) epidemic among the general population in China. *Int. J. Environ. Res. Public Health* 17:1729. doi: 10.3390/ijerph17051729

Wang, S., Zhang, Y., Ding, W., Meng, Y., Hu, H., Liu, Z., et al. (2020). Psychological distress and sleep problems when people are under interpersonal isolation during an epidemic: a nationwide multicenter cross-sectional study. *Eur. Psychiatry* 63:e77. doi: 10.1192/j.eurpsy.2020.78

Xiong, H., Zhang, C. H., Zhang, L., Luo, T., and Liu, D. (2017). A systematic review of the composition of childhood diseases in medical institutions in China. *Chin. J. Evi. Based Med.* 17, 973–982. doi: 10.7507/1672-2531.201702050

Yang, F., Yu, L., Qin, D., Hua, F., and Song, G. (2021). Online consultation and emergency management in paediatric dentistry during the COVID-19 epidemic in Wuhan: a retrospective study. *Int. J. Paediatr. Dent.* 31, 5–11. doi: 10.1111/ipd.12722

Zhang, L., Wang, S., Shen, J., Wang, Y., Huang, X., Wu, F., et al. (2020). The mental health of Chinese healthcare staff in non-epicenter of COVID-19: a cross-sectional study. *Ann. Palliat Med.* 9, 4127–4136. doi: 10.21037/apm-20-2041

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 29 April 2021
doi: 10.3389/fpsyg.2021.632227

Predicting the Severity of Symptoms of the COVID Stress Syndrome From Personality Traits: A Prospective Network Analysis

Steven Taylor[1], Allan Fong[1] and Gordon J. G. Asmundson[1,2]*

[1] Department of Psychiatry, University of British Columbia, Vancouver, BC, Canada, [2] Department of Psychology, University of Regina, Regina, SK, Canada

Psychological stress reactions to the COVID-19 pandemic are complex and multifaceted. Research provides evidence of a COVID Stress Syndrome (CSS), consisting of (1) worry about the dangerousness of getting infected with SARSCoV2 and coming into contact with infected surfaces, (2) worry concerning the personal socioeconomic consequences of COVID-19, (3) xenophobic fears that SARSCOV2 is being spread by foreigners, (4) COVID-19-related traumatic stress symptoms (e.g., nightmares), and (5) compulsive checking and reassurance-seeking about COVID-19. Little is known about how these symptoms are related to vulnerability and protective personality factors. Based on data from 1,976 US and Canadian adults, we conducted a prospective network analysis in which personality factors were initially assessed at Time 1 and then symptoms of the CSS were assessed at Time 2, 2.5 months later. Results indicated that trait optimism and trait resilience were negatively associated with negative emotionality, suggesting a modulatory (inhibitory) influence. Negative emotionality was positively linked to the narrower traits of intolerance of uncertainty and health anxiety proneness. These narrower traits, in turn, were prospectively linked to symptoms of the CSS. Results suggest that the effects of broad personality traits (e.g., negative emotionality, trait resilience) on symptoms of the CSS were mediated by narrower traits such as the intolerance of uncertainty. Treatment implications are discussed.

Keywords: COVID-19, COVID Stress Syndrome, personality, intolerance of uncertainty, health anxiety, resilience, negative emotionality, network analysis

OPEN ACCESS

Edited by:
Fang Pan,
Shandong University, China

Reviewed by:
Stefanie Duijndam,
Tilburg University, Netherlands
Lin Sun,
Weifang Medical University, China
Frauke Nees,
Kiel University, Germany

****Correspondence:***
Steven Taylor
steven.taylor@ubc.ca

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *22 November 2020*
Accepted: *12 April 2021*
Published: *29 April 2021*

Citation:
Taylor S, Fong A and Asmundson GJG (2021) Predicting the Severity of Symptoms of the COVID Stress Syndrome From Personality Traits: A Prospective Network Analysis. Front. Psychol. 12:632227. doi: 10.3389/fpsyg.2021.632227

HIGHLIGHTS

- Results support the concept of the COVID Stress Syndrome (CSS).
- Conducted a prospective network analysis of trait predictors of CSS.
- Trait optimism and resilience modulated the effects of negative emotionality on CSS.
- Negative emotionality was linked indirectly to the CSS via narrower traits.
- Intolerance of uncertainty and health anxiety proneness were directly linked to CSS.

INTRODUCTION

The understanding of COVID-19-related distress has rapidly evolved since the outbreak of the novel coronavirus. Initially, COVID-19-related distress was conceptualized narrowly, as a form of specific phobia ("coronaphobia") or a similarly narrowly defined anxiety-related phenomenon, whereas later research has shown that COVID-19-related distress is far more complex and multifaceted (Asmundson and Taylor, 2020). A growing body of research provides evidence of what has been called a COVID Stress Syndrome (CSS), which does not neatly fit into existing DSM-5 diagnostic categories (Taylor et al., 2020a,b). The syndrome is essentially dimensional in terms of severity (Taylor et al., 2020a), although for diagnostic purposes people can be classified as having a COVID Stress Disorder if they have severe impairment in social or occupational functioning due to COVID-19-related distress (Asmundson and Taylor, 2020). It is currently unclear whether this disorder is a form of adjustment reaction that abates when the COVID-19 pandemic subsides, or whether it will become chronic for some people. The CSS is currently conceptualized as an adjustment disorder, but that does not imply that it is evanescent, because some adjustment disorders can transform into chronic conditions (Taylor, 2021).

Given that the CSS is essentially dimensional in nature, researchers have investigated it in terms of severity (Taylor et al., 2020a). The syndrome consists of five intercorrelated elements, as assessed by the five COVID Stress Scales: (1) Worry concerning the dangerousness of COVID-19 along with worry about coming into contact with fomites (i.e., objects, surfaces) potentially contaminated with SARSCoV2, (2) worry concerning the personal socioeconomic consequences of the COVID-19 pandemic (e.g., worry about disruption in the supply chain, worry about personal finances), (3) xenophobic fears that SARSCOV2 is being spread by foreigners, (4) traumatic stress symptoms associated with vicarious or direct traumatic exposure to COVID-19 (i.e., COVID-19-related nightmares, intrusive thoughts or images), and (5) COVID-19-related reassurance-seeking and compulsive checking (Taylor et al., 2020a,b).

Research suggests that the severity of the CSS is associated with premorbid (i.e., pre-COVID-19 pandemic) mental health problems (Asmundson et al., 2020), although much remains to be learned about the links between these problems and specific symptoms of the CSS. Similarly, much remains to be learned about the relationship between personality traits and the CSS. Personality traits can be vulnerability factors for psychopathology or protective, stress-buffering factors that enable the person to cope with life stressors without developing psychopathology. Trait optimism and trait resilience are buffering factors against stressors in general (Connor and Davidson, 2003; Coelho et al., 2018). The most well-established vulnerability factor is negative emotionality (neuroticism), which is a broad trait conferring vulnerability for all kinds of psychopathology (Brandes et al., 2019). Although negative emotionality is composed of facets (narrow traits), research supports of bifactor model of negative emotionality, consisting of a general factor in addition to distinct, but correlated, narrow factors (Subica et al., 2016; Brandes et al., 2019; Fournier et al., 2019).

Proneness to health anxiety and intolerance of uncertainty are narrow factors, correlated with, but conceptually and empirically distinguishable from negative emotionality (Taylor and Asmundson, 2004; Carleton et al., 2007; Taylor, 2019). Research from recent pandemics, including the COVID-19 pandemic, shows that negative emotionality, intolerance of uncertainty, and proneness to health anxiety are correlated with pandemic-related distress (Taylor, 2019; Lee and Crunk, 2020; Rettie and Daniels, 2020; Taylor et al., 2020a). Research further suggests that trait optimism and trait resilience may serve as buffers against the effects of pandemic-related distress (Taylor, 2019; Barzilay et al., 2020; Paredes et al., 2021). Little is known about how such traits are related to specific symptoms of the CSS.

Network analysis can provide insights into the interrelationships among variables. In fact, a network approach makes theoretical sense in terms of cognitive-behavioral models of health anxiety, pandemics, and trauma-related fears (Taylor and Asmundson, 2004; Taylor, 2017, 2019). This is because these models predict that nodes in the network interact with one another. For example, negative beliefs or expectations (e.g., worry about COVID-19 infection and its sources and consequences) give rise to COVID-19-related checking for information about the seriousness of the threat and how best to cope. Checking, in turn, can exacerbate worries about the threat of COVID-19, because checking (e.g., checking for health-related information online) inevitably backfires, leading the person to encounter new, fear-evoking information (e.g., images or descriptions of sickness and death in the mainstream news or social media), which in turn amplify worries (Taylor, 2019; Taylor et al., 2020a). Exposure to graphic news stories can also give rise to traumatic stress symptoms, such as nightmares and intrusive thoughts and images. Reexperiencing symptoms, in turn, can increase the perceived threat, because reexperiencing provides vivid reminders of the dangerousness of COVID-19. The propensity to experience symptoms of the CSS is likely to be influenced by various personality traits, as discussed above, although the nature of the interrelationships remains to be elucidated.

Given these considerations, the present study examined how the above-mentioned personality traits (negative emotionality, trait optimism, trait resilience, intolerance of uncertainty, and proneness to health anxiety) are related specifically to symptoms of the CSS. Although other traits are potentially relevant to understanding COVID-19-related distress, practical considerations (e.g., logistic constraints on the size of the assessment battery), precluded the evaluation of other traits. However, we also examined the effects of past history of general medical conditions and mental health condition on the symptoms of the CSS.

A novel aspect of the present study is that the relationships between personality traits and symptoms of the CSS were investigated by conducting a prospective network analysis, where trait vulnerability and protective factors were assessed at Time 1 and symptoms of the CSS were assessed later, at Time 2. Network analysis yields important information about relationships among its elements (e.g., relationships among personality traits and

symptoms), assuming that nodes (e.g., symptoms, traits, or other variables) cluster together because they are somehow causally related to one another. The links between nodes are called "edges." Network analysis does not assume that nodes are influenced by some underlying factor such as a latent variable. Instead, network analysis assumes that nodes can influence one another via their edges (Epskamp et al., 2018). If nodes causally influence one another, then changes in a central node will lead to changes in other nodes through a spreading of activation throughout the network. Central nodes are defining features of a network; as such, identifying the most central nodes has the potential to inform which elements to target in interventions. As a caveat, it is important to note that, even with prospective designs such as the present study, results of network analyses suggest but do not establish causality. Significant edges could represent causal links but experimental designs are needed to establish causality. Therefore, network analyses provide a source of hypotheses about complex causalities among variables, which can then be examined in more detail using experimental designs.

MATERIALS AND METHODS

Sample

The sample consisted of 1,976 adults from the United States (n = 988) and Canada (n = 988). The mean age was 54 years (*SD* = 14 years, range 18–99 years). Most (82%) had completed full or partial college, most (93%) were employed full- or part-time, and 40% were female. Most (70%) were Caucasian, with the remainder being African American/Black (8%), Asian (12%), Latino/Hispanic (6%), and other (4%). Only 2% of the sample reported being diagnosed with COVID-19. A total of 43% had a preexisting medical condition, 14% had a pre-existing (past year) mental health disorder, and 13% currently met criteria for COVID Stress Disorder.

Data Collection Procedures

Data were collected at two timepoints (May 6–19 and July 20-August7, 2020), separated by a mean of 2.5 months, using an internet-based self-report survey delivered in English by Qualtrics, which is a commercial survey sampling and administration company. All participants completed assessments at both timepoints. Qualtrics solicited this adult sample as part of our research program concerning the psychology of COVID-19 (Taylor et al., 2020a,b). Qualtrics maintains a pool of survey participants and selects them to meet sampling quotas based on age, gender, ethnicity, socioeconomic status, and geographic region within each country. Items were used to identify and eliminate data from careless or incomplete responders. This included four items assessing whether participants were paying attention to the instructions (e.g., "This is an attention check, please select Strongly Agree"). To be included in the study, participants had to provide correct responses to three or more of the four attention check items. Also, at the end of the assessment battery participants were asked to indicate whether, in their honest opinion, we should use their data. Those who responded "no" were excluded from the study.

Incomplete item responses were rare (<5% per scale). Missing data were imputed via expectation-maximization. Respondents provided written informed consent prior to completing the survey. The Research Ethics Board of the University of Regina (REB# 2020-043) approved the research reported in this article.

Measures

Participants completed demographic questions along with the measures included in the network analysis. Vulnerability factors (described below) were assessed at the first time point and symptoms of the CSS were assessed at the second time point. Scales measuring vulnerability factors were as follows: Negative emotionality was assessed by the Ten Item Personality Inventory (Gosling et al., 2003). The scale has performed well on various indices of reliability and validity (Gosling et al., 2003; Ehrhart et al., 2009; Nunes et al., 2018). Trait optimism was measured by the Optimism Scale (Coelho et al., 2018), which has been previously shown to have good reliability and validity (Coelho et al., 2018). Trait resilience was assessed by the Connor-Davidson Resilience Scale (Connor and Davidson, 2003), which has good psychometric properties (Connor and Davidson, 2020). The tendency to worry about one's health in general (health anxiety proneness) was measured by the Short Health Anxiety Inventory, which has been shown to be psychometrically sound (Salkovskis et al., 2002). Intolerance of uncertainty was measured by the Intolerance of Uncertainty Scale-12, which also has good psychometric properties (Carleton et al., 2007). The presence (vs. absence) of a pre-existing general medical condition (e.g., heart disease) was assessed by a yes/no item, as was the presence (vs. absence) of a current (past-year) mental health condition. Symptoms of the CSS were assessed by the five COVID Stress Scales, as described earlier in this article, which have very good reliability and validity (Taylor et al., 2020b).

For each multi-item scale, ω total (McDonald, 1999) was used as the measure of reliability as internal consistency. McDonald's ω was used instead of Cronbach's α because the latter tends to underestimate reliability (McNeish, 2018). Values of ω are interpreted as follows: Values of 0.70–0.80 indicate acceptable reliability, 0.80–0.90 indicate good reliability, and values greater than 0.90 indicate excellent reliability. The obtained values of ω are presented along the diagonal of **Table 1**. Here it can be seen that the scales had excellent or good-to-excellent reliabilities.

Statistical Analyses

Glasso networks, computed as networks of statistically significant ($p < 0.01$) edges (regularized partial correlations), were computed using the *qgraph* package in R (Epskamp et al., 2016). The "strength" index of centrality, also calculated with *qgraph*, was used to identify the most central nodes in the network. Although there are other indicators of centrality, strength has the most support as a stable and reliable indicator of centrality (Epskamp et al., 2018). For a given node, its strength was calculated by summing the absolute values of edges that connect that node with other nodes. A central node is one the highest strength value.

Node centrality difference tests, which determine whether some nodes in the network are significantly more central than

TABLE 1 | Correlations among variables (nodes) in the network analysis. Reliabilities (ω) for multi-item scales are in parentheses.

	MH	MED	RES	OPT	HA	IU	N	DAN	SEC	XEN	TSS	CHECK
MH	–											
MED	0.18***	–										
RES	−0.23***	0.00	–									
OPT	−0.26***	−0.04	0.74***	(0.94)								
HA	0.31***	0.20***	−0.33***	−0.36***	(0.92)							
IU	0.26***	0.08	−0.34***	−0.36***	0.51***	(0.93)						
N	0.37***	0.04	−0.61***	−0.58***	0.43***	0.43***	(0.88)					
DAN	0.11***	0.04	−0.14***	−0.14***	0.44***	0.39***	0.20***	(0.96)				
SEC	0.09***	0.04	−0.12***	−0.14***	0.36***	0.31***	0.16***	0.69***	(0.95)			
XEN	0.04	0.00	−0.08***	−0.09***	0.29***	0.28***	0.13***	0.58***	0.55***	(0.96)		
TSS	0.19***	−0.01	−0.15***	−0.17***	0.47***	0.41***	0.25***	0.57***	0.56***	0.43***	(0.96)	
CHECK	0.05	−0.06	−0.01	0.00	0.33***	0.27***	0.11***	0.49***	0.50***	0.40***	0.65***	(0.91)

$^{*}p < 0.01$, $^{**}p < 0.005$, $^{***}p < 0.001$.

CHECK, COVID compulsive checking; DAN, Worry about the dangerousness of COVID; HA, Health anxiety proneness; IU, Intolerance of uncertainty; MED, Pre-existing medical condition; MH, Past year mental health condition; N, Negative emotionality; OPT, Trait optimism; RES, Trait resilience; SEC, Worry about socioeconomic impact; TSS, COVID traumatic stress symptoms; XEN, COVID xenophobia.

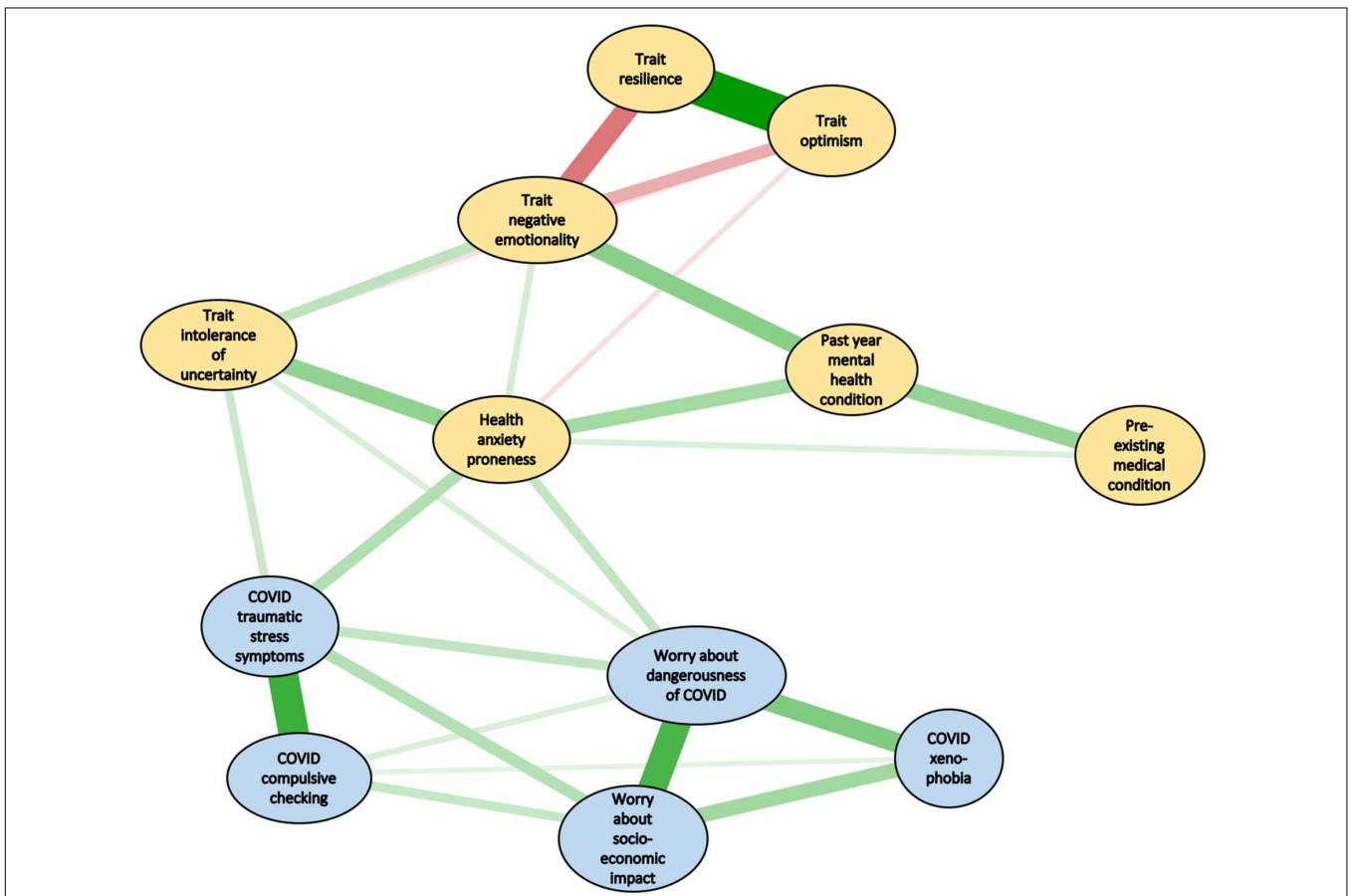


FIGURE 1 | Network analysis of vulnerability variables (yellow ellipses) and symptoms of the COVID Stress Syndrome (CSS) (blue ellipses). The size and thickness of lines indicate the degree of strength of connections. Green lines indicate positive connections (i.e., positive regularized partial correlations), whereas red lines indicate negative connections.

other nodes, were calculated using the R *bootnet* package (Epskamp et al., 2016). To assess the stability (reliability) of the strength values for the nodes and their links, the Correlation of Stability coefficient was calculated via *bootnet* (Epskamp et al., 2018). Given the number of computations in this study (e.g., tests of statistical significance), the alpha level was set at 0.01.

With regard to the tuning parameters, which dictate network sparcity, the lambda min ratio was set at the default of 0.01 and the tuning parameter was set at the default of 1.0. Various ranges of these parameters were then explored, within conventional limits (Epskamp and Fried, 2018). The results did not appreciably change from those obtained with the default values, most likely because the network with default values provided a sparse network with theoretically meaningful edges (see **Figure 1**). Bootstrapping for the various analyses involved 2,500 bootstraps per test. Given this high bootstrapping value, the results did not change when an even higher bootstrapping value was used.

RESULTS

Preliminary Analyses

For descriptive purposes, the correlations among variables in the network analysis are shown in **Table 1**. The table shows that most correlations were statistically significant and for more than a third (38%) their absolute values were medium-to-large in size ($|rs| > 0.30$), according to Cohen's criteria (Cohen, 1988). All correlations among the five nodes of the CSS were positive and large ($rs > 0.50$), as would be expected from a syndrome of closely interrelated variables. The absolute values of the correlations among the trait predictors were medium-to-large.

Network Analyses

Figure 1 shows the edges between nodes in the network (all $ps < 0.01$). The magnitude of the edges is indicated by shorter, thicker lines, with positive associations in green and negative ones in red. The numerical values of the edge and their significance levels appear in **Table 2**. The Correlation of Stability coefficients were 0.75 for both nodes and edges, which both exceed the cutoff of 0.50 (Epskamp et al., 2018), suggesting that the estimates of the relative magnitudes of nodes and edges were reliable. Note that because all of the edges in **Figure 1** are regularized partial correlations, they represent a form of mediator analysis, controlling for the effects of other variables. So, for example, the edge connecting trait intolerance of uncertainty with health anxiety proneness (**Figure 1**) is a regularized partial correlation that controls for the effects of other nodes on those two variables. The purpose of network analysis is not to conduct a formal Baron-Kenny type of mediator analysis (Barron and Kenny, 1986), but nevertheless the network analysis efficiently reveals mediated effects, in which the links between two nodes simultaneously control for links among all other nodes.

Strength values for the sub-network of vulnerability factors (yellow ellipses in **Figure 1**) are shown in **Figure 2**. Here it can be seen that negative emotionality is central to that sub-network, as indicated by the largest value in **Figure 2**. The centrality indices (strength values) for the sub-network of COVID stress symptoms (blue ellipses in **Figure 1**) are shown in **Figure 3**. Here it can be seen that worry about the dangerousness of COVID-19 is central to that sub-network, as indicated by the largest value in **Figure 3**.

As shown in **Figure 1**, the results indicated two sub-networks, with negative emotionality at the center of the sub-network of vulnerability factors, and worry about the dangerousness of COVID-19 at the center of the sub-network of COVID stress symptoms. The links among variables in the network make conceptual sense. Trait resilience and trait optimism have strong positive associations with one another and both have negative (inhibitory) associations with negative emotionality and, to a lesser extent, negative associations with trait intolerance of uncertainty and health anxiety proneness. Not surprisingly, trait negative emotionality was linked to having a past-year mental health condition. Pre-existing mental health conditions and general medical conditions are also positively linked to health anxiety proneness.

The link between negative emotionality and the symptoms of the CSS was mediated thought health anxiety proneness and intolerance of uncertainty. That is, negative emotionality was not directly linked to symptoms of the CSS. Rather, it was linked indirectly though health anxiety and intolerance of uncertainty. The symptoms of the CSS were all strongly connected (i.e., significant edges; see also **Table 1**).

The most peripheral node in the network was the history of a preexisting medical condition (**Figure 1**), which also

TABLE 2 | Edge weights (regularized partial correlations) between nodes in the network.

Edge	Weight
IU-HA	0.23***
IU-N	0.14***
IU-TSS	0.11***
IU-DAN	0.08***
IU-OPT	−0.06*
TSS-HA	0.16***
TSS-CHECK	0.41***
TSS-DAN	0.13***
TSS-SEC	0.16***
CHECK-DAN	0.08***
CHECK-XEN	0.06*
CHECK-SEC	0.12***
HA-N	0.09***
HA-MH	0.19***
HA-OPT	−0.07**
HA-DAN	0.13***
HA-MED	0.08***
OPT-RES	0.53***
N-RES	−0.29***
N-OPT	−0.17***
N-MH	0.25***
MH-MED	0.22***
SEC-DAN	0.38***
SEC-XEN	0.20***
DAN-XEN	0.27***

*$p < 0.01$, **$p < 0.005$, ***$p < 0.001$.
CHECK, COVID compulsive checking; DAN, Worry about the dangerousness of COVID; HA, Health anxiety proneness; IU, Intolerance of uncertainty; MED, Pre-existing medical condition; MH, Past year mental health condition; N, Negative emotionality; OPT, Trait optimism; RES, Trait resilience; SEC, Worry about socioeconomic impact; TSS, COVID traumatic stress symptoms; XEN, COVID xenophobia.

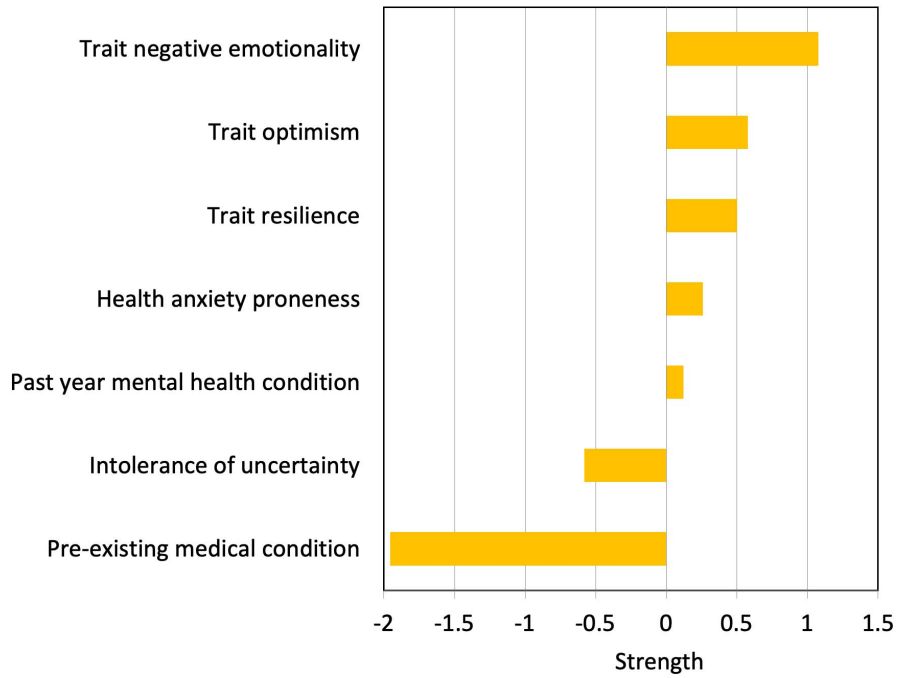


FIGURE 2 | Strength of connection among nodes representing vulnerability factors.

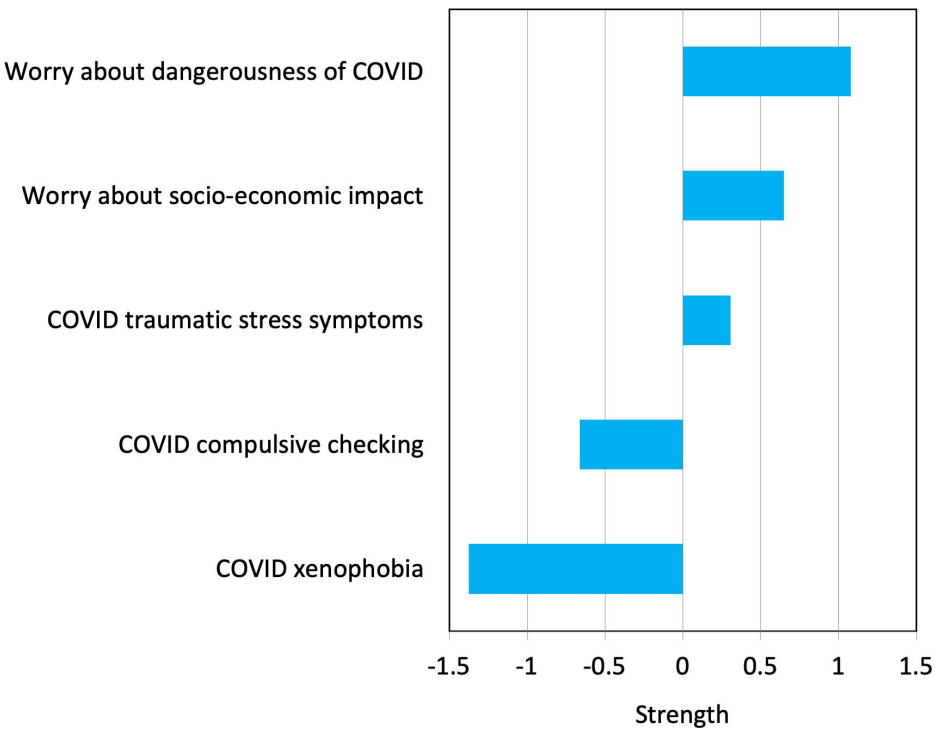


FIGURE 3 | Strength of connection among nodes of the COVID Stress Syndrome (CSS).

had the smallest and mostly non-significant correlations with other nodes (**Table 2**). This was an omnibus measure of past medical history, which was related, in theoretically expected ways, with past history of a mental health condition and with trait health anxiety proneness. Chronic diseases and other preexisting medical conditions are well-known contributors

to poor mental health (e.g., depression) and health anxiety (Taylor and Asmundson, 2004).

DISCUSSION

Replicating previous research (Taylor et al., 2020a), we found that the nodes of CSS form a tightly connected network, at the center of which is worry about the dangerousness of COVID-19. The center of the trait network was negative emotionality. Results of the prospective network analysis further indicated that trait optimism and trait resilience were negatively associated with negative emotionality, suggesting a modulatory influence. Negative emotionality was positively linked to the narrower traits of intolerance of uncertainty and health anxiety proneness. These narrower traits, in turn, were prospectively linked to symptoms of the CSS. Results suggest that the effects of broad personality traits (e.g., negative emotionality, trait resilience) on symptoms of the CSS were mediated by narrower traits such as the intolerance of uncertainty.

Findings from this study are consistent with theory and research about health anxiety in general (Taylor and Asmundson, 2004); specifically, that proneness to health anxiety is influenced by negative emotionality. In the present study, trait negative emotionality measured in May 2020 directly and indirectly (through intolerance of uncertainty and past year mental health conditions) influenced health anxiety which, in turn, impacted the severity of CSS in August 2020. The current findings are also consistent with research on pandemic-related fear in earlier (pre-COVID-19) pandemics, where it was found that the personality traits investigated in the present study were related to pandemic-related fear (Taylor, 2019). The present study builds on previous research by identifying a patterned network of inter-relations, where some traits are directly linked to the CSS while other traits are indirectly linked to the syndrome.

If the connections among nodes are causally related, then the findings suggest reducing intolerance of uncertainty and health anxiety proneness may have downstream beneficial effects in reducing symptoms of the CSS. However, the results of the network analysis suggest that a more efficient means of reducing symptoms of CSS (and COVID Stress Disorder) would be to target general vulnerability factors; that is, building optimism and resilience and reducing negative emotionality, which (if the network links are causal in nature) would reduce COVID-related stress symptoms as well as the intolerance of uncertainty and health anxiety proneness. This could be accomplished in a number of ways, such as by using transdiagnostic cognitive-behavior therapy to target negative emotionality and other vulnerability traits, as well as cognitive-behavioral and other methods for building resilience and optimism (Segerstrom, 2007; Zoellner and Feeny, 2014; Barlow and Farchione, 2017).

The present study has strengths and limitations. Regarding the strengths, the sample was large and the present study appears to be the first to use prospective network analysis to understand the interrelationships among vulnerability and protective traits and the symptoms of the CSS. The links found in this study made conceptual sense and are consistent with cognitive-behavioral approaches for understanding health anxiety, traumatic stress symptoms, and pandemic-related behaviors (Taylor and Asmundson, 2004; Taylor, 2017, 2019). A limitation is that not all potentially relevant traits were assessed. Potentially relevant traits for understanding pandemic-related stress include the traits of harm avoidance, overestimation of threat, and perfectionism (Taylor, 2019). Further research is needed to investigate their potential links to the symptoms of the CSS. The replicability of the findings across different countries and cultures also remains to be investigated in future research.

Additional research is needed to determine whether the findings of the present study, of which only 2% of participants were diagnosed with COVID-19, generalize to samples consisting entirely of patients diagnosed with COVID-19. Research suggests that infection with SARSCoV2 is associated with a heightened risk of psychopathology (Taquet et al., 2020). It is currently unclear whether personality traits such as those investigated in the present study play a role of exacerbating or buffering COVID-19-induced psychopathology. Variations as a function of demographics also remain to be investigated. Our sample, with a mean age of 54 years is representative of the age of adults in the US and Canada, according to census data of adults (>17 years) (e.g., https://www.census.gov/data/tables/time-series/demo/popest/2010s-national-detail.html). Nevertheless, the question arises as to whether the pattern of results vary across age groups and other demographic groups.

Finally, prospective network analysis, as a statistical modeling approach, is not sufficient for determining the causal status of nodes. Nevertheless, the present findings provide a strong rationale for conducting future experimental studies on the causal status of vulnerability and protective traits in shaping the severity of symptoms of the CSS.

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 Research Ethics Board of the University of Regina. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

ST: conceptualization, formal analysis, funding acquisition, supervision, methodology, writing—original draft, and writing—review and editing. AF: writing—original draft and writing—review and editing. GA: funding acquisition, methodology, data curation, supervision, writing—original draft, and writing—review and editing. All authors contributed to the article and approved the submitted version.

FUNDING

This research was supported by grants from the Canadian Institutes of Health Research (#439751) and the University of Regina.

ACKNOWLEDGMENTS

We thank Michelle M. Paluszek, Caeleigh A. Landry, and Geoffrey S. Rachor for their assistance in completing this study.

REFERENCES

Asmundson, G. J. G., Paluszek, M. M., Landry, C. A., Rachor, G. S., McKay, D., and Taylor, S. (2020). Do pre-existing anxiety-related and mood disorders differentially impact COVID-19 stress responses and coping? *J. Anx. Disord.* 74:102271. doi: 10.1016/j.janxdis.2020.102271

Asmundson, G. J. G., and Taylor, S. (2020). Coronaphobia revisited: a state-of-the-art on pandemic-related fear, anxiety, and stress. *J. Anx. Disord.* 76:102326. doi: 10.1016/j.janxdis.2020.102326

Barlow, D. H., and Farchione, T. J. (2017). *Applications of the Unified Protocol for Transdiagnostic Treatment of Emotional Disorders*. New York, NY: Oxford University Press.

Barron, R. M., and Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J. Pers. Soc. Psychol.* 51, 1173–1182. doi: 10.1037/0022-3514.51.6.1173

Barzilay, R., Moore, T. M., Greenberg, D. M., DiDomenico, G. E., Brown, L. A., White, L. K., et al. (2020). Resilience, COVID-19-related stress, anxiety and depression during the pandemic in a large population enriched for healthcare providers. *Transl. Psychiatry* 10:291.

Brandes, C. M., Herzhoff, K., Smack, A. J., and Tackett, J. L. (2019). The p factor and the n factor: associations between the general factors of psychopathology and neuroticism in children. *Clin. Psychol. Sci.* 7, 1266–1284. doi: 10.1177/2167702619859332

Carleton, R. N., Norton, P. J., and Asmundson, G. J. G. (2007). Fearing the unknown: a short version of the Intolerance of Uncertainty Scale. *J. Anx. Disord.* 21, 105–117. doi: 10.1016/j.janxdis.2006.03.014

Coelho, G. L. H., Vilar, R., Hanel, P. H. P., Monteiro, R. P., Ribeiro, M. G. C., and Gouveia, V. V. (2018). Optimism scale: evidence of psychometric validity in two countries and correlations with personality. *Pers. Indiv. Differ.* 134, 245–251. doi: 10.1016/j.paid.2018.06.030

Cohen, J. (1988). *Statistical Power Analyses for the Behavioral Sciences*, 2nd Edn. Hillsdale, NJ: Erlbaum.

Connor, K. M., and Davidson, J. R. T. (2003). Development of a new resilience scale: the Connor-Davidson Resilience Scale (CD-RISC). *Depres. Anx.* 18, 76–82. doi: 10.1002/da.10113

Connor, K. M., and Davidson, J. R. T. (2020). *Connor-Davidson Resilience Scale (CDRISC)*. Available online at: www.cdrisc.com (accessed June 5, 2020).

Ehrhart, M. G., Ehrhart, K. H., Roesch, S. C., Chung-Herrera, B. G., Nadler, K., and Bradshaw, K. (2009). Testing the latent factor structure and construct validity of the ten-item personality inventory. *Pers. Indiv. Differ.* 47, 900–905. doi: 10.1016/j.paid.2009.07.012

Epskamp, S., Borsboom, D., and Fried, E. I. (2018). Estimating psychological networks and their accuracy. *Behav. Res. Methods* 50, 195–212. doi: 10.3758/s13428-017-0862-1

Epskamp, S., and Fried, E. I. (2018). A tutorial on regularized partial correlation networks. *Psychol. Methods* 23, 617–634. doi: 10.1037/met0000167

Epskamp, S., Maris, G., Waldorp, L. J., and Borsboom, D. (2016). "Network psychometrics," in *Wiley Handbook of Psychometric Testing*, eds P. Irwing, T. Booth, and D. J. Hughes (New York, NY: Wiley), 953–985.

Fournier, J. C., Wright, A. G. C., Tackett, J. L., Uliaszek, A. A., Pilkonis, P. A., Manuck, S. B., et al. (2019). Decoupling personality and acute psychiatric symptoms in a depressed sample and a community sample. *Clin. Psychol. Sci.* 7, 566–581. doi: 10.1177/2167702618813989

Gosling, S. D., Rentfrow, P. J., and Swann, W. B. Jr. (2003). A very brief measure of the Big-Five personality domains. *J. Res. Pers.* 37, 504–528. doi: 10.1016/s0092-6566(03)00046-1

Lee, S. A., and Crunk, E. A. (2020). Fear and psychopathology during the COVID-19 crisis: neuroticism, hypochondriasis, reassurance-seeking, and coronaphobia as fear factors. *Omega* [Epub ahead of print]. doi: 10.1177/0030222820949350

McDonald, R. P. (1999). *Test Theory: A Unified Approach*. Mahwah, NJ: Erlbaum.

McNeish, D. (2018). Thanks coefficient alpha, we'll take it from here. *Psychol. Methods* 23, 412–433. doi: 10.1037/met0000144

Nunes, A., Limpo, T., Lima, C. F., and Castro, S. L. (2018). Short scales for the assessment of personality traits: development and validation of the portuguese ten-item personality inventory (TIPI). *Front. Psychol.* 9:461. doi: 10.3389/fpsyg.2018.00461

Paredes, M. R., Apaolaza, V., Fernandez-Robin, C., Hartmann, P., and Yañez-Martinez, D. (2021). The impact of the COVID-19 pandemic on subjective mental well-being: the interplay of perceived threat, future anxiety and resilience. *Pers. Indiv. Differ.* 170:110455. doi: 10.1016/j.paid.2020.110455

Rettie, H., and Daniels, J. (2020). Coping and tolerance of uncertainty: predictors and mediators of mental health during the COVID-19 pandemic. *Am. Psychol.* [Epub ahead of print] doi: 10.1037/amp0000710

Salkovskis, P. M., Rimes, K. A., Warwick, H. M. C., and Clark, D. M. (2002). The health anxiety inventory: development and validation of scales for the measurement of health anxiety and hypochondriasis. *Psychol. Med.* 32, 843–853.

Segerstrom, S. C. (2007). *Breaking Murphy's Law: How Optimists Get What They Want From Life—and Pessimists Can Too*. New York, NY: Guilford.

Subica, A. M., Allen, J. G., Frueh, B. C., Elhai, J. D., and Fowler, J. C. (2016). Disentangling depression and anxiety in relation to neuroticism, extraversion, suicide, and self—harm among adult psychiatric inpatients with serious mental illness. *Br. J. Clin. Psychol.* 55, 349–370. doi: 10.1111/bjc.12098

Taquet, M., Luciano, S., Geddes, J. R., and Harrison, P. J. (2020). Bidirectional associations between COVID-19 and psychiatric disorder: retrospective cohort studies of 62 354 COVID-19 cases in the USA. *Lancet Psychiatry* 8, 130–140. doi: 10.1016/S2215-0366(20)30462-4

Taylor, S. (2017). *Clinician's Guide to PTSD*, 2nd Edn. New York, NY: Guildford.

Taylor, S. (2019). *The Psychology of Pandemics: Preparing for the Next Global Outbreak of Infectious Disease*. Newcastle upon Tyne: Cambridge Scholars Publishing.

Taylor, S. (2021). COVID stress syndrome: clinical and nosological considerations. *Curr. Psychiatry Rep.* 23:19.

Taylor, S., and Asmundson, G. J. G. (2004). *Treating Health Anxiety*. New York, NY: Guilford.

Taylor, S., Landry, C. A., Paluszek, M. M., Fergus, T. A., McKay, D., and Asmundson, G. J. G. (2020a). Covid stress syndrome: concept, structure, and correlates. *Depres. Anx.* 37, 706–714. doi: 10.1002/da.23071

Taylor, S., Landry, C. A., Paluszek, M. M., Fergus, T. A., McKay, D., and Asmundson, G. J. G. (2020b). Development and initial validation of the COVID stress scales. *J. Anx. Disord.* 72:102232. doi: 10.1016/j.janxdis.2020.102232

Zoellner, L. A., and Feeny, N. C. (2014). *Facilitating Resilience and Recovery Following Trauma*. New York, NY: Guilford.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 29 April 2021
doi: 10.3389/fpsyg.2021.641806

Psychological Impact of COVID-19 on College Students After School Reopening: A Cross-Sectional Study Based on Machine Learning

Ziyuan Ren[1†], *Yaodong Xin*[2†], *Junpeng Ge*[3†], *Zheng Zhao*[1], *Dexiang Liu*[1*], *Roger C. M. Ho*[4] *and Cyrus S. H. Ho*[4]

[1] Department of Medical Psychology and Ethics, School of Basic Medicine Sciences, Cheeloo College of Medicine, Shandong University, Jinan, China, [2] School of Statistics and Management, Shanghai University of Finance and Economics, Shanghai, China, [3] School of Biology Engineering, Shandong Jianzhu University, Jinan, China, [4] Department of Psychological Medicine, Yong Loo Lin School of Medicine, National University of Singapore, Singapore, Singapore

COVID-19, the most severe public health problem to occur in the past 10 years, has greatly impacted people's mental health. Colleges in China have reopened, and how to prevent college students from suffering secondary damage due to school reopening remains elusive. This cross-sectional study was aimed to evaluate the psychological impact of COVID-19 after school reopening and explore via machine learning the factors that influence anxiety and depression among students. Among the 478 valid online questionnaires collected between September 14th and September 20th, 74 (15.5%) showed symptoms of anxiety (by the Self-Rating Anxiety Scale), and 155 (32.4%) showed symptoms of depression (by Patient Health Questionnaire-9). Descriptive analysis of basic personal characteristics indicated that students at a higher grade, having relatives or friends who have been infected, fearing being infected, and having a pessimistic attitude to COVID-19 easily experience anxiety or depression. The Synthetic Minority Oversampling Technique (SMOTE) was utilized to counteract the imbalance of retrieved data. The Akaike Information Criterion (AIC) and multivariate logistic regression were performed to explore significant influence factors. The results indicate that exercise frequency, alcohol use, school reopening, having relatives or friends who have been infected, self-quarantine, quarantine of classmates, taking temperature routinely, wearing masks routinely, sleep quality, retaining holiday, availability of package delivery, take-out availability, lockdown restriction, several areas in school closed due to COVID-19, living conditions in the school, taking the final examinations after school reopening, and the degree to which family economic status is influenced by COVID-19 are the primary influence factors for anxiety or depression. To evaluate the effect of our model, we used 5-fold cross-validation, and the average area under the curve (AUC) values of the receiver operating characteristic (ROC) curves of anxiety and depression on the test set reached 0.885 and 0.806, respectively. To conclude, we examined the presence of anxiety and depression symptoms among Chinese college students after school reopening and explored many factors influencing students' mental health, providing reasonable school management suggestions.

Keywords: COVID-19, anxiety, depression, college student, machine learning

OPEN ACCESS

Edited by:
Fushun Wang,
Nanjing University of Chinese Medicine, China

Reviewed by:
Xiaolu Zhou,
Shanghai Normal University, China
Eleni Vousoura,
American College of Greece, Greece

***Correspondence:**
Dexiang Liu
liudexiang@sdu.edu.cn

†These authors have contributed equally to this work and share first authorship

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *15 December 2020*
Accepted: *29 March 2021*
Published: *29 April 2021*

Citation:
Ren Z, Xin Y, Ge J, Zhao Z, Liu D, Ho RCM and Ho CSH (2021) Psychological Impact of COVID-19 on College Students After School Reopening: A Cross-Sectional Study Based on Machine Learning. Front. Psychol. 12:641806. doi: 10.3389/fpsyg.2021.641806

INTRODUCTION

COVID-19 (coronavirus disease 2019), the most severe public health problem to occur in the past 10 years, has dramatically impacted the medical health service systems worldwide, causing 57,882,183 confirmed cases and 1,377,395 confirmed deaths up to 22 November 2020 (World Health Organization, 2020). It was first discovered in Wuhan, the Hubei province's capital city, China, and rapidly spread to other regions (Guan et al., 2020a,b). Indeed, after strict regulations were administrated across China, including quarantine, mask-wearing, large-scale nucleic acid assay, etc., the situation of COVID-19 in China significantly improved (Tang et al., 2020; Tu et al., 2020). From 19 November to 21 November 2020, the number of new cases discovered in China was 11 (National Health Commission of the People's Republic of China, 2020). However, more psychologists find that psychological problems, especially post-traumatic anxiety and depression, also matter after this dreadful disaster (Mazza et al., 2020; Pappa et al., 2020; Shader, 2020; Vindegaard and Benros, 2020).

Due to the severity of COVID-19 in the first half of this year, universities across China were closed, and all the students stayed at home and took online courses. In May and June, several universities in the so-called low-risk area reopened. Their students came back to attend their final exams, while most universities did not reopen until September 2020 (Ministry of Education of the People's Republic of China, 2020; People's Daily, 2020). Additionally, strict regulations were announced to protect college students from being infected (Ministry of Education of the People's Republic of China, 2020). For example, students must wear masks and accept temperature testing before they can come into the classroom. Besides, delivery services and free entry to the campus are no longer allowed.

Even before the COVID-19, college students are susceptible to mental health challenges facing unprecedented levels of distress, and early adulthood is one of the peak periods for many mental disorders (de Girolamo et al., 2012). Seventy-five percent of patients with mental health disorders had the first onset before 25 (Kessler et al., 2007). In China, it is reported that the prevalence of suicidal ideation was 9.2% among college students in Jilin province, 2019, and the two most significant risk factors were being a senior and family relationship (Wang et al., 2019). College students play a crucial role in the development of a country. Therefore, with media attention on the college campus, the high rates of mental disorder prevalence have become a growing public health problem in many countries. During the COVID-19, young adults and college students faced more mental challenges, including academic pressure, employment pressure, and family pressure. Many previous studies demonstrated that COVID-19 has led to profound mental and behavioral changes among college students (Alemany-Arrebola et al., 2020; Huckins et al., 2020; Ma et al., 2020; Zhai and Du, 2020). Cao et al. performed a cross-sectional study in China and found that 0.9% of the respondents were experiencing severe anxiety, 2.7% were experiencing moderate anxiety, and 21.3% were experiencing mild anxiety (Cao et al., 2020). Similarly, college students' anxiety and depression rates during the early stages of COVID-19 were not optimistic in the United States (Kecojevic et al., 2020) and Bangladesh (Khan et al., 2020). It is necessary and urgent to improve college students' mental status, and any exacerbation due to strict school regulations after school reopening is unacceptable (Giannopoulou et al., 2020; Kalok et al., 2020).

Whether universities should implement strict regulations remains controversial (Beijing News, 2020). Some think it is irrational to sacrifice students' mental health to prevent COVID-19 transmission. Others believe the strict regulation will not cause mental damage to college students. COVID-19 will not be the last pandemic, so it is of great significance to accumulate experience to avoid severe damage to college students' mental health during the next pandemic event. However, no published articles have investigated the current psychological status of students under these regulations. To this end, we conducted this cross-sectional study via an online questionnaire to ascertain the psychological impact after school reopening on students among five universities across China. Further, we performed machine learning to screen out risk and protective factors that influence the college students' mental health status, including school regulation, family situation, and personal living styles. These influence factors may provide some sensible advice for the school administrative department to prevent college students from mental diseases.

MATERIALS AND METHODS

Ethics Statement

This cross-sectional study was approved by the Ethics Committee of Shandong University as a human-involved study with the serial number ECSBMSSDU2020-1-056. The Declaration of Helsinki was strictly followed, and no identifying information was collected. This cross-sectional study's data collection was conducted between September 14th and September 20th, mainly among five universities across China: Shandong University, Shandong Normal University, Qingdao University (Qingdao, Shandong province), Shanghai Tech University, and Shanghai University of Finance and Economics (Shanghai). Because of COVID-19, an online anonymous questionnaire website (www.wenjuan.com) was used. Therefore, no formal consent was acquired. All participants voluntarily ticked off the informed consent in the first item.

Participants

Among the 548 invited subjects, 508 subjects were invited to complete the questionnaire by the investigators, and 40 were invited by a free open access online questionnaire distribution platform, www.wjx.cn. Among all the 548 retrieved questionnaires, 478 were valid to study further. Two retrieved questionnaires left blanks, 66 left obvious and invalid options, and 2 had an IP address outside China.

Designed Questionnaire

Basic Personal Characteristics

Two sets of basic personal characteristics were listed in the questionnaire: demographic characteristics and personal perspectives on COVID-19. Demographic characteristics included gender, major, grade, and family location. Personal perspectives on COVID-19 included fear of being infected,

attitude to COVID-19, history of psychological counseling, and need for psychological counseling. In this study, "psychological counseling" means college students received psychological counseling from their school. In China, the impact of the COVID-19 on college students' mental health has drawn public attention. After the school reopening, the university might provide psychological counseling for all students. The detailed options for each question are presented in **Table 1**.

Assessment of Anxiety and Depression

The classic Zung's Self-rating Anxiety Scale (SAS) was used to evaluate the participants' anxiety degree (Zung, 1971); it includes 20 self-reported items about moods, sleep, sense of pain, etc. After the standardized scoring algorithm, four anxiety degree grades were defined. A score of 20–49 was considered as no anxiety, 50–59 as mild anxiety, 60–69 as moderate anxiety, and 70–80 as severe anxiety. Zhou et al. demonstrated that the reliability and validity of SAS applied in Chinese college students were acceptable. The criterion defining normal/mild/moderate/severe anxiety was suitable for Chinese (Yongan, 2012). The Cronbach's alpha was 0.906 for SAS in the current study.

The Patient Health Questionnaire-9 (PHQ-9) was used to evaluate the depression degree (Kroenke et al., 2001); it includes nine self-reported items with a score of 0–4 for each question. After the standardized scoring algorithm, five depression degree grades were defined. A score of 0–4 was considered as no depression, 5–9 as mild depression, 10–14 as moderate depression, 15–19 as moderate to severe depression, and 20–27 as severe depression. This scale has been confirmed to be a reliable and valid tool in assessing mental health in Chinese adolescents (Xingchen et al., 2014). In this study, the Cronbach's alpha for PHQ-9 was 0.918.

Influence Factor Selection

All the influence factors included in our questionnaire were acquired from a 20-subject pre-survey. We randomly invited 20 subjects included in the pre-survey from Shandong University. Two investigators (Y.X and J.P) searched the Pubmed and retrieved 30 potential influence factors. We asked 20 subjects whether they agreed a certain factor might significantly influence students' psychological condition. Therefore, we selected those factors which are agreed by most subjects (>10/20). After considering all the retrieved influence factors comprehensively, three sets of questions were included in our questionnaire: school regulations, family situation, and personal living style. School regulations mean the regulations announced during COVID-19 to prevent disease transmission across schools, including school reopening, routine mask-wearing, routine temperature-taking, several areas in school being closed due to COVID-19, final examinations being taken after school reopening, retaining holiday (whether to shorten or cancel the holiday after school reopening), availability of package delivery (after school reopening), take-out food availability (after school reopening), lockdown restriction (whether to allow free access to campus after school reopening), quarantine of classmates (after school reopening), and self-quarantine after school reopening. The "retaining holiday (whether to shorten or cancel the holiday after school reopening)" here refers to the fact that a number of universities in China have shortened or canceled some holidays in order to minimize the students' total in-school time after school reopening during COVID-19. "Holiday" here includes weekends and statutory holidays in China. The family situation means the impact of COVID-19 on family, including having relatives or friends who have been infected and the degree to which family economic status was influenced by COVID-19. The personal living style includes exercise frequency, alcohol use, sleep quality, and satisfaction with school living conditions. The detailed options for each question are presented in **Table 2**.

Statistics

Correlation analysis was performed for univariate analysis to primarily determine whether factors have relations with students' anxiety or depression conditions in a descriptive view. More specifically, for independent variables from two categories or multiple unordered categories, we used the chi-square test. For the cells in which the samples numbered <5, we used Fisher's exact test. For explanatory variables from multiple ordered categories, we used Somer's d to measure the consistency between the two (that is, whether the two tend to move in the same or opposite directions).

Logistic regression was performed for multivariate analysis to determine the association between a particular factor and students' psychological status quantitively, other factors being equal. First, we divided the samples into five equal parts in order to perform 5-fold cross-validation. Second, the Synthetic Minority Oversampling Technique (SMOTE) was performed on the training dataset to preprocess the retrieved data. As is acknowledged to all, the number of positive and negative samples of medical data is often uneven, which could strongly affect the effectiveness of the Logistic regression model. SMOTE is an oversampling algorithm that generates extra samples based on the original dataset. By setting a specific scale, SMOTE can make the dataset balanced using methods of oversampling. The Akaike Information Criterion (AIC) and binary logistic regression were performed to explore significant influence factors. The accuracy, sensitivity (recall), specificity (accuracy = (TP + TN)/(TP + TN + FP + FN), sensitivity = TP/(TP + FN), specificity = TN/(TN + FP), where TP is correct positive assignments, TN is correct negative assignments, FP is incorrect positive assignments, and FN is incorrect negative assignments) and area under the curve (AUC) values of the receiver operating characteristic (ROC) curves were used to evaluate the machine learning model.

Data collection and descriptive analysis were performed using Excel 2016 (Microsoft, Washington, D.C., US). Univariate analyses were performed using IBM SPSS Statistics 24.0 (International Business Machines Corporation, Armonk, NY, USA). Multivariate analyses were performed using the R language(R Core Team, 2020). A P-value <0.05 was considered statistically significant.

TABLE 1 | Descriptive analysis of basic characteristics.

Variable ($n = 478$)	All participants (%)		Anxiety				*P-value*	Depression				*P-value*
			NO		YES			NO		YES		
Gender												
Male	205	42.9%	168	82.0%	37	18.0%	0.18	140	68.3%	65	31.7%	0.77
Female	273	57.1%	236	86.4%	37	13.6%	Chi-square	183	67.0%	90	33.0%	Chi-square
Major												
Medicine/Biology	100	20.9%	87	87.0%	13	13.0%	0.64	63	63.0%	37	37.0%	0.64
Psychology	151	31.6%	129	85.4%	22	14.6%	Chi-square	107	70.9%	44	29.1%	Chi-square
Science/Engineering	59	12.3%	51	86.4%	9	15.3%		40	67.8%	19	32.2%	
Others	168	35.1%	137	81.5%	31	18.5%		113	67.3%	55	32.7%	
Grade												
Fresher	110	23.0%	100	90.9%	10	9.1%	0.03	82	74.5%	28	25.5%	0.35
Sophomore	182	38.1%	154	84.6%	28	15.4%	Chi-square	119	65.4%	63	34.6%	Chi-square
Junior	139	29.1%	116	83.5%	23	16.5%		92	66.2%	47	33.8%	
Senior (4th/5th) and above	47	9.8%	34	72.3%	13	27.7%		30	63.8%	17	36.2%	
Family location												
Rural/County areas	227	47.5%	194	85.5%	33	14.5%	0.59	158	69.6%	69	30.4%	0.37
City	251	52.5%	210	83.7%	41	16.3%	Chi-square	165	65.7%	86	34.3%	Chi-square
Fear of being infected												
Very low	186	38.9%	169	90.9%	17	9.1%	<0.001	140	75.3%	46	24.7%	<0.001
Low	152	31.8%	131	86.2%	21	13.8%	Somer's d	100	65.8%	52	34.2%	Somer's d
Medium	92	19.2%	71	77.2%	21	22.8%		55	59.8%	37	40.2%	
High	33	6.9%	22	66.7%	11	33.3%		20	60.6%	13	39.4%	
Very high	15	3.1%	11	73.3%	4	26.7%		8	53.3%	7	46.7%	
Attitude to COVID-19												
Very pessimistic	30	6.3%	24	80.0%	6	20.0%	<0.001	17	56.7%	13	43.3%	<0.001
Pessimistic	36	7.5%	25	69.4%	11	30.6%	Somer's d	21	58.3%	15	41.7%	Somer's d
Medium	100	20.9%	78	78.0%	22	22.0%		54	54.0%	46	46.0%	
Optimistic	120	25.1%	102	85.0%	18	15.0%		78	65.0%	42	35.0%	
Very optimistic	192	40.2%	175	91.1%	17	8.9%		153	79.7%	39	20.3%	
History of counseling												
Yes	215	45.0%	183	85.1%	32	14.9%	0.74	154	71.6%	61	28.4%	0.09
No	263	55.0%	221	84.0%	42	16.0%	Chi-square	169	64.3%	94	35.7%	Chi-square
Need for counseling												
Yes	60	12.6%	32	53.3%	28	46.7%		26	43.3%	34	56.7%	
No	352	73.6%	321	91.2%	31	8.8%		266	75.6%	86	24.4%	
Not sure	66	13.8%	51	77.3%	15	22.7%		31	47.0%	35	53.0%	

Counseling here means psychological counseling received from school or from others. Somer's d was used to measure the consistency of ordered categories. Chi-square test was used to measure correlations between unordered categories.

RESULTS

Presence of Anxiety and Depression Symptoms

This survey's response variables were anxiety and depression evaluated by SAS and PHQ-9, respectively. Among all the 478 valid subjects, 74 (15.5%) showed symptoms of anxiety (among which 4 (0.8%) showed severe anxiety, 15 (3.1%) showed moderate anxiety, and 55 (11.5%) showed mild anxiety). Besides, 155 (32.4%) showed symptoms of depression (among which 9 (1.9%) showed severe depression, 26 (5.4%) showed moderate to severe depression, 46 (9.6%) showed moderate depression, and 74 (15.5%) showed mild depression). We divided subjects into two sets—anxiety (depression) and normal (normal)—for further influence factor exploration.

Descriptive Analysis of Basic Personal Characteristics

The basic personal characteristics of the 478 valid subjects are displayed in **Table 1**. College students at a higher grade, fear being infected, and have a more pessimistic attitude to COVID-19 were more likely to report anxiety or depression, while gender, major, and family location did not significantly differ. After comparing 215 (45%) subjects who have received psychological

TABLE 2 | Descriptive statistics of influence factors.

Influence factors	Anxiety					Depression				
	NO		Yes		*P-value*	No		Yes		*P-value*
School regulation										
School reopening										
Yes	397	85.40%	68	14.60%	*F-P*	314	67.50%	151	32.50%	*F-P*
No	7	53.80%	6	46.20%	0.008	9	69.20%	4	30.80%	0.58
Wearing masks routinely										
Yes	246	84.80%	44	15.20%	*C-P*	202	69.70%	88	30.30%	*C-P*
No	158	84.00%	30	16.00%	0.817	121	64.40%	67	35.60%	0.227
Taking temperature routinely										
Yes	339	84.30%	63	15.70%	*C-P*	267	66.40%	135	33.60%	*C-P*
No	65	85.50%	11	14.50%	0.791	56	73.70%	20	26.30%	0.215
Several areas in school closed due to COVID-19 (136 reported not sure)										
Yes	135	82.80%	28	17.20%	*C-P*	101	62.00%	62	38.00%	*C-P*
No	149	83.20%	30	16.80%	0.918	132	73.70%	47	26.30%	0.02
Taking the final examination after school reopening										
Yes	237	86.80%	36	13.20%	*C-P*	190	69.60%	83	30.40%	*C-P*
No	167	81.50%	38	18.50%	0.11	133	64.90%	72	35.10%	0.275
Retaining holiday (119 reported not sure)										
Yes	100	86.20%	16	13.80%	*C-P*	80	69.00%	36	31.00%	*C-P*
No	200	82.30%	43	17.70%	0.351	165	67.90%	78	32.10%	0.839
Availability of package delivery (28 reported not sure)										
Yes	313	86.50%	49	13.50%	*C-P*	244	67.40%	118	32.60%	*C-P*
No	68	77.30%	20	22.70%	0.032	60	68.20%	28	31.80%	0.889
Take-out availability (31 reported not sure)										
Yes	41	67.20%	20	32.80%	*C-P*	36	59.00%	25	41.00%	*C-P*
No	335	86.80%	51	13.20%	<0.001	264	68.40%	122	31.60%	0.147
Lockdown restriction (19 reported not sure)										
Yes	364	85.60%	61	14.40%	*C-P*	287	67.50%	138	32.50%	*C-P*
No	23	67.60%	11	32.40%	0.005	22	64.70%	12	35.30%	0.736
Quarantine of classmates										
Yes	51	75.00%	17	25.00%	*C-P*	36	52.90%	32	47.10%	*C-P*
No	353	86.10%	57	13.90%	0.019	287	70.00%	123	30.00%	0.005
Self-quarantine after school reopening										
Yes	9	47.40%	10	52.60%	*C-P*	7	36.80%	12	63.20%	*C-P*
No	395	86.10%	64	13.90%	<0.001	316	68.80%	143	31.20%	0.003
Family situation										
Having relatives or friends who have been infected										
Yes	4	50.00%	4	50.00%	*F-P*	2	25.00%	6	75.00%	*F-P*
No	400	85.10%	70	14.90%	0.023	321	68.30%	149	31.70%	0.016
The degree of family economic status influenced by COVID-19 (1 for little, 5 for much)										
1	136	94.40%	8	5.60%		110	76.40%	34	23.60%	
2	87	74.40%	30	25.60%	S	71	60.70%	46	39.30%	S
3	119	88.10%	16	11.90%	0.066	90	66.70%	45	33.30%	0.06
4	35	70.00%	15	30.00%	*p*	31	62.00%	19	38.00%	*p*
5	27	84.40%	5	15.60%	0.004	21	65.60%	11	34.40%	0.053
Personal living style										
Exercise frequency (past 1 week)										
nearly 0 time	87	82.10%	19	17.90%		62	58.50%	44	41.50%	
1 time	79	78.20%	22	21.80%	S	64	63.40%	37	36.60%	S
2 times	89	88.10%	12	11.90%	−0.046	69	68.30%	32	31.70%	−0.092
3 times	45	83.30%	9	16.70%	*p*	41	75.90%	13	24.10%	*p*
more than 4 times	104	89.70%	12	10.30%	0.045	87	75.00%	29	25.00%	0.002

(Continued)

TABLE 2 | Continued

Influence factors	Anxiety					Depression				
	NO		Yes		*P-value*	No		Yes		*P-value*
Alcohol use (past 2 week)										
nearly 0 time	314	88.00%	43	12.00%		251	70.30%	106	29.70%	
1 time	52	76.50%	16	23.50%	S	42	61.80%	26	38.20%	S
2 times	18	66.70%	9	33.30%	0.124	16	59.30%	11	40.70%	0.102
3 times	9	64.30%	5	35.70%	*p*	7	50.00%	7	50.00%	*p*
more than 4 times	11	91.70%	1	8.30%	0.002	7	58.30%	5	41.70%	0.03
Self-rating sleep quality (1 for very poor, 5 for very good)										
1	39	81.30%	9	18.80%		29	60.40%	19	39.60%	
2	58	73.40%	21	26.60%	S	45	57.00%	34	43.00%	S
3	94	81.70%	21	18.30%	−0.089	70	60.90%	45	39.10%	−0.147
4	96	86.50%	15	13.50%	*p*	69	62.20%	42	37.80%	*p*
5	117	93.60%	8	6.40%	<0.001	110	88.00%	15	12.00%	<0.001
Satisfaction of living conditions in school (1 for very unsatisfied, 5 for very satisfied)										
1	52	85.20%	9	14.80%		43	70.50%	18	29.50%	
2	83	80.60%	20	19.40%	S	69	67.00%	34	33.00%	S
3	110	78.00%	31	22.00%	−0.059	82	58.20%	59	41.80%	−0.043
4	81	89.00%	10	11.00%	*p*	64	70.30%	27	29.70%	*p*
5	78	95.10%	4	4.90%	0.005	65	79.30%	17	20.70%	0.141

F-P, P-value of Fisher's test; C-P, P-value of the Chi-square test; S, Somer's d; p, P-value of Somer's d.

counseling with the other students who did not, no significant difference in the presence of expression/anxiety symptoms was observed for students who had received counseling ($p = 0.74$ for anxiety, and $p = 0.09$ for depression) compared with the control group, which means that the effect of current psychological counseling is limited. Besides, 60 (12.6%) students reported that they need psychological counseling. Notably, 66 (13.8%) students reported that they had no idea whether they need professional psychological counseling; the presence of anxiety was 22.7%, and that of depression was 53% in this group, which is nearly three times the presence of anxiety and two times the presence of depression observed in the group of students who reported that they did not need counseling. Therefore, the group of students who are not sure whether they need psychological counseling appears particularly vulnerable for experiencing clinically significant depression or anxiety.

Descriptive Analysis of Influence Factors

The characteristics of the 17 influence factors in our questionnaires are displayed in **Table 2**. In the set of school regulations, school reopening, several areas in schools being closed due to COVID-19, lockdown restriction, and availability of package delivery alleviated college students' anxiety or depression. A significant relationship between depression or anxiety and take-out availability, quarantine of classmates, and self-quarantine after school reopening was found ($p < 0.05$). Other risk factors were of no statistical significance ($p > 0.05$). In terms of family situation, having relatives or friends who have been infected and the family economic status being influenced to a strong degree by COVID-19 were significantly related to psychological problems. Finally, in personal living style, students who exercise more, drink less, sleep better, and are satisfied with their living conditions reported a healthier psychological state.

Construction of the Logistic Regression Model

SMOTE was performed to counteract the imbalance of the retrieved data (15.5% of subjects showed a symptom of anxiety, and 32.4% of subjects show a symptom of depression). When using SMOTE, we need to determine three parameters: k, perc.over, and perc.under. k represents the number of nearest neighbors used to generate new instances of the minority classes. perc.over decides how many additional cases to generate from the minority classes (known as oversampling). perc.under decides how many extra cases from the majority classes are selected for each case generated from the minority class (known as under-sampling). As shown in **Figure 1A**, for the SAS dataset, when $\underline{k} = 6$, perc.over = 500, and perc.under = 120, the AUC reaches the maximum. Similarly, for the PHQ9 dataset, when $k = 2$, perc.over = 400, and perc.under = 125, the AUC reaches the maximum (**Figure 1B**). Since we had divided the dataset into five equal parts, we selected one part as the test set each time and using SMOTE to process the other four groups. A new dataset was thus utilized in the construction of the logistic regression model for anxiety and depression.

The AIC (**Table 3**) was applied to select proper influence factors for inclusion in the logistic regression model. Among the 17 influence factors acquired from a 20-subject pre-survey, 13 factors (taking temperature routinely, retaining holiday, self-rated sleep quality, taking the final examination after school

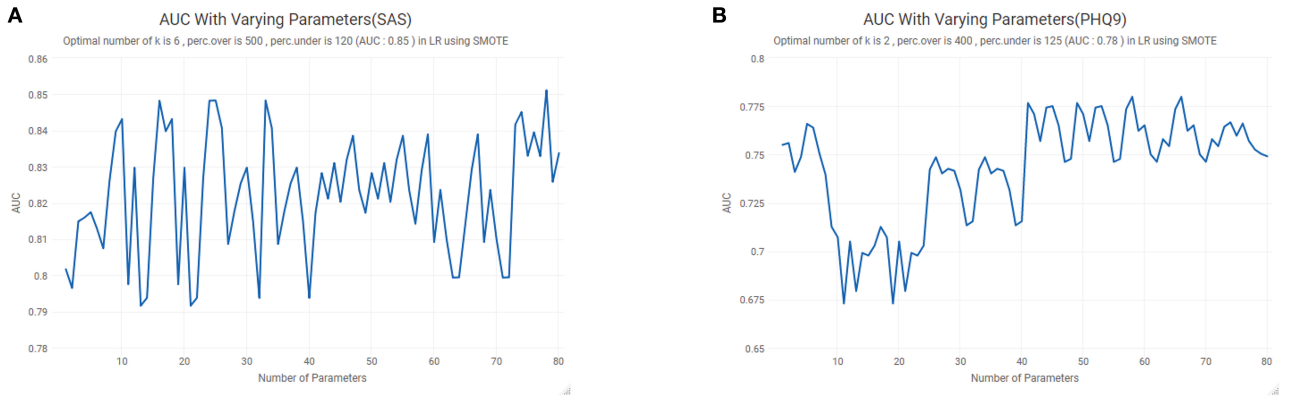


FIGURE 1 | The Synthetic Minority Oversampling Technique (SMOTE): **(A)** anxiety; **(B)** depression. AUC, area under the curve.

reopening, lockdown restriction, exercise frequency, quarantine of classmates, take-out availability, alcohol use, availability of package delivery, school reopening, self-quarantine after school reopening, and the degree to which family economic status is influenced by COVID-19) were extracted according to the AIC for anxiety, while 15 factors (routinely wearing masks, having relatives or friends who have been infected, satisfaction with living conditions in the school, taking temperature routinely, several areas in school being closed due to COVID-19, self-rated sleep quality, taking the final examination after school reopening, lockdown restriction, exercise frequency, quarantine of classmates, take-out availability, alcohol use, availability of package delivery, self-quarantine after school reopening, and the degree to which family economic status is influenced by COVID-19) were extracted for depression.

We used a conventional generalized linear model, Logistic regression, to analyze the data after selecting factors. For each factor, we set the first level as the control group. The results of the logistic regression are presented in **Table 4**. The binary logistic regression finally extracted 12 significant influence factors (excluding sleep quality from the list of 13 above) for anxiety and 12 (excluding taking temperature routinely, taking the final examination after school reopening, and availability of package delivery from the list of 15 above) for depression ($p < 0.05$).

Evaluation of the Logistic Regression Model

When applying a logistic regression model, it is crucial to avoid overfitting. To evaluate our model effectively, we first divided the dataset into five equal parts, using four of them to train a regression model. Then, we tested the generated model to see whether there was a significant difference. The ROC curves of 5-fold cross-validation were plotted to evaluate our logistic regression model (**Figure 2**), where the shadow area represents the 95% confidence interval of the ROC curve. The anxiety model's average accuracy was 81.42%, and that of the depression model was 73.5%. On the test dataset, the average AUC of the anxiety model was 0.885, and that of the depression model was 0.806, which indicates that the predictive power of our models is excellent. The average sensitivity (recall) of the models reached 83.21 and 75.3%, respectively. The average specificity of the models reached 80.38 and 71.80%, respectively. The sensitivity and specificity were both acceptable.

DISCUSSION

In this study, we performed a cross-sectional survey to investigate the presence of anxiety and depression symptoms among Chinese college students after school reopening and explored a series of factors influencing students' mental health.

First, the descriptive statistics of basic personal characteristics were utilized to test whether these basic characteristics would affect students' emotional status. The result shows that students having relatives or friends who have been infected, fearing being infected, having a more pessimistic attitude toward COVID-19 were more likely to report psychological problems. Moreover, we found that students at a higher grade easily got anxious and depressed. First, senior students must participate in a practicum, which has been demonstrated as a risk factor for stress and anxiety (Cheung et al., 2016). Besides, senior students faced more mental challenges, including greater academic pressure, graduation pressure, etc. Furthermore, due to the pandemic of COVID-19, these pressures were amplified. Of the participants, 60 (12.6%) reported needing psychological help, and 66 (13.8%) reported that they had no idea whether they needed psychological help. These students would be more vulnerable than others for lacking awareness of the importance of psychological health and not getting prompt treatment. Therefore, it is necessary to give students universal mental health education. Besides, among the 478 subjects, 215 (45%) had received psychological counseling from school. However, it had not resulted in a significant improvement of their mental health, which indicates that the effect of current psychological help for college students is limited. Several potential reasons probably cause this. Firstly, the effect of current psychological help, especially online counseling, for college students is limited. Many Chinese university counselors

TABLE 3 | The Akaike Information Criterion (AIC) values of the 17 influence factors for anxiety and depression.

In/Out	Influence factor	Df	Deviance	AIC
Anxiety				
	<none>		447.52	507.52
Out	wearing masks routinely	1	446.65	508.65
Out	having relatives or friends who have been infected	1	447.49	509.49
Out	satisfaction of living conditions in school (1 for very unsatisfied, 5 for very satisfied)	4	441.6	509.6
In	taking temperature routinely	1	451.68	509.68
Out	several areas in school closed due to COVID-19	1	446.72	510.72
In	retaining holiday	1	456.94	512.94
In	self-rating sleep quality (1 for very poor, 5 for very good)	4	463.64	515.64
In	taking final examination after school reopening	1	457.95	515.95
In	lockdown restriction	1	462.73	518.73
In	exercise frequency (past 1 week)	4	472.48	524.48
In	quarantine of classmates	1	467.86	525.86
In	take-out food availability	1	470.69	526.69
In	alcohol use (past 2 week)	4	476.08	528.08
In	availability of package delivery	1	472.56	528.56
In	school reopening	1	473.96	531.96
In	self-quarantine after school reopening	1	476.11	534.11
In	the degree of family economic status influenced by COVID-19 (1 for little, 5 for much)	4	482.45	534.45
Depression				
	<none>		1205.8	1275.8
In	taking the final examination after school reopening	1	1208.5	1276.5
Out	retaining holiday	1	1203	1277
In	taking temperature routinely	1	1209.2	1277.2
Out	school reopening	1	1205.8	1277.8
In	several areas in school closed due to COVID-19	1	1212.5	1278.5
In	availability of package delivery	1	1213.7	1279.7
In	exercise frequency (past 1 week)	4	1227	1289
In	the degree of family economic status influenced by COVID-19 (1 for little, 5 for much)	4	1230.2	1292.2
In	take-out food availability	1	1228.2	1294.2
In	satisfaction of living conditions in school (1 for very unsatisfied, 5 for very satisfied)	4	1233.9	1295.9
In	alcohol use (past 2 week)	4	1240.1	1302.1
In	wearing masks routinely	1	1235.3	1303.3
In	lockdown restriction	1	1237.3	1303.3
In	having relatives or friends who have been infected	1	1238.5	1306.5
In	quarantine of classmates	1	1239	1307
In	self-quarantine after school reopening	1	1256.2	1324.2
In	self-rating sleep quality (1 for very poor, 5 for very good)	4	1272.8	1334.8

"In" means included in the logistic regression model; "Out" means excluded from the logistic regression model; DF, degrees of freedom.

would need training in psychological service. Moreover, it may still require a longer time to observe therapeutic changes of the psychological survey. Universities are essential in dealing with the mental status of college students (Zhai and Du, 2020). It is impractical to provide face-to-face professional psychological counseling to every college student due to financial limitations and psychologists' numbers. Besides selecting students in need by way of the influence factors discussed above, tele-counseling is particularly important in this area. Previous studies have reported that tele-counseling or digital mental health interventions have developmental prospects (Levin et al., 2016, 2017; Lattie et al., 2019). However, some also reported that the current situation of college psychological centers' website effectiveness is compromised. Seidel et al. reported that only half of all 138 analyzed websites provided information about remote counseling. Approximately two-thirds of them had directions for students experiencing a mental health emergency (Seidel et al., 2020). Indeed, how to provide professional psychological help to students in need remains controversial (Lungu and Sun, 2016; Webermann and Murphy, 2020).

Second, univariate and multivariate analysis extracted 17 significant factors influencing college students' mental status. Among these influence factors, four factors of healthier personal lifestyles—higher exercise frequency, lower alcohol use, higher sleep quality, and higher satisfaction with living conditions in the school—were closely related to a lower risk of psychological problems. Several studies in the literature have demonstrated that these influence factors play a crucial role in public mental health (Walsh, 2011; Velten et al., 2018; Oftedal et al., 2019). Notably, it was reported that sleep problems among adolescents and young adults during the COVID-19 epidemic, especially college students, are common and negatively associated with students' projections of trends in COVID-19 (Zhou et al., 2020). Zhang et al. found that sleep problems may mediate the pandemic's impact on mental health (Zhang et al., 2020). Therefore, more attention should be paid to insomnia currently. As for the two family situation influence factors, having relatives or friends who have been infected and unstable family income would cause psychological problems. In terms of the 11 school regulation influence factors, quarantine was a robust factor associated with clinical symptoms of anxiety and depression (Khan et al., 2020; Tang et al., 2020,a; Xin et al., 2020) compared with the control group, suggesting that reducing unnecessary quarantine measures can effectively improve students' mental health. The protective regulations, such as lockdown restriction, were mostly related to better mental health, unexpected before this investigation. This result suggests that college students would rather endure some inconvenience in daily life than be probably infected with the virus, except for some daily necessities, such as delivery and retaining holiday. With the rate of the virus spread slowing down, schools at all levels are reopening. Although the pandemic situation has been much improved, finding the balance between protecting students from coronavirus infection and preventing students from the pressure of delayed schooling, compromised living conditions, and physical health is challenging for policymakers. In this study, we screened the significant influence factors associated with

TABLE 4 | Binary logistic regression model.

	Anxiety		Depression	
	OR(95% CI)	***P-value***	**OR(95% CI)**	***P-value***
School regulation				
School reopening				
Yes	reference		none	
No	21.99(6.84,70.68)	<0.001		
Wearing masks routinely				
Yes			reference	
No			2.33(1.71,3.17)	<0.001
Taking temperature routinely				
Yes	reference		reference	
No	1.88(1.10,3.23)	0.021	0.7(0.47,1.03)	0.067 (out)
Several areas in school closed due to COVID-19				
Yes	none		reference	
No			0.64(0.45,0.9)	0.011
Taking the final examination after school reopening				
Yes	reference		reference	
No	2.40(1.53,3.79)	<0.001	1.27(0.96,1.7)	0.099 (out)
Retaining holiday				
Yes	reference		none	
No	1.85(1.07,3.21)	0.028		
Availability of package delivery				
Yes	reference		reference	
No	3.53(2.06,6.03)	<0.001	1.13(0.77,1.64)	0.5329 (out)
Tale-out food availability				
Yes	reference		reference	
No	0.21(0.12,0.37)	<0.001	0.39(0.26,0.58)	<0.001
Lockdown restriction				
Yes	reference		reference	
No	4.35(2.33,8.33)	<0.001	2.63(1.67,4.17)	<0.001
Quarantine of classmates				
Yes	reference		reference	
No	0.23(0.12,0.42)	<0.001	0.32(0.22,0.48)	<0.001
Self-quarantine after school reopening				
Yes	reference		reference	
No	0.15(0.07,0.33)	<0.001	0.13(0.07,0.26)	<0.001
Family situation				
Having relatives or friends who have been infected				
Yes	none		reference	
No			0.08(0.03,0.24)	<0.001
The degree of family economic status influenced by COVID-19 (1 for little, 5 for much)				
1	reference		reference	
2	4.56(2.31,9.00)	<0.001	1.86(1.23,2.8)	0.003
3	1.00(0.5,2.04)	0.990	1.37(0.92,2.05)	0.124
4	4.7(2.15,10.28)	<0.001	3.28(1.91,5.64)	<0.001
5	4.35(1.69,11.18)	0.002	2.26(1.26,4.06)	0.006
Personal living style				
Exercise frequency (past 1 week)				
nearly 0 time	reference		reference	
1 time	1.48(0.80,2.73)	0.215	0.65(0.43,1.01)	0.053
2 times	0.54(0.28,1.03)	0.060	0.75(0.49,1.15)	0.185
3 times	0.90(0.40,2.03)	0.802	0.45(0.26,0.78)	0.004
more than 4 times	0.37(0.18,0.74)	0.005	0.42(0.28,0.63)	<0.001

(Continued)

TABLE 4 | Continued

	Anxiety		Depression	
	OR(95% CI)	***P-value***	**OR(95% CI)**	***P-value***
Alcohol use (past 2 week)				
nearly 0 time	reference		reference	
1 time	1.86(1.06,3.26)	0.029	1.76(1.21,2.56)	0.003
2 times	3.97(1.67,9.44)	0.002	3.79(2.03,7.06)	<0.001
3 times	9.21(1.78,47.58)	0.008	4.47(1.88,10.63)	0.001
more than 4 times	0.15(0.02,1.11)	0.064	1.02(0.37,2.79)	0.975
Self-rating sleep quality (1 for very poor, 5 for very good)				
1	reference		reference	
2	1.73(0.72,4.19)	0.221 (out)	0.73(0.39,1.37)	0.326
3	1.66(0.70,3.94)	0.254	0.78(0.43,1.4)	0.406
4	1.15(0.49,2.67)	0.747	0.66(0.37,1.18)	0.165
5	0.61(0.24,1.54)	0.296	0.17(0.09,0.32)	<0.001
Satisfaction of living conditions in school (1 for very unsatisfied, 5 for very satisfied)				
1	none		reference	
2			2.44(1.31,4.53)	0.005
3			3.32(1.85,5.94)	<0.001
4			1.48(0.79,2.76)	0.217
5			3.04(1.61,5.75)	0.001

OR, odds ratio; CI, confidence interval; "out" means no statistical significance; "none" means excluded by AIC.

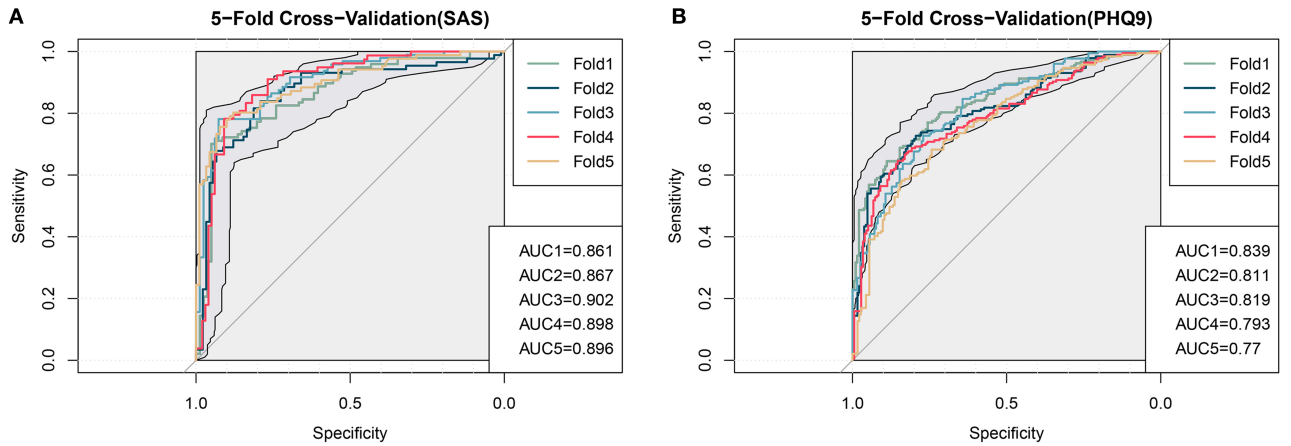


FIGURE 2 | Evaluation of the logistic model by 5-fold cross-validation. **(A)** anxiety; **(B)** depression. AUC, area under the curve.

anxiety and depression among college students. According to our findings, several preventive interventions should be mentioned. First, schools should provide professional psychological help for students suffering from COVID-19, especially having relatives or friends who have been infected. Schools should also provide more financial aids for students in poverty during COVID-19. Besides, schools should encourage students to develop healthy lifestyles, including daily exercise and lower alcohol use. Besides, schools should emphasize the importance of sleep, especially in this particular period. Finally, some strict regulations should be applied, such as wearing masks and taking temperature routinely. These measurements would even improve students' mental health. Simultaneously, schools should ensure that some services closely related to students' daily life, such as delivery service, will be maintained.

Previous studies have demonstrated that college students have been suffering extreme mental pressure during this pandemic, and proposed some countermeasures. Chi's study supported interventions promoting resilience, even remotely, to subjects with specific risk factors of developing poor mental health during COVID-19 or other pandemics with social isolation (Chi et al., 2020). Chen et al. found that isolation policy had a complex influence on the symptoms of obsessive–compulsive disorder, fear, hypochondria, depression, and neurasthenia via various

factors and introduced a six-step intervention strategy to alleviate young people's psychological problems while in isolation (Chen et al., 2020). Similar studies were performed in many other countries, including the United States (Huckins et al., 2020; Son et al., 2020), Saudi Arabia (Alkhamees et al., 2020), India (Kapasia et al., 2020), Bangladesh (Khan et al., 2020), and Jordan (Naser et al., 2020). Huckins et al. reported that compared with U.S. college students in the prior academic terms, the Winter 2020 term individuals were more sedentary, anxious, and depressed. A wide variety of behaviors, including increased phone usage, decreased physical activity, and fewer locations visited, were associated with fluctuations in COVID-19 news reporting (Huckins et al., 2020).

Some previous studies have also reported some "hub influence factors" that serve as mediators between "ordinary influence factors" and psychological problems. For example, as mentioned above, Zhang et al. utilized R software's mediation package to find that the severity of the COVID-19 outbreak indirectly affects negative emotions by affecting sleep quality (Zhang et al., 2020). Such mediators also include resilience, social support, and coping (Yang et al., 2020a). These "hub factors" could be considered "targets" for psychological interventions, including psychological counsel to strengthen one's resilience and coping ability, social support from friends or family, and even medical intervention. For example, the appropriate application of some hypnotics has been proved to be effective for anxiety and depression patients without significant side effects (Yang et al., 2020b). The "sleep quality" factor derived in our study is one of the previously discovered "hub influence factors" (Zhang et al., 2020). Therefore, we highly suggested that schools encourage students to get enough sleep times and higher sleep quality.

In our study, we did not find any relationship between majors and the mental health of college students. However, many previous studies have reported that the psychological impact of the pandemic on college students majoring in psychology or medicine-related subjects is more significant. Guidotti et al. found that a notable percentage of neuropsychology trainees reported increased personal mental health symptoms (i.e., anxiety/depression; 74/54%) as well as several other personal stressors (Guidotti Breting et al., 2020). Similar situations occurred in Nepal (Khanal et al., 2020; Shrestha, 2020) and China (Xiao et al., 2020). To conclude, as for psychological/medical students, COVID-19 might cause enormous psychological stress. And psychological interventions should be implemented. Besides, more clinical studies should be conducted to prove this point.

This study has some strengths. First, this is the first published article examining college students' mental status after school reopening to the best of our knowledge. Second, the subjects included in this study were from several different schools across China, which increases this study's universality. Third, the application of machine learning algorithms, including SMOTE, AIC, multivariate logistic regression, and ROC curves, is appropriate and reasonable, increasing the study's scientificity and reliability.

This study also has some limitations. First, the sample was relatively small. It is not easy to explore differences among schools. We just used the Chi-square test to prove no significant differences between city areas and rural areas. Second, some infrequent influence factors, which certain subjects mentioned, were not included in the questionnaire. Third, more psychological clinical trials should be performed to discover the susceptibility to other mental problems such as alexithymia (Tang et al., 2020,b) and PTSD after school reopening.

CONCLUSION

In this study, we performed a cross-sectional survey to investigate the prevalence of anxiety and depression among Chinese college students after school reopening and explored a series of factors influencing students' mental health. Many studies have demonstrated that college students have been suffering extreme mental pressure during the pandemic. For example, Cao et al. performed a cross-sectional study in China and found that 0.9% of the respondents were experiencing severe anxiety, 2.7% were experiencing moderate anxiety, and 21.3% were experiencing mild anxiety. Also, influence factors and some so-called "hub influence factors" were mentioned. Currently, the pandemic's control status varies worldwide. The situation of COVID-19 in China significantly improved and the school reopens. However, in some other countries, the school might reopen after a period of time. To the best of our knowledge, this is the first published article examining college students' mental status after school reopening. Therefore, we evaluated the school regulation measures based on college students' mental health, which could provide sensitive suggestions for school management worldwide.

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 Shandong University. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

Data collection was fulfilled by ZR, JG, and ZZ. Statistical analyses were performed by YX. The manuscript was written by ZR and YX. The study was designed by ZR, JG, and DL. The manuscript was revised by DL, RH, and CH. All authors read and approved the final manuscript.

FUNDING

This work was supported by the National Key Research and Development Program of China (No. 2017YFC0820203).

REFERENCES

Alemany-Arrebola, I., Rojas-Ruiz, G., Granda-Vera, J., and Mingorance-Estrada, Á. C. (2020). Influence of COVID-19 on the perception of academic self-efficacy, state anxiety, and trait anxiety in college students. *Front. Psychol.* 11:570017. doi: 10.3389/fpsyg.2020.570017

Alkhamees, A. A., Alrashed, S. A., Alzunaydi, A. A., Almohimeed, A. S., and Aljohani, M. S. (2020). The psychological impact of COVID-19 pandemic on the general population of Saudi Arabia. *Compr. Psychiatry* 102:152192. doi: 10.1016/j.comppsych.2020.152192

Beijing News (2020). *In Jiangxi province, all closed campus management has been abolished, combining "humanization" with scientific prevention and control*. Available online at: https://www.bjnews.com.cn/detail/160042055315203.html (accessed November 25, 2020).

Cao, W., Fang, Z., Hou, G., Han, M., Xu, X., Dong, J., et al. (2020). The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry Res.* 287:112934. doi: 10.1016/j.psychres.2020.112934

Chen, B., Sun, J., and Feng, Y. (2020). How have COVID-19 isolation policies affected young people's mental health? - Evidence from Chinese college students. *Front. Psychol.* 11:1529. doi: 10.3389/fpsyg.2020.01529

Cheung, T., Wong, S. Y., Wong, K. Y., Law, L. Y., Ng, K., Tong, M. T., et al. (2016). Depression, anxiety and symptoms of stress among baccalaureate nursing students in hong kong: a cross-sectional study. *Int. J. Environ. Res. Public Health* 13:779. doi: 10.3390/ijerph13080779

Chi, X., Becker, B., Yu, Q., Willeit, P., Jiao, C., Huang, L., et al. (2020). Prevalence and psychosocial correlates of mental health outcomes among chinese college students during the Coronavirus disease (COVID-19) pandemic. *Front. Psychiatry* 11:803. doi: 10.3389/fpsyt.2020.00803

de Girolamo, G., Dagani, J., Purcell, R., Cocchi, A., and McGorry, P. D. (2012). Age of onset of mental disorders and use of mental health services: needs, opportunities and obstacles. *Epidemiol. Psychiatr. Sci.* 21, 47–57. doi: 10.1017/S2045796011000746

Giannopoulou, I., Efstathiou, V., Triantafyllou, G., Korkoliakou, P., and Douzenis, A. (2020). Adding stress to the stressed: senior high school students' mental health amidst the COVID-19 nationwide lockdown in Greece. *Psychiatry Res.* 2020:113560. doi: 10.1016/j.psychres.2020.113560

Guan, W. J., Liang, W. H., Zhao, Y., Liang, H. R., Chen, Z. S., Li, Y. M., et al. (2020a). Comorbidity and its impact on 1590 patients with COVID-19 in China: a nationwide analysis. *Eur. Respir. J.* 55:2000547. doi: 10.1183/13993003.00547-2020

Guan, W. J., Ni, Z. Y., Hu, Y., Liang, W. H., Ou, C. Q., He, J. X., et al. (2020b). Clinical characteristics of Coronavirus disease 2019 in China. *N. Engl. J. Med.* 382, 1708–1720. doi: 10.1056/NEJMoa2002032

Guidotti Breting, L. M., Towns, S. J., Butts, A. M., Brett, B. L., Leaffer, E. B., and Whiteside, D. M. (2020). 2020 COVID-19 American Academy of Clinical Neuropsychology (AACN) Student Affairs Committee survey of neuropsychology trainees. *Clin. Neuropsychol.* 2020, 1–30. doi: 10.1080/13854046.2020.1809712

Huckins, J. F., daSilva, A. W., Wang, W., Hedlund, E., Rogers, C., Nepal, S. K., et al. (2020). Mental health and behavior of college students during the early phases of the COVID-19 pandemic: longitudinal smartphone and ecological momentary assessment study. *J. Med. Internet Res.* 22:e20185. doi: 10.31234/osf.io/4enzm

Kalok, A., Sharip, S., Abdul Hafizz, A. M., Zainuddin, Z. M., and Shafiee, M. N. (2020). The psychological impact of movement restriction during the COVID-19 outbreak on clinical undergraduates: a cross-sectional study. *Int. J. Environ. Res. Public Health* 17:8522. doi: 10.3390/ijerph17228522

Kapasia, N., Paul, P., Roy, A., Saha, J., Zaveri, A., Mallick, R., et al. (2020). Impact of lockdown on learning status of undergraduate and postgraduate students during COVID-19 pandemic in West Bengal, India. *Child. Youth Serv. Rev.* 116:105194. doi: 10.1016/j.childyouth.2020.105194

Kecojevic, A., Basch, C. H., Sullivan, M., and Davi, N. K. (2020). The impact of the COVID-19 epidemic on mental health of undergraduate students in New Jersey, cross-sectional study. *PLoS ONE* 15:e0239696. doi: 10.1371/journal.pone.0239696

Kessler, R. C., Amminger, G. P., Aguilar-Gaxiola, S., Alonso, J., Lee, S., and Ustün, T. B. (2007). Age of onset of mental disorders: a review of recent literature. *Curr. Opin. Psychiatry* 20, 359–364. doi: 10.1097/YCO.0b013e32816ebc8c

Khan, A. H., Sultana, M. S., Hossain, S., Hasan, M. T., Ahmed, H. U., and Sikder, M. T. (2020). The impact of COVID-19 pandemic on mental health and wellbeing among home-quarantined Bangladeshi students: a cross-sectional pilot study. *J. Affect. Disord.* 277, 121–128. doi: 10.1016/j.jad.2020.07.135

Khanal, P., Devkota, N., Dahal, M., Paudel, K., and Joshi, D. (2020). Mental health impacts among health workers during COVID-19 in a low resource setting: a cross-sectional survey from Nepal. *Global. Health* 16:89. doi: 10.1186/s12992-020-00621-z

Kroenke, K., Spitzer, R. L., and Williams, J. B. (2001). The PHQ-9: validity of a brief depression severity measure. *J. Gen. Intern. Med.* 16, 606–613. doi: 10.1046/j.1525-1497.2001.016009606.x

Lattie, E. G., Adkins, E. C., Winquist, N., Stiles-Shields, C., Wafford, Q. E., and Graham, A. K. (2019). Digital mental health interventions for depression, anxiety, and enhancement of psychological well-being among college students: systematic review. *J. Med. Internet Res.* 21:e12869. doi: 10.2196/12869

Levin, M. E., Haeger, J. A., Pierce, B. G., and Twohig, M. P. (2017). Web-based acceptance and commitment therapy for mental health problems in college students: a randomized controlled trial. *Behav. Modif.* 41, 141–162. doi: 10.1177/0145445516659645

Levin, M. E., Hayes, S. C., Pistorello, J., and Seeley, J. R. (2016). Web-based self-help for preventing mental health problems in universities: comparing acceptance and commitment training to mental health education. *J. Clin. Psychol.* 72, 207–225. doi: 10.1002/jclp.22254

Lungu, A., and Sun, M. (2016). Time for a change: college students' preference for technology-mediated versus face-to-face help for emotional distress. *Telemed. J. E-Health* 22, 991–1000. doi: 10.1089/tmj.2015.0214

Ma, Z., Zhao, J., Li, Y., Chen, D., Wang, T., Zhang, Z., et al. (2020). Mental health problems and correlates among 746 217 college students during the coronavirus disease 2019 outbreak in China. *Epidemiol. Psychiatr. Sci.* 29:e181. doi: 10.1017/S2045796020000931

Mazza, M. G., De Lorenzo, R., Conte, C., Poletti, S., Vai, B., Bollettini, I., et al. (2020). Anxiety and depression in COVID-19 survivors: role of inflammatory and clinical predictors. *Brain Behav. Immun.* 89, 594–600. doi: 10.1016/j.bbi.2020.07.037

Ministry of Education of the People's Republic of China (2020). *20 questions about the resumption of school and class under normalization of Epidemic prevention and controls* (in Chinese). Available online at: http://www.moe.gov.cn/jyb_xwfb/moe_1946/fj_2020/202006/t20200612_465535.html (accessed November 25, 2020).

Naser, A. Y., Dahmash, E. Z., Al-Rousan, R., Alwafi, H., Alrawashdeh, H. M., Ghoul, I., et al. (2020). Mental health status of the general population, healthcare professionals, and university students during 2019 coronavirus disease outbreak in Jordan: a cross-sectional study. *Brain Behav.* 10:e01730. doi: 10.1002/brb3.1730

National Health Commission of the People's Republic of China (2020). *Notification for the coronavirus disease (COVID-19) pandemic* (in Chinese) Available online at: http://www.nhc.gov.cn/xcs/yqfkdt/gzbd_index.shtml (accessed November 22, 2020).

Oftedal, S., Kolt, G. S., Holliday, E. G., Stamatakis, E., Vandelanotte, C., Brown, W. J., et al. (2019). Associations of health-behavior patterns, mental health and self-rated health. *Prev. Med.* 118, 295–303. doi: 10.1016/j.ypmed.2018.11.017

Pappa, S., Ntella, V., Giannakas, T., Giannakoulis, V. G., Papoutsi, E., and Katsaounou, P. (2020). Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: a systematic review and meta-analysis. *Brain Behav. Immun.* 88, 901–907. doi: 10.1016/j.bbi.2020.05.026

People's Daily (2020). To investigate and inspect the prevention before school reopening (in Chinese). Available online at: *http://paper.people.com.cn/rmrb/html/2020-06/05/nw.D110000renmrb_20200605_3-02.htm* (accessed November 25, 2020).

R Core Team (2020). *R: A Language and Environment for Statistical Computing*. Vienna: R Foundation for Statistical Computing. Available online at: https://www.R-project.org/ (accessed September 26, 2020).

Seidel, E. J., Mohlman, J., Basch, C. H., Fera, J., Cosgrove, A., and Ethan, D. (2020). Communicating mental health support to college students during covid-19: an exploration of website messaging. *J. Commun. Health* 45, 1259–1262. doi: 10.1007/s10900-020-00905-w

Shader, R. I. (2020). COVID-19 and depression. *Clin. Ther*. 42, 962–963. doi: 10.1016/j.clinthera.2020.04.010

Shrestha, S. L. (2020). Prevalence of psychological effect of COVID-19 on medical professionals in a tertiary care center. *J. Nepal Med. Assoc.* 58, 550–553. doi: 10.31729/jnma.5087

Son, C., Hegde, S., Smith, A., Wang, X., and Sasangohar, F. (2020). Effects of COVID-19 on college students mental health in the US: an interview-survey study. *J. Med. Internet Res.* 22:e21279. doi: 10.2196/21279

Tang, B., Xia, F., Tang, S., Bragazzi, N. L., Li, Q., Sun, X., et al. (2020). The effectiveness of quarantine and isolation determine the trend of the COVID-19 epidemics in the final phase of the current outbreak in China. *Int. J. Infect. Dis.* 95, 288–293. doi: 10.1016/j.ijid.2020.03.018

Tang, W., Hu, T., Hu, B., Jin, C., Wang, G., Xie, C., et al. (2020a). Prevalence and correlates of PTSD and depressive symptoms one month after the outbreak of the COVID-19 epidemic in a sample of home-quarantined Chinese university students. *J. Affect. Disord*. 274, 1–7. doi: 10.1016/j.jad.2020.05.009

Tang, W., Hu, T., Yang, L., and Xu, J. (2020b). The role of alexithymia in the mental health problems of home-quarantined university students during the COVID-19 pandemic in China. *Pers. Individ. Dif.* 165:110131. doi: 10.1016/j.paid.2020.110131

Tu, H., Tu, S., Gao, S., Shao, A., and Sheng, J. (2020). Current epidemiological and clinical features of COVID-19; a global perspective from China. *J. Infect*. 81, 1–9. doi: 10.1016/j.jinf.2020.04.011

Velten, J., Bieda, A., Scholten, S., Wannemüller, A., and Margraf, J. (2018). Lifestyle choices and mental health: a longitudinal survey with German and Chinese students. *BMC Public Health* 18:632. doi: 10.1186/s12889-018-5526-2

Vindegaard, N., and Benros, M. E. (2020). COVID-19 pandemic and mental health consequences: systematic review of the current evidence. *Brain Behav. Immun*. 89, 531–542. doi: 10.1016/j.bbi.2020.05.048

Walsh, R. (2011). Lifestyle and mental health. *Am. Psychol*. 66, 579–592. doi: 10.1037/a0021769

Wang, M., Kou, C., Bai, W., Song, Y., Liu, X., Yu, W., et al. (2019). Prevalence and correlates of suicidal ideation among college students: a mental health survey in Jilin Province, China. *J. Affect. Disord*. 246, 166–173. doi: 10.1016/j.jad.2018.12.055

Webermann, A. R., and Murphy, C. M. (2020). How can psychology help reduce gender-based violence and misconduct on college campuses? *Am. Psychol*. doi: 10.1037/amp0000705. [Epub ahead of print].

World Health Organization (2020). *Coronavirus disease (COVID-19) pandemic*. Available online at: https://www.who.int/emergencies/diseases/novel-coronavirus-2019 (accessed November 22, 2020).

Xiao, H., Shu, W., Li, M., Li, Z., Tao, F., Wu, X., et al. (2020). Social distancing among medical students during the 2019 Coronavirus disease pandemic in China: disease awareness, anxiety disorder, depression, and behavioral activities. *Int. J. Environ. Res. Public Health* 17:5047. doi: 10.3390/ijerph17145047

Xin, M., Luo, S., She, R., Yu, Y., Li, L., Wang, S., et al. (2020). Negative cognitive and psychological correlates of mandatory quarantine during the initial COVID-19 outbreak in China. *Am. Psychol*. 75, 607–617. doi: 10.1037/amp0000692

Xingchen, H., Yingli, Z., and Wei, L. (2014). The reliability and validity test of the patient health questionnaire depression scale (PHQ-9) in adolescent (in Chinese). *Psychol. J. Sichuan Province*. 27, 357–360. Available online at: http://www.psychjm.net.cn/ch/reader/view_abstract.aspx?file_no=201404021&flag=1

Yang, D., Tu, C. C., and Dai, X. (2020a). The effect of the 2019 novel coronavirus pandemic on college students in Wuhan. *Psychol. Trauma* 12, 6–14. doi: 10.1037/tra0000930

Yang, L., Yu, Z., Xu, Y., Liu, W., Liu, L., and Mao, H. (2020b). Mental status of patients with chronic insomnia in China during COVID-19 epidemic. *Int. J. Soc. Psychiatry* 66, 821–826. doi: 10.1177/0020764020937716

Yongan, Z. (2012). *Application of the Self-Rating Anxiety Scale in College Students in China* (in Chinese). Master's thesis. Southern Medical University, Guangzhou, China.

Zhai, Y., and Du, X. (2020). Addressing collegiate mental health amid COVID-19 pandemic. *Psychiatry Res.* 288:113003. doi: 10.1016/j.psychres.2020.113003

Zhang, Y., Zhang, H., Ma, X., and Di, Q. (2020). Mental health problems during the COVID-19 pandemics and the mitigation effects of exercise: a longitudinal study of college students in China. *Int. J. Environ. Res. Public Health* 17:3722. doi: 10.3390/ijerph17103722

Zhou, S. J., Wang, L. L., Yang, R., Yang, X. J., Zhang, L. G., Guo, Z. C., et al. (2020). Sleep problems among Chinese adolescents and young adults during the coronavirus-2019 pandemic. *Sleep Med*. 74, 39–47. doi: 10.1016/j.sleep.2020.06.001

Zung, W. W. (1971). A rating instrument for anxiety disorders. *Psychosomatics* 12, 371–379. doi: 10.1016/S0033-3182(71)71479-0

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 30 April 2021
doi: 10.3389/fpsyg.2021.633765

Association of Stress-Related Factors With Anxiety Among Chinese Pregnant Participants in an Online Crisis Intervention During COVID-19 Epidemic

Fangfang Shangguan[1], Ruoxi Wang[2], Xiao Quan[1], Chenhao Zhou[1], Chen Zhang[1], Wei Qian[3,4], Yongjie Zhou[5], Zhengkui Liu[3,4] and Xiang Yang Zhang[3,4]**

[1] School of Psychology, Capital Normal University, Bejing, China, [2] School of Medicine and Health Management, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China, [3] CAS Key Laboratory of Mental Health, Institute of Psychology, Chinese Academy of Sciences, Bejing, China, [4] Department of Psychology, University of Chinese Academy of Sciences, Bejing, China, [5] Shenzhen KangNing Hospital, Shenzhen, China

OPEN ACCESS

Edited by:
Fushun Wang,
Nanjing University of Chinese Medicine, China

Reviewed by:
Lucia Bonassi,
Bolognini Hospital, Italy
Yezhe Lin,
University of Rochester, United States

***Correspondence:**
Zhengkui Liu
liuzk@psych.ac.cn
Xiang Yang Zhang
zhangxy@psych.ac.cn

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *26 November 2020*
Accepted: *16 March 2021*
Published: *30 April 2021*

Citation:
Shangguan F, Wang R, Quan X, Zhou C, Zhang C, Qian W, Zhou Y, Liu Z and Zhang XY (2021) Association of Stress-Related Factors With Anxiety Among Chinese Pregnant Participants in an Online Crisis Intervention During COVID-19 Epidemic. Front. Psychol. 12:633765. doi: 10.3389/fpsyg.2021.633765

Background: Previous systematic review indicated the prevalence of prenatal anxiety as 14–54%. Pregnant women are a high-risk population for COVID-19. However, the prevalence of anxiety symptoms and related factors is unknown in Chinese pregnant women during COVID-19 outbreak.

Objective: To investigate the prevalence of anxiety symptoms and the related factors in Chinese pregnant women who were attending crisis intervention during the COVID-19 pandemic.

Methods: The data of this cross-sectional study were collected in about 2 months (February 28 to April 26, 2020). Data analysis was performed from April to May 2020. Participants completed a set of questionnaires via the Wechat Mini-program before starting the online self-help crisis intervention for COVID-19 epidemic. A total of 2,120 Chinese pregnant women who were attending a self-help crisis intervention participated in this study. A survey was developed to address possible stress-related factors in pregnant women during the COVID-19 outbreak, including demographic, socioeconomic, and pregnancy-related factors, as well as COVID-19 related factors. Generalized Anxiety Disorder-7 (GAD-7) scale and the 10-item perceived stress scale were, respectively, employed to measure anxiety and stress-related factors.

Results: A total of 21.7% (459) of pregnant women reported at least mild anxiety (≥5 on the GAD-7 scale), and only 82 women reported moderate to severe anxiety (≥10 on the GAD-7 scale). Factors associated with at least mild anxiety included living in Hubei province ($OR = 1.68$, $95\%\ CI = 1.32–2.13$), nobody providing everyday life support ($OR = 1.81$, $95\%\ CI = 1.18–2.77$), pelvic pain or vaginal bleeding ($OR = 1.67$, $95\%\ CI = 1.32–2.09$), and higher perceived stress ($OR = 6.87$, $95\%\ CI = 5.42–9.02$). Having relatives or neighbors with a diagnosis of COVID-19 was not associated with anxiety ($p > 0.05$).

Conclusions and Relevance: Our findings indicate that evaluation and intervention for maternal and infant health are necessary in pregnant women with anxiety during COVID-19 epidemic, especially those with higher perceived stress, less everyday life support, or vaginal bleeding. Interactions among these related medical, social and psychological factors need to be investigated in future studies.

Keywords: prenatal anxiety, crisis intervention, perceived stress, pelvic pain, vaginal bleeding, COVID-19 outbreak

INTRODUCTION

Prenatal anxiety in pregnant women is a worldwide public health issue due to its high prevalence and heavy burden posed to not only pregnant women themselves but also their family. Previous studies have suggested that 14–54% pregnant women experienced anxiety (Madhavanprabhakaran et al., 2015; Rees et al., 2019; Adhikari et al., 2020; Bhushan et al., 2020; Molgora et al., 2020). A recent Chinese study found maternal anxiety in 26% of 119 well-educated and employed healthy pregnant women (Wu et al., 2020). Prenatal anxiety can result in adverse perinatal outcomes (Mirzadeh and Khedmat, 2020), impaired fetal brain development (Wu et al., 2020), and even long-lasting adverse health outcomes in their offspring's late lives (Helgertz and Bengtsson, 2019; Rees et al., 2019). During the present COVID-19 epidemic, a systematic review found that among 108 pregnant women between December 8, 2019 and April 1, 2020, 91% delivered by cesarean section (Zaigham and Andersson, 2020). The high rate of cesarean section may reflect the anxiety-related impacts on mothers under the COVID-19 outbreak estimated by researchers (Fakari and Simbar, 2020; Mirzadeh and Khedmat, 2020). However, the screening and recognition of anxiety symptoms during pregnancy remain insufficient (Bright et al., 2019; Hoyer et al., 2020).

Prenatal anxiety has been associated with socioeconomic factors, pregnancy-related factors, and perceived stress (e.g., Rallis et al., 2014; Kang et al., 2016). Several studies reported that anxiety during pregnancy was associated with low socioeconomic status (including income, education and employment status) (Kang et al., 2016; Adhikari et al., 2020; Liao et al., 2020). A previous study reported that pregnant women experienced fewer anxiety symptoms during the second trimester compared to the other trimesters (Rallis et al., 2014). Nulliparous women might be less anxious than multiparous women (Koelewijn et al., 2017; Liao et al., 2020; Lu et al., 2020). Furthermore, the lack of someone providing emotional support was associated with anxiety symptoms in pregnant women (González-Mesa et al., 2020). Besides, more anxiety in pregnant women was related to high perceived stress (Gul et al., 2017; Li et al., 2020). Perceived stress, the cognitive appraisal process when facing stressful situations, is closely related with prodromal stages of psychiatric disorders (Taylor, 2015).

COVID-19 epidemic may have exerted extra influence on prenatal anxiety in pregnant women (Corbett et al., 2020; Mirzadeh and Khedmat, 2020). First, pregnant women had heightened anxiety about health status of their family members during the epidemic than before (Corbett et al., 2020). Second, health education about COVID-19 have stressed chronic illness as high risk for complications in severe COVID-19 patients (Beghi et al., 2020; Bravi et al., 2020), therefore, pregnant women with a history of chronic illness may be more anxious than those without. Third, in China, participants in Hubei Province may be more anxious of being infected with COVID-2019 when compared with those in the non-endemic provinces (Yuan et al., 2020). However, there were only 33 participants from Hubei was included in that study, which were not convincing in explaining the anxiety level in Hubei population. Last but not least, during COVID-19 epidemic, pregnant women may also be anxious about the lack of accessibility of health service because of threatened miscarriage when experiencing vaginal bleeding (Hooker, 2020). Pregnant women were more preferentially admitted to a hospital during previous influenza epidemics, seeking high quality of medical care (Mertz et al., 2019). However, this year, pregnant women were anxious about possible COVID-19 risks in hospital settings, so some canceled regular visits in the hospital, or want selective cesarean section to terminate pregnancy (Fakari and Simbar, 2020; Gunnes et al., 2020; Ding et al., 2021). Therefore, pelvic pain or vaginal bleeding might be both pregnancy-related and COVID-19 related stressful events.

To our best knowledge, no prior study has measured anxiety in pregnancy during COVID-19 epidemic. Moreover, as a subjective appraisal of stress, perceived stress has not been integrated in previous studies that investigated socioeconomic or pregnancy-related characteristics in prenatal anxiety. More importantly, some factors might raise health risk in pregnant women during COVID-19 epidemic, such as history of chronic illness, COVID-19 diagnosis of family members or neighbors, and living in Hubei. Accordingly, the objectives of this study include: (1) to investigate the prevalence of anxiety symptoms, (2) to explore the demographic, pregnancy-related factors, COVID-19 related factors, and perceived stress that are associated with anxiety in pregnant women.

METHODS

Procedure

All participants were recruited by the obstetric clinicians through the Wechat. The criteria for inclusion were: all participants were pregnant Chinese women, and they all registered in an online self-help intervention program targeting crisis intervention during the COVID-19 epidemic. Pregnant women completed a set of questionnaires on the Wechat Mini-program before the beginning of the online crisis intervention for COVID-19 epidemic. The 7-day self-help online intervention was designed

according to some core strategies of Problem Management Plus (PM+), a low intensity psychological intervention (Dawson et al., 2015). The main purpose of the self-help intervention was introduced on the webpage, concentrating on stress reduction of the public. The intervention was arranged as 10–20 min per day in consecutive 7 days. Before they started the self-help intervention, participants saw themes of every day, namely Stability, Relaxation, Sense of control, Self-efficacy, Social support, Keeping healthy, and Hope, which might help them make decision whether they would like to complete the questionnaire and then start the intervention. The enrollment of participants was carried out according to the Declaration of Helsinki. All women provided informed consent. The Institutional Review Board of Institute of Psychology, Chinese Academy of Sciences, approved this study. The data were collected in about 2 months (February 28 to April 26, 2020) with the dissemination of the online intervention.

Measures

The GAD-7 Scale

The GAD-7 scale is used to assess the severity of generalized anxiety disorder. Each item is scored as 0–3-point on a Likert scale (3 = "almost every day" and 0 = "not at all"). Scores on the GAD-7 scale ranges from 0 to 21. The Chinese version of GAD-7 scale has been widely used in China (He et al., 2010). The Cronbach's α coefficient of the GAD-7 scale was 0.86 in the current study. The participants were evaluated as with at least mild anxiety symptoms when the total scores $\geq$ 5 on the Generalized Anxiety Disorder-7 (GAD-7) scale (Spitzer et al., 2006). Therefore, this study divided all the subjects into two groups: anxiety group and non-anxiety group.

The 10-Item Perceived Stress Scale (PSS)

The PSS was used to evaluate one's level of perceived stress in terms of unpredictability, and overload (Cohen et al., 1983). Each item is scored on 0–4-point using a Likert scale (4 = very often and 0 = never). Six of the 10 items evaluate the frequency of negative thoughts, and the remained items evaluate the frequency of positive thoughts. The four positive items are reverse scored and the scores for all items are added up as a total score. The Chinese version of the scale demonstrates good reliability and validity (e.g. Ng, 2013). In the present study, the Cronbach's alpha value was 0.82 for the PSS.

Demographic Data and COVID-19-Related Factors in Pregnant Women

A survey was developed to address possible stressors in pregnant women during the COVID-19 outbreak. First, we collected sociodemographic data including age, gender, residential location during the outbreak, education, marital status, professional information, family annual income, and support for everyday life. Second, the survey also included questions about factors that might raise anxiety in pregnant women during COVID-19 epidemic: (1) pelvic pain or vaginal bleeding; (2) history of chronic illness, including diabetes, hypertension, hypothyroidism, hyperthyroidism pre- or during pregnancy; (3) contact history with COVID-19 indicated by infection in their family and neighbors; (4) living in Hubei.

Statistical Analysis

The normal distribution of each variable was examined by Shapiro-Wilk test, and none of the variables showed normal distribution (all $p < 0.01$). Descriptive statistics of the two groups (anxiety group and non-anxiety group) were calculated. Categorical variables (family annual income, marital status, etc.) were reported in percentages. Continuous variables (such as age, gestational age, education year, etc.) were expressed as median (Min, Max). The Mann–Whitney *U*-test or chi-square test was used to test the differences in these variables between the anxiety group and the non-anxiety group. Chi-square test was used to compare the prevalence of anxiety symptom among early, middle, and late pregnancy. A binary logistic regression analysis was performed to test the underlying factors associated with mild to severe anxiety (yes/no). Independent variables were variables that showed significant differences between anxiety group and the non-anxiety group in the previous mentioned Mann–Whitney *U*-test or chi-square test. SPSS Statistic 21.0 was applied to perform the analyses.

RESULTS

Demographic Characteristics of Participants

Totally 2,139 pregnant women who are currently living in 15 cities in China participated in this study, and 2,120 of them submitted qualified questionnaires. It is worth noting that there were 693 participants in Hubei. The average age of the participants is 30.51 years (SD = 9.67). Among all the participants, 31.3% have an annual family income below 80,000 RMB, and 0.5% of households have an annual income over 1,000,000 RMB. Among all participants, 440 pregnant women were in the first trimester ($\leq$12 weeks), and 1,203 were in the third trimester ($\geq$25 weeks). All participants' privacy was guaranteed.

Prevalence of Anxiety

Mild to severe anxiety was identified in 21.7% (459) of pregnant women in this study, who were categorized as anxiety group. In anxiety group, most of the women reported mild anxiety (17.8%, n = 377), and only 82 women reported moderate to severe anxiety. 22.7, 21, and 21.5% women in early (gestational age $\leq$ 12 weeks), middle (at 13–24 weeks) and late pregnancy ($\geq$25 weeks) reported at least mild anxiety, and no significant differences were found in prevalence among early, middle and late pregnancy ($\chi^2 = 0.44$, $p > 0.05$). The prevalence of prenatal anxiety symptoms were 27.0 and 19.1% in and out of Hubei province, respectively.

Comparison of Stress Correlates Between Women With and Without Anxiety

There were significant differences in age, education levels and the percentage of residence in Hubei province (Bonferroni corrected $ps < 0.05$) between non-anxiety group and anxiety

group. More women in anxiety group had an annual family income <80,000 RMB than in non-anxiety group (Bonferroni corrected $p < 0.05$). Chronic illness during or prior to pregnancy and current oral medication on chronic illness was reported by more women in anxiety group than in non-anxiety group (Bonferroni corrected *ps* >0.05). Pelvic pain or vaginal bleeding occurred more in anxiety group than in non-anxiety group (Bonferroni corrected $p < 0.05$). Having neighbors or relatives with a diagnosis of COVID-19 was not associated with anxiety ($p > 0.05$). See **Table 1**.

The Correlates of Anxiety in Pregnant Women

The results of binary logistic regression showed that elder age, living in Hubei, without anyone to turn to for support in everyday life, higher perceived stress, pelvic pain, or vaginal bleeding were significantly associated with at least mild anxiety (**Table 2**). Pregnant women living in Hubei were 1.68 times more likely to be anxious than those living in other provinces ($OR = 1.68$, *95% CI* = 1.32–2.13). Pregnant women were 1.81 times more likely to be anxious when there was nobody providing everyday life support ($OR = 1.81$, *95% CI* = 1.18–2.77). PSS scores ≥14 was regarded as indicating higher perceived stress (Monk et al., 2020). Pregnant women with higher perceived stress are 6.87 times more likely to be anxious than those with lower perceived stress ($OR = 6.87$, *95% CI* = 5.42–9.02). Pregnant women with pelvic pain or vaginal bleeding were 1.67 times more likely to be anxious than those without ($OR = 1.67$, *95% CI* = 1.32–2.09).

DISCUSSION

To our best knowledge, the current study is the first to integrate socioeconomic factors, pregnancy-related factors, COVID-19-related stressful events, and perceived stress in a survey on prenatal anxiety. The main findings are as following: (1) the prevalence of prenatal anxiety symptom was 21.7%, and most of the anxious pregnant women reported mild anxiety; (2) higher perceived stress was a critical predictor of prenatal anxiety symptoms, not indicating specific stressful events; (3) anxiety symptoms were associated with pregnancy-related stressful events, including nobody providing emotional support and experiencing pelvic pain or vaginal bleeding, and the latter was a both pregnancy-related and COVID-19 related stressful event; (4) anxiety symptoms were associated with living in Hubei, but was not associated with the other COVID-19-related factors.

In the current study, we found that during the COVID-19 epidemic, the prevalence of anxiety symptom was 21.7% in Chinese pregnant women attending the crisis intervention, and the rate was 27.0% in the pregnant participants living in Hubei. Similarly, two survey in Wuhan, respectively reported that 20.8% (in February 2020; Ding et al., 2021) or 24.5% (in March 2020; Liu et al., 2020) pregnant women felt anxious during the COVID-19 epidemic. The reason of the various rates in these studies might be different self-rating scales, sampling periods. Other reasons might be differences in demographic and socioeconomic facets, since we found differences of age, education level, and family annual income between participants with and without prenatal anxiety, which is consistent with previous studies in China (Kang et al., 2016; Liao et al., 2020; Lu et al., 2020).

TABLE 1 | Comparison of COVID-19-related factors between the participants with and without anxiety.

	Non-anxiety (*n* = 1,661)	Anxiety (*n* = 459)	*Z* or χ^2	*p*
Age	30 (19, 45)	30 (20, 47)	−3.07**	0.002
Educated	16 (6, 23)	15 (6, 23)	−3.44**	0.001
Married	98.4% (1,634)	97.4% (447)	1.95	0.163
smoking	0.2% (4)	0.7% (3)	1.86	0.172
Drinking	1.7% (29)	2.4% (11)	0.82	0.365
Family annual income <80,000 Yuan	29.3% (487)	38.3% (176)	13.63***	0.000
Gestational week	26 (1, 42)	30 (1, 41)	−0.56	0.576
Nulliparae	54.6% (907)	55.1% (253)	0.04	0.845
Nobody providing support in everyday life	5.4% (89)	8.9% (41)	7.98**	0.005
Perceived stress	13 (1, 25)	19 (6, 37)	251.87***	0.000
Work as medical staff	6.1% (102)	6.8% (31)	0.23	0.632
Residence (Hubei)	30.5% (506)	40.7% (187)	17.24***	0.000
Relatives with a diagnosis of COVID-19	1.1% (18)	1.3% (6)	0.16	0.689
Neighbor with a diagnosis of COVID-19	1.1% (19)	0.9% (4)	0.25	0.618
Pelvic pain or vaginal bleeding	37.9% (629)	48.1% (459)	15.82***	0.000
History of chronic illness	16.8% (279)	20.9% (96)	4.19*	0.041
History of medical conditions related to pregnancy	11.2% (186)	13.3% (61)	1.53	0.216
Current medication for chronic illness	8.5% (142)	12.4% (57)	6.33**	0.012

Categorized variables were presented as percentage (n). Continuous variables were presented as median (Min, Max).
*Z: outcome of Mann–Whittney U-test; *p < 0.05; **p < 0.01; ***p < 0.001.*

TABLE 2 | Factors associated with prenatal anxiety.

Variable	*n* (%)	Wald χ^2	df	OR	95% CI	*p*
Age (years)	30 (19, 47)	5.78	1	0.96*	0.94–0.99	0.016
Education (years)	15 (6, 23)	0.66	1	1.02	0.97–1.07	0.418
Living in Hubei		18.21	1	1.68***	1.32–2.13	0.000
Yes	693 (32.7)					
No	1,427 (67.3)					
Family annual income < 80,000 Yuan		2.77	1	1.24	0.96–1.61	0.096
Yes	663 (31.3)					
No	1,457 (68.7)					
Nobody providing support in everyday life		7.35	1	1.81**	1.18–2.77	0.007
Yes	130 (6.1)					
No	1,990 (93.9)					
Perceived stress		193.71	1	6.87***	5.24–9.02	0.000
Yes	1,074 (50.7)					
No	1,046 (49.3)					
Current medication for chronic illness		3.69	1	1.43	0.99–2.06	0.055
Yes	1,921 (90.6)					
No	199 (9.4)					
Pelvic pain or vaginal bleeding		19.07	1	1.67***	1.32–2.09	0.000
Yes	850 (40.1)					
No	1,270 (59.9)					
History of chronic illness		3.54	1	1.33	0.99–1.78	0.060
Yes	375 (17.7)					
No	1,745 (82.3)					

*Continuous variables are presented as Median (Min, Max). *p < 0.05; **p < 0.01; ***p < 0.001.*

Due to the cross-sectional design, we could not conclude whether our participants had increased anxiety compared to the period right before COVID-19 pandemic. A study in Turkey found that among the 63 pregnant participants, women with mild anxiety decreased and women with moderate and severe anxiety increased after 2019-nCoV infection (Ayaz et al., 2020). Therefore, the public health emergency brought by the COVID-19 epidemic might have influenced the pregnant women all over the world (e.g., de Arriba-García et al., 2021; Saadati et al., 2021). An international prospective cohort study had just started to evaluate the impact of COVID-19 on pregnant women postpartum women over the next 6 month period in 14 countries (using GAD-7 when assessing anxiety symptoms) (Motrico et al., 2021).

Importantly, our results suggested living in Hubei was an independent factor that related to self-reported anxiety symptoms of pregnant women during the COVID-19 epidemic. This is reasonable since Hubei province was much more influenced by the crisis of COVID-19 epidemic than other provinces in China. Similarly, a survey on pregnant women in and showed that more women Wuhan (the capital of Hubei province) in Wuhan felt anxious compared to those in Chongqing (a big city in southwestern China) (24.5 vs. 10.4%) (Liu et al., 2020). Furthermore, we found that pregnant women with experience of pelvic pain or vaginal bleeding were more likely to report anxiety symptoms during COVID-19 epidemic. Vaginal bleeding or pelvic pain might be related to prenatal anxiety according to previous studies before the COVID-19 epidemic. For example, Richardson et al. (2017) claimed that the experience of vaginal bleeding and/or abdominal pain in early pregnancy was highly anxiogenic. Pelvic pain and vaginal bleeding may rise anxiety in pregnant women because their association with miscarriage (Kilfoyle et al., 2016) or diagnostic uncertainty (Richardson et al., 2017). Pelvic pain or vaginal bleeding was both pregnancy-related and COVID-19 related stressful events, as we mentioned above.

We also found prenatal anxiety was related to nobody providing support in everyday life. This result is similar with previous studies, which suggested that lack of emotional support was associated with anxiety in pregnant women. In China, most pregnant women were taken care of by their husbands or other family members, and this is also the case in our study. Therefore, it is reasonable to find that pregnant women were more likely to report anxiety when nobody could provide support for them in everyday life, particularly in case of quarantine during the COVID-19 epidemic. Besides, in the current study, no significant differences were found in prevalence among early, middle, and late pregnancy. However, a survey in Chinese pregnant women before the pandemic also reported a relatively high rate (20.6%) of anxiety in women at least 38 weeks into pregnancy, and the high rate were attributed to socioeconomic status and the third trimester (Kang et al., 2016). No existing survey on prenatal anxiety during COVID-19 epidemic reported the association of pregnancy trimester and prenatal anxiety.

Notably, we found that women with higher perceived stress were more likely to be anxious than those with lower perceived stress, which is in line with a recent study in women with recurrent pregnancy loss (Li et al., 2020). High perceived stress indicates people perceive their lives as excessively stressful relative to their capability to cope. Perceived stress showed significant relationship with physical and psychological symptoms in numerous studies (Hewitt et al., 1992; Beshai et al., 2016; Hjelm et al., 2017). The PSS examined women's general beliefs about stress without giving a list of specific events (Hewitt et al., 1992), so scores on the PSS in our study were not biased by the events related to pregnancy, COVID-19 epidemic and the recall of past life events.

LIMITATIONS

There are several limitations in this study. First, this is a cross-sectional study, which is not sufficient to find risk factors or examine perceived change in anxiety during pregnancy. Second, there were only 82 pregnant women with moderate to severe anxiety in our survey, which restricted the application of our results in the explanation of severe prenatal anxiety during COVID-19 pandemic. Third, we found a small proportion of women who had relatives or neighbors with a diagnosis of COVID-19. This might be the reason that we found that COVID-19 diagnosis of relatives or neighbors was not associated with anxiety symptoms. Fourth, more questions should be designed to detect COVID-19-related stressful events. Fifth, self-report pelvic pain and vaginal bleeding may be not as reliable as the evaluation by doctors. Sixth, there were significant differences in age, education levels and family incomes between pregnant women with and without anxiety. Although other related factors were identified by adjusting these confounders in this study, future studies should better match these characteristics between groups. Seventh, family annual income varies in different provinces, so the subgroup of family annual income <80,000 Yuan was not suitable for every province. This restricted the application of our result on the criteria of family annual income. Eighth, the response rate was not available due to the internet technological problem of the newly developed Wechat Mini-program. Last, depending on dissemination of the crisis intervention program, pregnant women in this study were mainly from Hubei, Beijing and Gansu, and there were scarce participants in the other 12 provinces. Therefore, we cannot compare the prevalence of anxiety of our survey with that of other provinces and find more associate factors of anxiety in the COVID-19 pandemic.

CONCLUSIONS

Anxiety in about one-fifth of pregnant women highlights the importance of instant distribution of clinical and mental health advice in the early stage of infectious disease epidemic. Both COVID-19-related and pregnancy-related factors were associated with anxiety in pregnant women seeking self-help online crisis intervention during COVID-19 epidemic. Furthermore, our study is the first to claim that general beliefs about stress might also be an independent factor associated with anxiety during COVID-19 epidemic. However, since there were only 3.9% pregnant women reported moderate to severe anxiety in our survey, we should be cautious when applying our conclusions in severe prenatal anxiety during the COVID-19 pandemic. Our findings have important clinical implications for medical and mental health service during and after the COVID-19 epidemic. First, measurement of perceived stress may be recommended in clinical obstetric practice and psychological crisis intervention. Second, integrated service should be considered in clinical obstetric setting during and after the COVID-19 pandemic. Since vaginal bleeding and/or abdominal pain may be anxiogenic, mental health service should also be provided for pregnant women seeking medical help for vaginal bleeding and/or abdominal pain in community hospitals, specialist hospitals or general hospitals. Third, pregnant women with less everyday life support should be supported by mental health in the future clinical practice, especially when facing public health emergencies. Last, systematic preventive interventions need to be exerted for anxiety during pregnancy, including socioeconomic measures, psychological and medical 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 of Institute of Psychology, Chinese Academy of Sciences. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

FS: conceptualization, formal analysis, methodology, writing – original draft, writing – review, and editing. RW: conceptualization, writing – review, and editing. XQ: data curation, formal analysis, and writing – original draft. CZho and CZha: writing – original draft. WQ: data collection. YZ: methodology and data collection. ZL: conceptualization, methodology, project administration, and investigation. XZ: investigation, writing – review, and editing. All authors contributed to the article and approved the submitted version.

FUNDING

This research was supported by the Shenzhen-Hongkong Institute of Brain Science-Shenzhen Fundamental Research Institutions (NYKFKT 2020002).

ACKNOWLEDGMENTS

We thank our colleagues in collaborated hospitals who contributed to data collection.

REFERENCES

Adhikari, K., Patten, S. B., Williamson, T., Patel, A. B., Premji, S., Tough, S., et al. (2020). Neighbourhood socioeconomic status modifies the association between anxiety and depression during pregnancy and preterm birth: a Community-based Canadian cohort study. *BMJ Open* 10:e031035. doi: 10.1136/bmjopen-2019-031035

Ayaz, R., Hocaoglu, M., Günay, T., Yardimci, O. D., Turgut, A., and Karateke, A. (2020). Anxiety and depression symptoms in the same pregnant women before and during the COVID-19 pandemic. *J. Perinat. Med*. 48, 965–970. doi: 10.1515/jpm-2020-0380

Beghi, E., Feigin, V., Caso, V., Santalucia, P., and Logroscino, G. (2020). COVID-19 infection and neurological complications: present findings and future predictions. *Neuroepidemiology*. 54, 364–369. doi: 10.1159/000508991

Beshai, S., McAlpine, L., Weare, K., and Kuyken, W. (2016). A non-randomised feasibility trial assessing the efficacy of a mindfulness-based intervention for teachers to reduce stress and improve well-being. *Mindfulness*. 7, 198–208. doi: 10.1007/s12671-015-0436-1

Bhushan, N. L., Krupp, K., Jaykrishna, P., Ravi, K., and Madhivanan, P. (2020). The association between social support through contacts with Accredited Social Health Activists (ASHAs) and antenatal anxiety among women in Mysore, India: a cross-sectional study. *Soc. Psychiatry Psychiatr. Epidemiol*. 55, 1323–1333. doi: 10.1007/s00127-020-01854-4

Bravi, F., Flacco, M. E., Carradori, T., Volta, C. A., Cosenza, G., De Togni, A., et al. (2020). Predictors of severe or lethal covid-19, including angiotensin converting enzyme inhibitors and angiotensin ii receptor blockers, in a sample of infected italian citizens. *PLoS ONE* 15:e0235248. doi: 10.1371/journal.pone.0235248

Bright, K. S., Mughal, M. K., Wajid, A., Lane-Smith, M., Murray, L., Roy, N., et al. (2019). Internet-based interpersonal psychotherapy for stress, anxiety, and depression in prenatal women: study protocol for a pilot randomized controlled trial. *Trials* 20:814. doi: 10.1186/s13063-019-3897-z

Cohen, S., Kamarck, T., and Mermelstein, R. (1983). A global measure of perceived stress. *J. Health Soc. Behav*. 24, 385–396. doi: 10.2307/2136404

Corbett, G. A., Milne, S. J., Hehir, M. P., Lindow, S. W., and O'Connell, M. P. (2020). Health anxiety and behavioural changes of pregnant women during the COVID-19 pandemic. *Eur. J. Obstet. Gynecol. Reprod. Biol*. 249, 96–97. doi: 10.1016/j.ejogrb.2020.04.022

Dawson, K. S., Bryant, R. A., Harper, M., Kuowei, T. A., Rahman, A., and Schafer, A. (2015). Problem Management Plus (PM+): a WHO transdiagnostic psychological intervention for common mental health problems. *World Psychiatry* 14, 354–357. doi: 10.1002/wps.20255

de Arriba-García, M., Diaz-Martinez, A., Monfort-Ortiz, R., Roca-Prats, A., Monfort-Beltrán, S., Ivañez-Muñoz, M., et al. (2021). GESTACOVID project: psychological and perinatal effects in Spanish pregnant women subjected to confinement due to the COVID-19 pandemic. *J. Matern. Fetal Neonatal Med*. 21, 1–7. doi: 10.1080/14767058.2021.1888922

Ding, W., Lu, J., Zhou, Y., Wei, W., Zhou, Z., and Chen, M. (2021). Knowledge, attitudes, practices, and influencing factors of anxiety among pregnant women in Wuhan during the outbreak of COVID-19: a cross-sectional study. *BMC Pregnancy Childbirth* 21:80. doi: 10.1186/s12884-021-03561-7

Fakari, F. R., and Simbar, M. (2020). Coronavirus pandemic and worries during pregnancy; a Letter to Editor. *Arch. Acad. Emerg. Med*. 8:e21.

González-Mesa, E., Kabukcuoglu, K., Blasco, M., Körükcü, O., Ibrahim, N., González-Cazorla, A., et al. (2020). Comorbid anxiety and depression (CAD) at early stages of the pregnancy. *A multicultural cross-sectional study. J. Affect. Disord.* 270, 85–89. doi: 10.1016/j.jad.2020.03.086

Gul, F., Sherin, A., Jabeen, M., and Khan, S. A. (2017). Association of stress with anxiety and depression during pregnancy. *J. Pak. Med. Assoc*. 67, 1803–1808.

Gunnes, N., Gjessing, H. K., Bakken, I. J., Ghaderi, S., Gran, J. M., Hungnes, O., et al. (2020). Seasonal and pandemic influenza during pregnancy and risk of fetal death: a Norwegian registry-based cohort study. *Eur. J. Epidemiol*. 35, 371–379. doi: 10.1007/s10654-020-00600-z

He, X., Li, C., Qian, J., Cui, H., and Reliability, W. W. (2010). Validity of a generalized anxiety scale in general hospital outpatients. *Shanghai Arch. Psychiatry*. 22, 200–203.

Helgertz, J., and Bengtsson, T. (2019). The long-lasting influenza: the impact of fetal stress during the 1918 influenza pandemic on socioeconomic attainment and health in Sweden, 1968-2012. *Demography* 56, 1389–1425. doi: 10.1007/s13524-019-00799-x

Hewitt, P. L., Flett, G. L., and Mosher, S. W. (1992). The perceived stress scale: factor structure and relation to depression symptoms in a psychiatric sample. *J. Psychopathol. Behav. Assess*. 14, 247–257. doi: 10.1007/BF00962631

Hjelm, L., Handa, S., de Hoop, J., Palermo, T., and Zambia CGP and MCP Evaluation Teams. (2017). Poverty and perceived stress: Evidence from two unconditional cash transfer programs in Zambia. *Soc. Sci. Med*. 177, 110–117. doi: 10.1016/j.socscimed.2017.01.023

Hooker, A. B. (2020). Progesterone treatment in women with a threatened miscarriage remains controversial after reviewing the available literature. *BJOG* 127:1065. doi: 10.1111/1471-0528.16305

Hoyer, J., Wieder, G., Höfler, M., Krause, L., Wittchen, H. U., and Martini, J. (2020). Do lifetime anxiety disorders (anxiety liability) and pregnancy-related anxiety predict complications during pregnancy and delivery?. *Early Hum. Dev*. 144:105022. doi: 10.1016/j.earlhumdev.2020.105022

Kang, Y. T., Yao, Y., Dou, J., Guo, X., Li, S. Y., Zhao, C. N., et al. (2016). Prevalence and risk factors of maternal anxiety in late pregnancy in China. *Int. J. Environ. Res. Public Health* 13:468. doi: 10.3390/ijerph13050468

Kilfoyle, K. A., Vrees, R., Raker, C. A., and Matteson, K. A. (2016). Non-urgent and urgent emergency department use during pregnancy: an observational study. *Am. J. Obstet. Gynecol.* 216, 181.e181–187. doi: 10.1016/j.ajog.2016.10.013

Koelewijn, J. M., Sluijs, A. M., and Vrijkotte, T. G. M. (2017). Possible relationship between general and pregnancy-related anxiety during the first half of pregnancy and the birth process: a prospective cohort study. *BMJ Open* 7:e013413. doi: 10.1136/bmjopen-2016-013413

Li, G., Jiang, Z., Han, X., Shang, X., Tian, W., Kang, X., et al. (2020). A moderated mediation model of perceived stress, negative emotions and mindfulness on fertility quality of life in women with recurrent pregnancy loss. *Qual. Life Res*. 29, 1775–1787. doi: 10.1007/s11136-020-02460-2

Liao, M., Fang, F., Liu, G., Zhang, Y., Deng, C., and Zhang, X. (2020). Influencing factors and correlation of anxiety, psychological stress sources, and psychological capital among women pregnant with a second child in Guangdong and Shandong Province. *J. Affect. Disord.* 264, 115–122. doi: 10.1016/j.jad.2019.11.148

Liu, X., Chen, M., Wang, Y., Sun, L., Zhang, J., Shi, Y., et al. (2020). Prenatal anxiety and obstetric decisions among pregnant women in Wuhan and Chongqing during the COVID-19 outbreak: a cross-sectional study. *BJOG* 127, 1229–1240. doi: 10.1111/1471-0528.16381

Lu, L., Duan, Z., Wang, Y., Wilson, A., Yang, Y., Zhu, L., et al. (2020). Mental health outcomes among Chinese prenatal and postpartum women after the implementation of universal two-child policy. *J. Affect. Disord*. 264, 187–192. doi: 10.1016/j.jad.2019.12.011

Madhavanprabhakaran, G. K., Dsouza, M., and Nairy, S. (2015). Prevalence of pregnancy anxiety and associated factors. *Int. J. Afr. Nurs. Sci*. 3, 1–7. doi: 10.1016/j.ijans.2015.06.002

Mertz, D., Lo, C. K., Lytvyn, L., Ortiz, J. R., Loeb, M., and FLURISK-INVESTIGATOR. (2019). Pregnancy as a risk factor for severe influenza infection: an individual participant data meta-analysis. *BMC Infect. Dis*. 19:683. doi: 10.1186/s12879-019-4318-3

Mirzadeh, M., and Khedmat, L. (2020). Pregnant women in the exposure to COVID-19 infection outbreak: the unseen risk factors and preventive healthcare patterns. *J. Matern. Fetal. Neonatal Med*. 1–2. doi: 10.1080/14767058.2020.1749257. [Epub ahead of print].

Molgora, S., Fenaroli, V., and Saita, E. (2020). Psychological distress profiles in expectant mothers: what is the association with pregnancy-related and relational variables?. *J. Affect. Disord*. 262, 83–89. doi: 10.1016/j.jad.2019.10.045

Monk, C., Webster, R. S., McNeil, R. B., Parker, C. B., Catov, J. M., Greenland, P., et al. (2020). Associations of perceived prenatal stress and adverse pregnancy outcomes with perceived stress years after delivery. *Arch. Womens. Ment. Health*. 23, 361–369. doi: 10.1007/s00737-019-00970-8

Motrico, E., Bina, R., Domínguez-Salas, S., Mateus, V., Contreras-García, Y., Carrasco-Portiño, M., et al. (2021). Impact of the Covid-19 pandemic on perinatal mental health (Riseup-PPD-COVID-19): protocol for an international prospective cohort study. *BMC Public Health* 21:368. doi: 10.1186/s12889-021-10330-w

Ng, S. M. (2013). Validation of the 10-item Chinese Perceived Stress Scale in elderly service workers: one-factor versus two-factor structure. *BMC Psychol.* 1:9. doi: 10.1186/2050-7283-1-9

Rallis, S., Skouteris, H., McCabe, M., and Milgrom, J. (2014). A prospective examination of depression, anxiety and stress throughout pregnancy. *Women Birth* 27, e36–e42. doi: 10.1016/j.wombi.2014.08.002

Rees, S., Channon, S., and Waters, C. S. (2019). The impact of maternal prenatal and postnatal anxiety on children's emotional problems: a systematic review. *Eur. Child Adolesc. Psychiatry* 28, 257–280. doi: 10.1007/s00787-018-1173-5

Richardson, A., Raine-Fenning, N., Deb, S., Campbell, B., and Vedhara, K. (2017). Anxiety associated with diagnostic uncertainty in early pregnancy. *Ultrasound Obstet. Gynecol.* 50, 247–254. doi: 10.1002/uog.17214

Saadati, N., Afshari, P., Boostani, H., Beheshtinasab, M., Abedi, P., and Maraghi, E. (2021). Health anxiety and related factors among pregnant women during the COVID-19 pandemic: a cross-sectional study from Iran. *BMC Psychiatry* 21:95. doi: 10.1186/s12888-021-03092-7

Spitzer, R. L., Kroenke, K., Williams, J. B., and Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch. Intern. Med.* 166, 1092–1097. doi: 10.1001/archinte.166.10.1092

Taylor, J. M. (2015). Psychometric analysis of the ten-item perceived stress scale. *Psychol. Assess.* 27, 90–101. doi: 10.1037/a0038100

Wu, Y., Lu, Y. C., Jacobs, M., Pradhan, S., Kapse, K., Zhao, L., et al. (2020). Association of prenatal maternal psychological distress with fetal brain growth, metabolism, and cortical maturation. *JAMA Netw. Open* 3:e1919940. doi: 10.1001/jamanetworkopen.2019.19940

Yuan, S., Liao, Z., Huang, H., Jiang, B., Zhang, X., Wang, Y., et al. (2020). Comparison of the indicators of psychological stress in the population of Hubei province and non-endemic provinces in China during two weeks during the coronavirus disease 2019 (COVID-19) outbreak in February 2020. *Med. Sci. Monit.* 26:e923767. doi: 10.12659/MSM.923767

Zaigham, M., and Andersson, O. (2020). Maternal and perinatal outcomes with COVID-19: a systematic review of 108 pregnancies. *Acta Obstet. Gynecol. Scand.* 99, 823–829. doi: 10.1111/aogs.13867

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

SYSTEMATIC REVIEW
published: 04 May 2021
doi: 10.3389/fpsyg.2021.614964

The Prevalence of Psychological Status During the COVID-19 Epidemic in China: A Systemic Review and Meta-Analysis

Wei Li[1], Huijuan Zhang[1], Caidi Zhang[1], Jinjing Luo[1], Hongyan Wang[1], Hui Wu[2], Yikang Zhu[1], Huiru Cui[1], Jijun Wang[1,3,4,5], Hui Li[6†], Zhuoying Zhu[1,5], Yifeng Xu[1,5] and Chunbo Li[1,3,4,5*†]*

[1] Shanghai Key Laboratory of Psychotic Disorders, Shanghai Mental Health Center, Shanghai Jiao Tong University School of Medicine, Shanghai, China, [2] Shanghai General Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai, China, [3] Chinese Academy of Science Center for Excellence in Brain Science and Intelligence Technology, Chinese Academy of Science, Shanghai, China, [4] Brain Science and Technology Research Center, Shanghai Jiao Tong University, Shanghai, China, [5] Institute of Psychology and Behavioral Science, Shanghai Jiao Tong University, Shanghai, China, [6] Shanghai Clinical Research Center for Mental Health, Shanghai Mental Health Center, Shanghai Jiao Tong University School of Medicine, Shanghai, China

OPEN ACCESS

Edited by:
Fushun Wang, Nanjing University of Chinese Medicine, China

Reviewed by:
Stephen Zhang, University of Adelaide, Australia
Abida Sultana, EviSyn Health, Bangladesh

***Correspondence:**
Chunbo Li
licb@smhc.org.cn
Hui Li
lihuindyxs@163.com

† These authors have contributed equally to this work

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *07 October 2020*
Accepted: *24 March 2021*
Published: *04 May 2021*

Citation:
Li W, Zhang H, Zhang C, Luo J, Wang H, Wu H, Zhu Y, Cui H, Wang J, Li H, Zhu Z, Xu Y and Li C (2021) The Prevalence of Psychological Status During the COVID-19 Epidemic in China: A Systemic Review and Meta-Analysis. Front. Psychol. 12:614964. doi: 10.3389/fpsyg.2021.614964

The COVID-19 is creating panic among people around the world and is causing a huge public mental health crisis. Large numbers of observational studies focused on the prevalence of psychological problems during the COVID-19 pandemic were published. It is essential to conduct a meta-analysis of the prevalence of different psychological statuses to insight the psychological reactions of general population during the COVID-19 epidemic in China. Sixty six observational studies about the psychological statuses of people during the COVID-19 were included, searching up to 1 December 2020. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) was used to evaluate the quality of the included studies. OpenMeta[Analyst] was used for the data analysis. High prevalence of acute stress and fear symptoms were observed in the early period of the epidemic. Additionally, anxiety and depression symptoms continued at a high prevalence rate during the epidemic. It should alert the lasting mental health problems and the risk of post-traumatic stress disorder and other mental disorders.

Systematic Review Registration: PROSPERO CRD 42020171485.

Keywords: mental healthcare, COVID-19 pandemic, meta-analysis, psychological problems, PTSD

INTRODUCTION

The coronavirus disease (COVID-19) spread rapidly in China since it first appeared in Wuhan, China, in December 2019 (Liu et al., 2012). The acute respiratory infection caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has spread globally due to its high transmission rate (The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team, 2020). On 11 March 2020, the WHO characterized COVID-19 as a pandemic. By 1 October 2020, the cumulative number of infections worldwide has exceeded 36 million, and the number of deaths has exceeded 1 million (World Health Organization, 2020). The COVID-19 is creating panic among people around the world and is causing a public mental health crisis (Dong and Bouey, 2020; Yao et al., 2020).

Looking back at the SARS outbreak in 2003 and the Ebola outbreak in 2014, not only did the incidence of psychological problems such as anxiety, fear, and stress increase during the epidemic

period, but the psychological problems were also decelerating the recovery of infected patients (Person et al., 2004; Shultz et al., 2016). In addition, long-term follow-up revealed a significant increase in the incidence of mental disorders such as post-traumatic stress disorder and depression, especially among the health care workers (HCW) and survivors of the infection (Mak et al., 2009; Wu et al., 2009; Liu et al., 2012). Fear of illness and death, social isolation, and reduced income all contribute to the high incidence of mental and psychological problems during the emergence of epidemics (Carvalho et al., 2020). Therefore, targeted intervention according to the prevalence of mental and psychological problems during the epidemic has important social effects.

We conducted a meta-analysis of cross-sectional studies published before 6 March 2020 on the prevalence of different psychological states during early stage of COVID-19 epidemic in China (Li W. et al., 2020). The present study updated the literature retrieval date to 1 December 2020 to search more databases through a more comprehensive retrieval strategy. At the same time, the present study focuses on not only the prevalence of different psychological states, but also the difference of the prevalence among different periods of COVID-19 pandemic. Based on the changes in the epidemic situation and the major events related to the psychological status of people, this study provides an evidence-based data for the prevention and control of the epidemic and psychological crisis intervention in the future.

MATERIALS AND METHODS

Search Strategy

We searched the following databases for studies published before 1 December 2020: PubMed, EMBASE, The Cochrane Library, EBSCO, Web of Science, medRxiv, PsycINFO, Chinese National Knowledge Infrastructure (CNKI), Chongqing VIP database for Chinese Technical Periodicals, WANFANG DATA, Chinese Biological Medical Literature Database, and official information release platform (WeChat Official Account or Weibo). The search terms are described in the **Supplementary Material**. The reference lists of included articles were hand-checked for further relevant studies, and experts in the field were asked about the ongoing studies.

Inclusion and Exclusion Criteria

All reports investigating the psychological status during the COVID-19 outbreak were screened using the following inclusion criteria: (a) the survey was carried out by using scales with good reliability and validity, and definite boundary values; (b) information about prevalence, sample size, and time of investigation or time of submission; (c) the survey was conducted after COVID-19 outbreak; (d) the survey was conducted among general population; (e) cross-sectional study; (f) studies published in either English or Chinese. The exclusion criteria were as follows: (a) incomplete outcome data or lack of valid data following contact with the original authors; (b) descriptive studies, qualitative studies, anthropologic studies, review articles, research protocols, case reports, and duplicated reports.

Screening of Articles and Data Extraction

Three researchers (CD.Z., JJ.L., and HY.W.) independently explored previous studies based on search terms. The retrieved records were managed by Endnote X9. After removing the duplicates, all titles and abstracts of the records were screened by the three independent researchers (CD.Z., JJ.L., and HY.W.), and all studies that could possibly meet the inclusion criteria according to one of the researchers were retrieved as full text. The decision to include or exclude a study was also made by the three independent researchers (CD.Z., JJ.L., and HY.W.). The disagreements were discussed and resolved through discussion with a third reviewer (YK. Z.).

The data were then extracted and checked by two independent reviewers (H.L. and W.L.) using a standardized data collection form. The pertinent data extracted included data source, publication date, sample size, investigation time, population, location, and method of investigation, where possible.

Quality Assessment of the Studies

The included studies were assessed using the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist (Vandenbroucke et al., 2007), which includes 22 items for evaluating the title and abstract, introduction, methods, results and discussion, while assigning 1 point for each item, with a total of 22 points.

Outcome Measures

The primary outcome is the prevalence of different psychological statuses during the COVID-19 outbreak. The secondary outcomes are the prevalence of different psychological statuses in Hubei province and other provinces/cities outside the Hubei province.

Categorization of Time Periods

According to the dynamic changes in the situation and the major events related to the psychological status (Pan et al., 2020), we divided the epidemic into three time periods: the first period was from 23 January to 1 February 2020, during which the experts announced that the virus could be passed on, the government enforced lockdown in Wuhan, local traffic control and social isolation, and the hospitals faced serious shortages of medical resources and protective materials. The second period was from 2 February to 17 February, 2020, during which the Chinese government dispatched medical teams to Hubei Province for medical assistance, alleviated the shortage of medical resources and protective materials gradually, and set up psychological assistance hotlines in all provinces and cities throughout the country. The third period was from 18 February to 24 April, 2020. During this period, the number of patients recovered and discharged increased, and many provinces and cities down-regulated the level of emergency response to major public health emergencies and psychological medical teams to assist Wuhan.

Analysis

Meta-analyses were performed using the OpenMeta[Analyst] (Brown University, Rhode Island) (Lau et al., 1992; Viechtbauer,

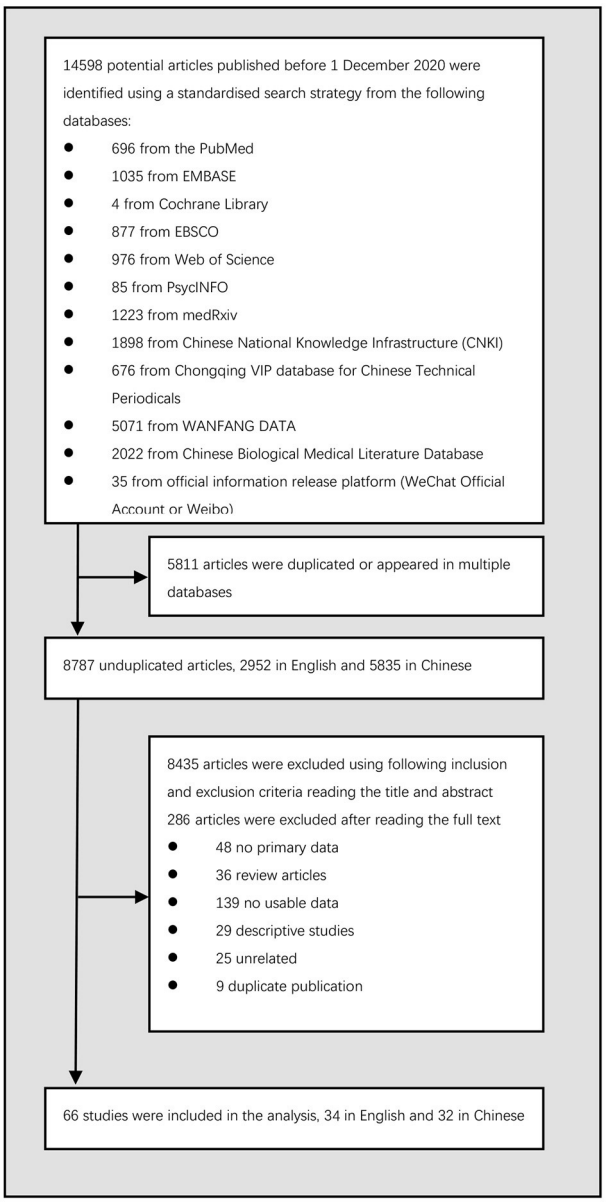


FIGURE 1 | Identification of included studies.

2010; Wallace et al., 2012). For different psychological statuses, only when no less than five different time points could be extracted from the included studies, a meta-analysis was performed. The studies were listed by the investigation time. The pooled effect size was calculated using the DerSimonian-Laird method for the point at which each new study was chronologically added to the evidence base (Kristian et al., 2011). The forest plots provide a visual representation of the trend of different psychological states with the spread of the epidemic. To present the prevalence of different psychological status during different periods of the COVID-19 epidemic, we performed the subgroup meta-analysis according to different periods.

For each meta-analysis, the heterogeneity was estimated using the inconsistency relative index I^2, which describes the percentage of variation among studies by heterogeneity and not by chance. Values of I^2 above 25, 50, and 75% were defined as low, moderate, and high heterogeneity, respectively (Higgins et al., 2011). Because the heterogeneity was high ($I^2 >$ 75%), we used the random effects model and the DerSimonian-Laird method to interpolate the prevalence with a 95% confidence interval (CI) (Kristian et al., 2011). To identify the potential impact of small sample size (<500), sensitivity analyses were performed.

RESULTS

Characteristics of the Included Studies

The process of identification of studies included in the analysis was shown in **Figure 1**. We found a total of 14,598 references in the databases. After removing these duplicates and studies that were reported in more than one article, 8,787 unduplicated articles remained. After reading the title and abstract of these unduplicated articles, we identified 8,435 articles that did not meet our inclusion and exclusion criteria, and after reading the full text, we identified an additional 286 articles that did not meet our criteria. This left us with 66 articles. Among these 66 studies, 34 in English and 32 in Chinese, were included in the subsequent analyses.

The characteristics of these 66 studies are shown in **Table 1**.

The respondents of seven studies came from Hubei province (Cao H. et al., 2020; Fu et al., 2020; Huo et al., 2020; Luo F. et al., 2020; Yang T. et al., 2020; Yu et al., 2020; Zhou and Liu, 2020); the respondents of the thirteen studies came from provinces and cities other than Hubei province (Cao H. et al., 2020; Deng and Lei, 2020; Fu et al., 2020; Guo L. et al., 2020; Huo et al., 2020; Lin G. et al., 2020; Liu Z. et al., 2020; Sun Q. et al., 2020; Tan et al., 2020; Yang B. et al., 2020; Yang L. et al., 2020; Yang S. et al., 2020; Zhang J. et al., 2020).

Quality Assessment of the Included Studies

The STROBE evaluation results of the included studies showed that all of studies had scores >11, the lowest score was 12 (Qiu et al., 2020), and the highest score was 22 (Wang et al., 2020a). The average score was (18.56 ± 1.51), which is at the relatively good level.

Findings From Meta-Analyses

The Prevalence of Different Psychological Statuses During the COVID-19 Epidemic

A total of 53 studies investigated the prevalence of anxiety symptoms from 28 January to 15 April, 2020, and the prevalence was found to be 29.6% (95% CI: 19.7–39.5%). There were respectively 7, 24, and 22 studies to investigate the prevalence of anxiety symptoms during three periods of epidemic. The prevalence were found to be 26.2% (95% CI: 19.3–33.1%) in the

TABLE 1 | Characteristics of the included studies.

No.	Study	Time of investigation	Age (Mean ± SD)	Sex (M/F)	Location of investigation	Questionnaires	Sample size
1	Cai et al., 2020	1/31–2/4	Unavailable	7404/14898	China	Self-compiled questionnaire	22,302
2	Cao H. et al., 2020	2/6–2/13	Unavailable	478/1022	China	HAMA/HAMD	1,500
3	Cao Y. et al., 2020	5/2–5/10	Unavailable	127/303	Shanghai	IES	430
4	Deng et al., 2020	2/13–2/16	32.48 ± 9.05	226/254	China	SAS/SDS/SRQ	480
5	Deng and Lei, 2020	3/2–3/9	Unavailable	77/496	Guangdong province	SAS	573
6	Dong et al., 2020	2/16–2/22	34 ± 9	378/567	China	PHQ-9	945
7	Feng et al., 2020	2/17–3/10	Unavailable	Unavailable	China	SAS/SDS/AIS/PCL-C	53,427
8	Fu et al., 2020	2/18–2/28	Unavailable	376/866	Wuhan	GAD-7/PHQ-9/AIS	1,242
9	Gao et al., 2020	1/31–2/2	32.3 ± 10.0	1560/3267	China	WHO-5/GAD-7	4,827
10	Guo F. et al., 2020	2/18–2/22	Unavailable	15034/11683	China	CES-D/GAD-2	26,717
11	Guo L. et al., 2020	2/3–2/14	Unavailable	3903/9919	China	SCL-90/SASRQ	13,822
12	Guo Y. et al., 2020	2/26–/29	34.4 ± 11.1	1024/1307	China	HADS	2,331
13	He et al., 2020	2/17–2/27	Unavailable	246/876	China	ISI	1,066
14	Huang et al., 2020	2/10–2/15	Unavailable	2676/3585	China	PHQ-9/SAS	6,261
15	Huang and Zhao, 2020	2/3–2/17	35.3 ± 5.6	3284/3952	China	GAD-7/CES-D/PSQI	7,236
16	Huo et al., 2020	2/9–2/14	Unavailable	434/496	Hubei and Yunnan province	GAD-7/PHQ-9	930
17	Jiang et al., 2020a	1/31–2/2	39.6 ± 12.1	261/825	China	Self-compiled questionnaire	1,086
18	Jiang et al., 2020b	2/23–2/29	34.66 ± 12.02	25781/34418	China	SDS/SAI	60,199
19	Li S. et al., 2020	2/16–2/23	Unavailable	833/2168	China	GAD-7/PHQ-9	3,001
20	Li Y. et al., 2020	1/30–2/1	33.2 ± 8.6	209/768	China	GAD-7/PHQ-9	977
21	Liang et al., 2020	1/30	Unavailable	223/361	China	PCL-C	584
22	Lin G. et al., 2020	1/31–2/8	27.7 ± 10.9	213/591	Hainan province	Self-compiled questionnaire	804
23	Lin L. et al., 2020	2/5–2/10	Unavailable	Unavailable	China	GAD-7/PHQ-9/ASDS	3,826
24	Lin L.-Y. et al., 2020	2/5–2/27	Unavailable	1685/3956	China	GAD-7 /PHQ-9/ASDS/ISI	5,641
25	Lin Y. et al., 2020	1/24–2/24	Unavailable	733/1713	China	STAI	2,446
26	Liu et al., 2020	1/30–2/3	Unavailable	251/357	China	STAI/SDS/SCL-90	608
27	Liu Y. et al., 2020	2/13–3/4	Unavailable	301/461	China	SCL-90	762
28	Liu Z. et al., 2020	3/11–3/15	Unavailable	224/503	Guangdong province	GAD-7/PHQ-9	727
29	Luo F. et al., 2020	3/14–3/17	45.0 ± 10.0	122/361	Hubei province	SAS/SDS	483
30	Qi et al., 2020	2/25–3/15	31.8 ± 8.6	250/395	China	PSS-10	645
31	Qiu et al., 2020	1/31–2/10	Unavailable	Unavailable	China	Self-compiled questionnaire	52,730
32	Ran et al., 2020	2/23–3/2	28.7 ± 10.64	586/1184	China	GAD-7 /PHQ-9/PHQ-15	1,770
33	Ren Y. et al., 2020	2/14–3/29	Unavailable	360/812	China	GAD-7/PHQ-9/SCL-90/PSS-10/ISI/PCL-5	1,172
34	Ren Z. et al., 2020	2/9–2/20	Unavailable	2030/4100	China	GAD-7/PHQ-9	6,130
35	Shi et al., 2020	2/28–3/11	35.97 ± 8.22	27149/29530	China	GAD-7/PHQ-9/ISI/ASDS	56,679
36	Song F. et al., 2020	1/28–2/20	Unavailable	553/525	China	SCL-90	1,078
37	Song L. et al., 2020	4/9–4/22	35.35 ± 6.61	183/526	China	GAD-7/CES-D/ISI	709
38	Sun et al., 2021	1/30–2/3	Unavailable	Unavailable	China	PCL-5	2,091
39	Sun M. et al., 2020	1/28–2/4	Unavailable	323/887	China	GAD-7	3,111
40	Sun Q. et al., 2020	2/5–2/19	Unavailable	1162/1972	Except for Hubei province	GAD-7 /PHQ-9/ISI	3,134
41	Tan et al., 2020	2/24–2/25	30.8 ± 7.4	501/172	Chongqing	IES-R/DASS-21/ISI	673
42	Tian et al., 2020	1/31–2/2	35.01 ± 12.8	549/511	China	SCL-90	1,060
43	Wang C. et al., 2020	1/31–2/2	Unavailable	396/814	China	IES-R/DASS	1,210
44	Wang J. et al., 2020	2/4–2/18	Unavailable	2824/3613	China	PSQI	6,437
45	Wang M. et al., 2020	2/1–2/18	Unavailable	576/925	China	GAD-7/PHQ-9/SRQ-20/ISI	1,501
46	Wang et al., 2020a	1/31–2/2	32.32 ± 9.98	1560/3267	China	GAD-7/WHO-5	4,827
47	Wang et al., 2020b	2/20–2/22	Unavailable	406/623	China	SAS/SDS	1,029
48	Wu M. et al., 2020	2/13–2/29	Unavailable	13304/11485	China	HADS	24,789
49	Xiao et al., 2020	2/1–3/31	25.05 ± 9.18	1037/2038	China	GAD-7/PHQ-9	3,075
50	Yang B. et al., 2020	2/2–2/3	Unavailable	213/414	Sichuan province	GAD-7/PHQ-9	627

(Continued)

TABLE 1 | Continued

No.	Study	Time of investigation	Age (Mean ± SD)	Sex (M/F)	Location of investigation	Questionnaires	Sample size
51	Yang L. et al., 2020	2/1–2/9	Unavailable	142/379	Fujian province	PQEEPH	521
52	Yang S. et al., 2020	3/5–3/14	Unavailable	1239/1196	Deqing and Taizhou	GAD-7/PHQ-9	2,435
53	Yang T. et al., 2020	2/13–2/15	Unavailable	185/148	Wuhan	GAD-7/PHQ-9	333
54	Yang X. et al., 2020	2/1–2/4	33.84 ± 12.28	542/1096	China	PSS	1,638
55	Yang Y. et al., 2020	2/19–2/21	Unavailable	1548/1611	China	GHQ-20	3,159
56	Yu et al., 2020	2/17–2/27	Unavailable	1180/1847	Enshi	SAS	3,027
57	Zhang J. et al., 2020	2/10–2/15	36.45 ± 2.14	0/300	Changzhi	SCL-90	300
58	Zhang et al., 2020b	2/1–2/5	Unavailable	617/561	Wuhan	ISI	1,178
59	Zhao et al., 2020	2/18–2/25	29.17 ± 10.58	Unavailable	China	PSQI	1,722
60	Zhen and Zhou, 2020	1/27–1/30	Unavailable	361/689	China	Self-compiled questionnaire	1,050
61	Zhong et al., 2020	2/13–2/24	Unavailable	5685/10363	China	SASRQ	16,048
62	Zhou and Liu, 2020	3/2–3/5	33.22 ± 0.61	73/138	Hubei province	PQEEPH	211
63	Zhu et al., 2020b	2/5–2/7	33 ± 9	380/996	China	SAS/SDS	1,376
64	Zhu et al., 2020a	2/19–2/26	Unavailable	424/568	China	SAS	992
65	Zhu X. et al., 2020	1/30–2/13	Unavailable	2176/4219	China	GAD-7/PHQ-9/SRQ-20	63,85
66	Zhu Z. et al., 2020	2/17–3/10	Unavailable	410/512	China	SCL-90	922

HAMA, Hamilton Anxiety Scale; HAMD, Hamilton Depression Scale; IES, Impact of Event Scale; SAS, Self-rating Anxiety Scale; SDS, Self-rating Depression Scale; SRQ, Stress Response Questionnaire; PHQ-9, 9-item Patient Health Questionnaire; AIS, Athens Insomnia Scale; PLC-C, Post-traumatic Stress Disorder Checklist-Civilian Version; GAD-7, 7-item anxiety scale; CES-D, Center for Epidemiological Survey, Depression Scale; GAD-2, 2-item anxiety scale; WHO-5, 5-item World Health Organization Well-Being Index; SCL-90, 90-item Symptom Check List; SASRQ, Stanford Acute Stress Reaction Questionnaire; HADS, Hospital Anxiety and Depression Scale; ISI, Insomnia Severity Index; PSQI, Pittsburgh Sleep Quality Index; SAI, State Anxiety Inventory; ASDS, Acute Stress Disorder Scale; STAI, state-trait anxiety inventory; PSS-10, 10-item Perceived Stress Scale; PHQ-15, 15-item Patient Health Questionnaire; IES-R, Impact of Event Scale-Revised; DASS-21, 21-item Depression Anxiety Stress Scale; SRQ-20, 20-item Stress Response Questionnaire; PQEEPH, Psychological Questionnaires for Emergent Events of Public Health; PSS, Perceived Stress Scale; GHQ-20, General Health Questionnaire.

first period, 32.5% (95% CI: 25.7–39.3%) in the second period, and 27.4% (95% CI: 14.6–40.3%) in the third period of epidemic (see in **Figure 2A**).

A total of 45 studies investigated the prevalence of depression symptoms from 31 January to 15 April, 2020, with a prevalence of 32.5% (95% CI: 20.5–44.4%). There were respectively 5, 20 and 20 studies to investigate the prevalence of depression symptoms during three periods of epidemic. The prevalence were found to be 31.4% (95% CI: 16.9–45.9%) in the first period, 32.6% (95% CI: 26.5–38.8%) in the second period, and 32.5% (95% CI: 15.3–49.6%) in the third period of epidemic (see in **Figure 2B**).

A total of 15 studies investigated the prevalence of sleep problems from 3 February to 15 April, 2020, and the overall prevalence was found to be 26.3% (95% CI: 13.0–39.6%). There were respectively seven and eight studies to investigate the prevalence of sleep problems during the second and third period of epidemic. The prevalence were found to be 18.8% (95% CI: 13.9–23.7%) in the second period, and 32.8% (95% CI: 13.6–51.9%) in the third period of epidemic (see in **Figure 2C**).

A total of 11 studies investigated the prevalence of acute stress symptoms from 1 February to 6 May, 2020, with a prevalence of 39.4% (95% CI: 32.5–46.2%). There were respectively 1, 4, and 6 studies to investigate the prevalence of acute stress symptoms during three periods of epidemic. The prevalence were found to be 75.5% (95% CI: 73.1–78.0%) in the first period, 24.1% (95% CI: 15.0–33.3%) in the second period, and 43.5% (95% CI: 35.1–52.0%) in the third period of epidemic (see in **Figure 2D**).

A total of nine studies investigated the prevalence of somatic symptoms from 1 February to 7 March, 2020, with a prevalence of 22.2% (95%CI: 14.0–30.5%). There were respectively 1, 4, and 4 studies to investigate the prevalence of somatic symptoms during three periods of epidemic. The prevalence were found to be 33.6% (95% CI: 30.7–36.4%) in the first period, 22.1% (95% CI: 12.3–32.0%) in the second period, and 19.2% (95% CI: 1.0–37.5%) in the third period of epidemic (see in **Figure 2E**).

A total of seven studies investigated the prevalence of fear symptoms from 1 February to 3 March, 2020, with a total incidence of 41.4% (95% CI: 27.4–55.4%). There were respectively 1, 4, and 2 studies to investigate the prevalence of fear symptoms during three periods of epidemic. The prevalence were found to be 44.8% (95% CI: 41.8–47.8%) in the first period, 53.2% (95% CI: 33.4–73.0%) in the second period, and 16.0% (95% CI: 13.7–18.3%) in the third period of epidemic (see in **Figure 2F**).

A total of five studies investigated the prevalence of obsessive-compulsive symptoms from 1 February to 22 February, 2020, with a total incidence of 39.9% (95% CI: 11.0–68.7%). There were respectively 1, 3, and 1 studies to investigate the prevalence of obsessive-compulsive symptoms during three periods of epidemic. The prevalence were found to be 59.6% (95% CI: 56.7–62.6%) in the first period, 23.0% (95% CI: 3.5–42.6%) in the second period, and 69.9% (95% CI: 66.7–73.2%) in the third period of epidemic (see in **Figure 2G**).

A total of six studies did not classify different psychological statuses, but used some comprehensive mental health

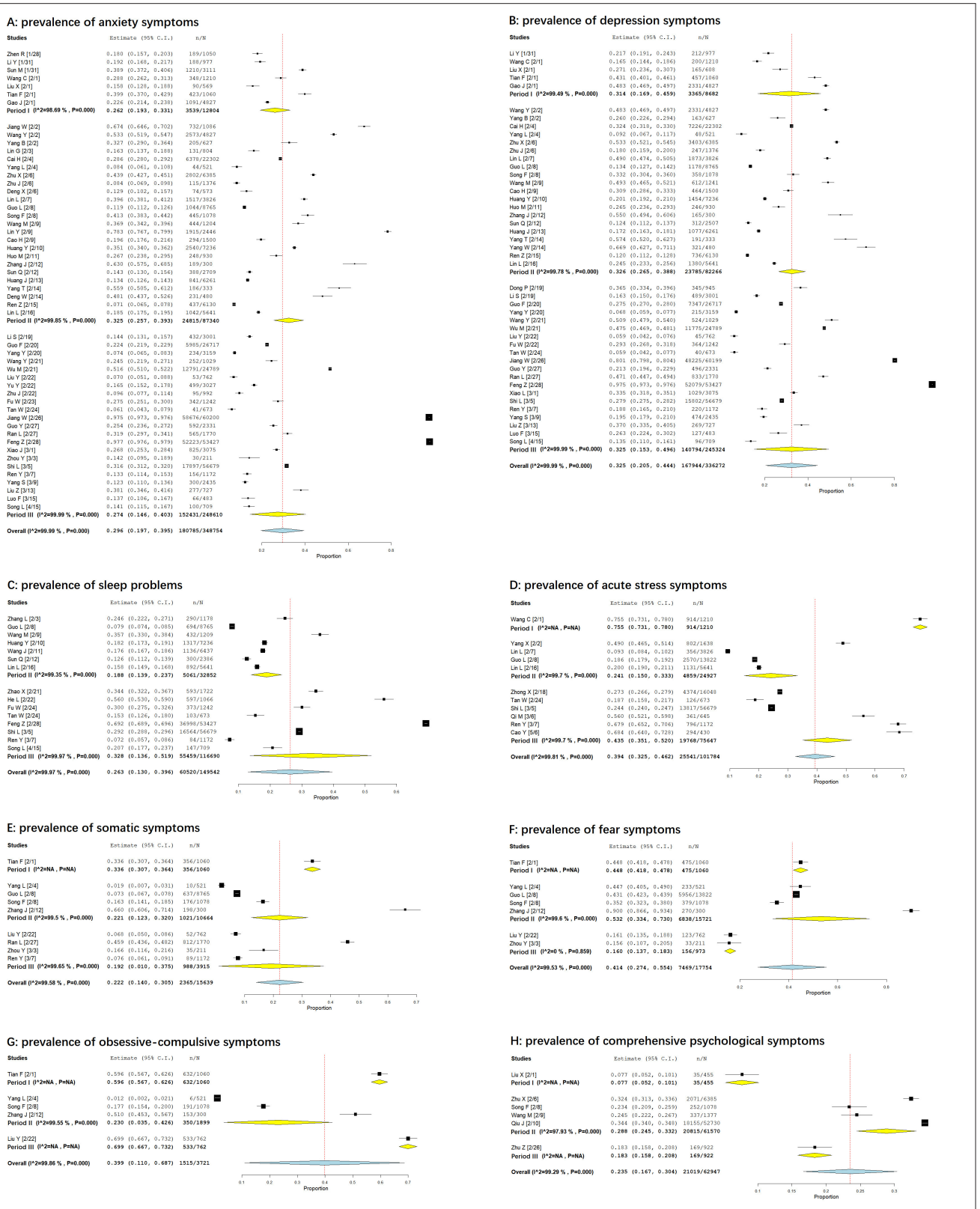


FIGURE 2 | Forest plots: the prevalence of different psychological statuses during the COVID-19 outbreak in China. [**(A)** prevalence of anxiety symptoms; **(B)** prevalence of depression symptoms; **(C)** prevalence of sleep problems; **(D)** prevalence of acute stress symptoms; **(E)** prevalence of somatic symptoms; **(F)** prevalence of fear symptoms; **(G)** prevalence of obsessive-compulsive symptoms; **(H)** prevalence of comprehensive psychological symptoms].

questionnaires to investigate it from 1 February to 26 February, 2020. The prevalence of comprehensive psychological symptoms was 23.5% (95% CI: 16.7–30.4%). There were respectively 1, 4 and 1 studies to investigate the prevalence of comprehensive psychological symptoms during three periods of epidemic. The prevalence were found to be 7.7% (95% CI: 5.2–10.1%) in the first period, 28.8% (95% CI: 24.5–33.2%) in the second period, and 18.3% (95% CI: 15.8–20.8%) in the third period of epidemic (see in **Figure 2H**).

The Prevalence of Different Psychological Status in Hubei Province and Other Provinces/Cities Outside Hubei Province

A total of six studies investigated the prevalence of anxiety symptoms in Hubei province from 9 February to 15 March, 2020, with a prevalence of 24.7% (95% CI: 16.4–32.9%). A total of 13 studies investigated the prevalence of anxiety symptoms in provinces and cities other than Hubei province from 2 February to 13 March, 2020, with a prevalence of 21.6% (95%CI: 17.1–26.1%) (See in **Figure 3A**).

A total of five studies investigated the prevalence of depression symptoms in Hubei province. The investigation period was from 9 February to 15 March, 2020, with a prevalence of 34.7% (95% CI: 26.2–43.1%). A total of 10 studies conducted investigations on the prevalence of depression symptoms in provinces and cities other than Hubei province, from 2 February to 13 March, 2020, with a prevalence of 22.5% (95%CI: 17.6–27.5%) (see in **Figure 3B**).

Sensitivity Analyses

The studies with small sample size (sample size < 500) were excluded for sensitivity analysis (Cao Y. et al., 2020; Deng et al., 2020; Luo F. et al., 2020; Yang T. et al., 2020; Zhang J. et al., 2020; Zhou and Liu, 2020). It was found that the results did not change in direction, indicating that the results were relatively stable (**Table 2** and S2 in **Supplementary Material**).

DISCUSSION

Compared with previous meta-analysis studies focusing on the mental health during the Covid-19 outbreak (Hessami et al., 2020; Luo M. et al., 2020; Ren X. et al., 2020; Wu T. et al., 2020), the present study tried to show psychological statuses during different periods of epidemic through subgroup analysis. By reviewing the psychological conditions at different periods after the occurrence of the stress event of the COVID-19 epidemic, according to the results of our research, more targeted psychological assistance can be arranged at appropriate time point to help people during public emergent events.

An overview of the different psychological statuses during the COVID-19 epidemic in China showed that although the prevalence of acute stress symptoms reached a high level in the early stage of the epidemic, it gradually declined with the progress of the epidemic. However, the prevalence of anxiety and depression symptoms did not improve with the control of the epidemic, but still stayed at a high level, which was significantly higher than the average level of anxiety and depression according to the results from meta-analyses on prevalence of depression and anxiety in Chinese general population before the COVID-19 epidemic (Baxter et al., 2016; Guo et al., 2016; Wang et al., 2017). Previous studies found that anxiety and depression are risk factors for post-traumatic stress disorder (PTSD) (Grekin and O'hara, 2014; Song et al., 2018). Thus, the continued high prevalence of anxiety and depression symptoms during an epidemic may account for the elevated risk of long-term psychological problems (such as PTSD). Timely intervention for anxiety and depression during the epidemic is also helpful in preventing from the incidence of PTSD and related mental disorders.

In the early period of the COVID-19 epidemic, the public's response to the epidemic was not only reflected in the unknown pathogenic capacity and lethality of the virus, but also in the trust in the national public health response capacity and the effectiveness of personal protection measures (Dong and Bouey, 2020). Furthermore, with the promulgation of public health policies, such as the lockdown of the city, the blocking

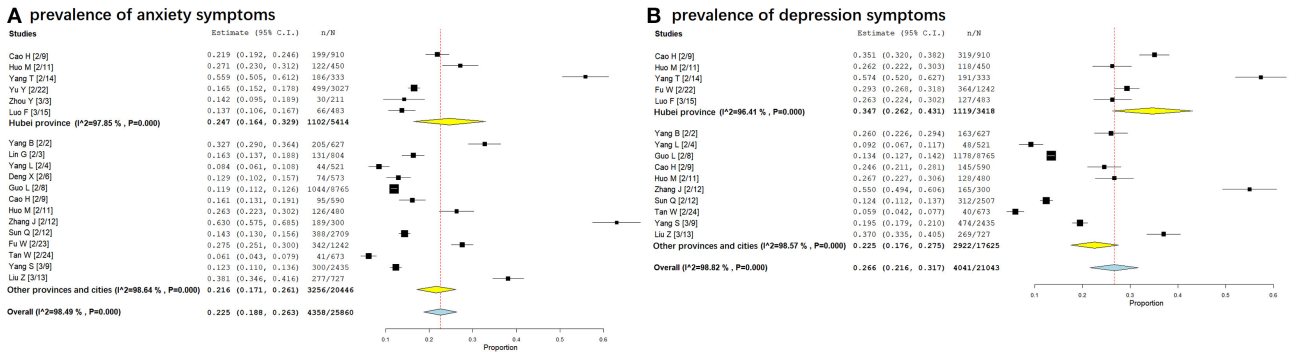


FIGURE 3 | Forest plots: the prevalence of anxiety and depression symptoms in Hubei province and other provinces/cities. [**(A)** prevalence of anxiety symptoms in Hubei province and other provinces/cities; **(B)** prevalence of anxiety symptoms in other provinces/cities outside Hubei province and other provinces/cities].

TABLE 2 | Sensitivity analysis: the prevalence of different psychological statuses after removing small-sample study.

	Period 1 (23th Jan−1st Feb)	Period 2 (2nd Feb−17th Feb)	Period 3 (18th Feb−24th Apr)	Overall
Anxiety symptoms	26.2% (95% CI: 19.3–33.1%)	29.3% (95% CI: 22.0–36.5%)	28.8% (95% CI: 15.4–42.2%)	28.6% (95% CI: 18.2–39.0%)
Depression symptoms	31.4% (95% CI: 16.9–45.9%)	28.0% (95% CI: 21.5–34.4%)	32.8% (95% CI: 15.1–50.4%)	30.6% (95% CI: 18.1–43.1%)
Sleep problems	NA	18.8% (95% CI: 13.9–23.7%)	32.8% (95% CI: 13.6–51.9%)	26.3% (95% CI: 13.0–39.6%)
Acute stress symptoms	75.5% (95% CI: 73.1–78.0%)	24.1% (95% CI: 15.0–33.3%)	38.7% (95% CI: 30.4–46.9%)	36.5% (95% CI: 29.6–43.5%)
Somatic symptoms	33.6% (95% CI: 30.7–36.4%)	8.4% (95% CI: 2.8–14.0%)	20.1% (95% CI: −1.9–42.0%)	17.0% (95% CI: 8.7–25.3%)
Fear symptoms	44.8% (95% CI: 41.8–47.8%)	40.9% (95% CI: 35.5–46.4%)	16.1% (95% CI: 13.5–18.8%)	36.8% (95% CI: 26.4–47.1%)
Obsessive-compulsive symptoms	59.6% (95% CI: 56.7–62.6%)	9.4% (95% CI: −6.8–25.6%)	69.9% (95% CI: 66.7–73.2%)	37.1% (95% CI: 4.8–69.4%)
Comprehensive psychological symptoms	NA	28.8% (95% CI: 24.5–33.2%)	18.3% (95% CI: 15.8–20.8%)	26.7% (95% CI: 21.6–31.8%)
Anxiety symptoms				
Hubei province				19.0% (95% CI: 13.8–24.3%)
Other cities/provinces				17.7% (95% CI: 13.8–21.6%)
Depressive symptoms				
Hubei province				32.1% (95% CI: 26.5–37.7%)
Other cities/provinces				18.3% (95% CI: 13.8–22.8%)

NA: There was no study investigated the prevalence of the psychological status during the time period.

of traffic, and social isolation, the public's fear of COVID-19 increased (Wu et al., 2009). Therefore, the prevalence of fear and acute stress symptoms, the two acute psychological reactions to traumatic events, which quickly increased at the early period, and the prevalence was significantly higher than other psychological problems (Prati et al., 2012; Santos-Reyes and Gouzeva, 2020). Under the intervention of epidemic prevention and control at the national level, the prevalence of fear and acute stress symptoms decreased at the late period of epidemic.

Previous studies on the psychological reaction of the public during COVID-19 mentioned the "Psychological Typhoon Eye" effect (Yáñez et al., 2020; Zhang et al., 2020,a; Zhang S. X. et al., 2020). At the beginning of the epidemic, the residents in Hubei province did not realize the severity of the epidemic and felt that the virus was far away from them. The Hubei Provincial Government did not take strong measures in time. The information received by people is not symmetrical with the facts, it will cause greater panic later. This sent a false signal to the people: this new disease is not serious and can be prevented and controlled. Thus, the true situation of the epidemic was concealed. Furthermore, the residents outside the Hubei province appeared to be more anxious due to the asymmetry of information, and the media reported that the epidemic was very serious (Zhang et al., 2020a). This study did not found that the prevalence of anxiety and depression symptoms outside Hubei province were significantly higher than the prevalence inside Hubei province. However, the results of sensitivity analysis showed the prevalence of depression symptoms inside Hubei province is higher than the prevalence outside Hubei province. This may be related to the explosive increase of infected cases in Hubei province at the early stage of the epidemic, but the local government did not take active and effective measures to prevent the epidemic. However, few studies have been carried out on the prevalence of psychological statuses of residents in Hubei Province, which may be one of the reasons for the insignificant typhoon eye effect. Further researches are needed to show the effect in the future.

LIMITATIONS

However, the study had several limitations. Firstly, although we have tried to avoid the influence of noise on the results, some confounding factors may still influence the results. In order to reduce the impact of noise on the results, we used more stringent inclusion criteria. Therefore, the present study

only focused studies conducted in general population, the study population may be more homogeneous, which may partly reduce the influence of possible noise. At the same time, all of the included studies were conducted quality assessment and were at the relatively good level. Additionally, in the sensitivity analysis, when we excluded the studies with small sample size to redo meta-analysis. It was found that the results did not change in direction, indicating that the results were relatively stable. For the longitudinal observation of the dynamic psychological status, the optimal way is to conduct a long-term cross-sectional survey of a specific population through systematic sampling. However, during the epidemic, it was difficult to restrict the population of investigation through an online survey. Additionally, the results of this current study show that there is significant heterogeneity among the studies. The heterogeneity is still large after subgroup analysis, which may be due to the fact that the included studies investigated very different population and settings.

CONCLUSIONS

There are different characteristics of the prevalence of psychological problems/symptoms during the COVID-19 epidemic. The persistently high prevalence of anxiety and depression symptoms during the epidemic could be a risk factor for PTSD and other mental disorders after the outbreak. Therefore, timely implementation of mental health policies is urgently needed for the public mental health crisis during the fight against COVID-19.

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

CL and HL designed the study. WL, HL, and HZ were responsible for drafting the research searching strategy and data extraction. JL, CZ, YZ, and HW conducted the searching and screening of studies. WL drafted the manuscript. HL, HW, HC, JW ZZ, YX, and CL made critical revisions. All authors approved the final version for publication.

FUNDING

This work was funded by Shanghai Jiao Tong University Special Grant for the Prevention and Control of Novel Coronavirus (2020RK61), Shanghai Clinical Research Center for Mental Health (19MC1911100), and National Key R&D Program of China (2018YFC2001605).

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.614964/full#supplementary-material

REFERENCES

Baxter, A. J., Charlson, F. J., Cheng, H. G., Shidhaye, R., Ferrari, A. J., and Whiteford, H. A. (2016). Prevalence of mental, neurological, and substance use disorders in China and India: a systematic analysis. *Lancet Psychiatry* 3, 832–841. doi: 10.1016/S2215-0366(16)30139-0

Cai, H., Zhu, Y., Lei, L., Pan, C., Zhu, L., Li, J., et al. (2020). Novel coronavirus pneumonia epidemic-related knowledge, behaviors and psychology status among college students and their family members and friends: an internet-based cross-sectional survey (in Chinese). *Chin. J. Public Health* 36, 152–155. doi: 10.11847/zgggws1128106

Cao, H., Zuo, C., Li, G., Huang, Y., Li, L., Huang, S., et al. (2020). A cross-sectional study of psychological status in different epidemic areas in China after the COVID-19 outbreak. *Front. Psychiatry* 11:575705. doi: 10.3389/fpsyt.2020.575705

Cao, Y., Ma, Z. F., Zhang, Y., and Zhang, Y. (2020). Evaluation of lifestyle, attitude and stressful impact amid COVID-19 among adults in Shanghai, China. *Int. J. Environ. Health Res.* doi: 10.1080/09603123.2020.1841887. [Epub ahead of print].

Carvalho, P. M. D. M., Moreira, M. M., De Oliveira, M. N. A., Landim, J. M. M., and Neto, M. L. R. (2020). The psychiatric impact of the novel coronavirus outbreak. *Psychiatry Res. Neuroimag.* 286:112902. doi: 10.1016/j.psychres.2020.112902

Deng, W., Liu, Y., and Cheng, S. (2020). Investigation on psychological status of the people under coronavirus disease (in Chinese). *J. North China Univ. Sci. Technol.* 22, 482–488. doi: 10.19539/j.cnki.2095-2694.2020.06.013

Deng, X., and Lei, L. (2020). A survey of public anxiety and health needs in Guangdong during the COVID-19 period (in Chinese). *J. Med. Aesthetice Cosmetol.* 29, 7–8.

Dong, L., and Bouey, J. (2020). Public mental health crisis during COVID-19 pandemic, China. *Emerg. Infect. Dis.* 26, 1616–1618. doi: 10.3201/eid2607.202407

Dong, P., Ni, Z., Zhao, K., Sun, G., and Sun, H. (2020). Public depression status during the COVID-19 epidemic (in Chinese). *Chin. Mental Health J.* 34, 710–714. doi: 10.3969/j.issn.1000-6729.2020.8.014

Feng, Z., Liu, X., and Chen, Z. (2020). Analysis of characteristics of public psychological problems during COVID-19 epidemic (in Chinese). *J. Southwest Univ.* 46, 109–115. doi: 10.13718/j.cnki.xdsk.2020.04.013

Fu, W., Wang, C., Zou, L., Guo, Y., Lu, Z., Yan, S., et al. (2020). Psychological health, sleep quality, and coping styles to stress facing the COVID-19 in Wuhan, China. *Transl. Psychiatry* 10, 225–225. doi: 10.1038/s41398-020-00913-3

Gao, J., Zheng, P., Jia, Y., Chen, H., Mao, Y., Chen, S., et al. (2020). Mental health problems and social media exposure during COVID-19 outbreak. *PLoS ONE* 15:e0231924. doi: 10.2139/ssrn.3541120

Grekin, R., and O'hara, M. W. (2014). Prevalence and risk factors of postpartum posttraumatic stress disorder: a meta-analysis. *Clin. Psychol. Rev.* 34, 389–401. doi: 10.1016/j.cpr.2014.05.003

Guo, F., Cai, Y., Wang, Y., Li, Y., and Chen, Z. (2020). Emotional health status and social mentality of the Chinese general public during the 2019 novel coronavirus pneumonia pandemic (in Chinese). *Sci. Technol. Rev.* 38, 68–76. doi: 10.3981/j.issn.1000-7857.2020.04.009

Guo, L., Xu, P., Yao, F., Zhang, F., Qi, L., and Yang, F. (2020). The effect of acute stress disorder on negative emotions in chinese public during the NCP epidemic moderating effect of social support (in Chinese). *J. Southwest Univ.* 42, 21–30. doi: 10.13718/j.cnki.xdzk.2020.05.003

Guo, X., Meng, Z., Huang, G., Fan, J., Zhou, W., Ling, W., et al. (2016). Meta-analysis of the prevalence of anxiety disorders in mainland China from 2000 to 2015. *Sci. Rep.* 6:28033. doi: 10.1038/srep28033

Guo, Y., Cheng, C., Zeng, Y., Li, Y., Zhu, M., Yang, W., et al. (2020). Mental health disorders and associated risk factors in quarantined adults during the COVID-19 outbreak in China: a cross-sectional study. *J. Med. Internet Res.* 22:e20328. doi: 10.2196/preprints.20328

He, L., Gao, Y., Gao, X., and Lei, X. (2020). Sleep patterns and physical and mental health of residents during the COVID-19: susceptibility factors and coping strategies (in Chinese). *J. Southwest Univ.* 42, 11–20. doi: 10.13718/j.cnki.xdzk.2020.05.002

Hessami, K., Romanelli, C., Chiurazzi, M., and Cozzolino, M. (2020). COVID-19 pandemic and maternal mental health: a systematic review and meta-analysis. *J. Matern Fetal Neonatal Med*. doi: 10.1080/14767058.2020.1843155. [Epub ahead of print].

Higgins, J., Green, S., and Collaboration, C. (2011). Cochrane handbook for systematic reviews for interventions. *Cochrane Database Syst. Rev.* 2011:S38.

Huang, J., Liu, F., Teng, Z., Chen, J., Zhao, J., Wang, X., et al. (2020). Public behavior change, perceptions, depression, and anxiety in relation to the COVID-19 outbreak. *Open Forum Infect. Dis.* 7:ofaa273. doi: 10.1093/ofid/ofaa273

Huang, Y., and Zhao, N. (2020). Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey. *Psychiatry Res.* 288:112954. doi: 10.1016/j.psychres.2020.112954

Huo, M., Yin, Y., Jiang, L., and Duan, X. (2020). Survey on the mental status of inhabitants living in Wuhan, Huanggang, Kunmingand Yuxi during epidemic outbreak stage of COVID-19 (in Chinese). *J. Int. Psychiatry* 47, 197–200. doi: 10.13479/j.cnki.jip.2020.02.002

Jiang, W., Fang, Y., Sun, F., Gao, Y., Sun, L., Yue, L., et al. (2020a). *A Snapshot of the Mental State of Chinese Public During the 2019 Novel Coronavirus Outbreak [Gray Literature]*. Shanghai: Shanghai Mental Health Center.

Jiang, W., Liu, X., Zhang, J., and Feng, Z. (2020b). Mental health status of Chinese residents during the COVID-19 epidemic. *BMC Psychiatry* 20:580. doi: 10.1186/s12888-020-02966-6

Kristian, T., Wetterslev, J., Awad, T., Thabane, L., and Gluud, C. (2011). Comparison of statistical inferences from the DerSimonian–Laird and alternative random-effects model meta-analyses – an empirical assessment of 920 cochrane primary outcome meta-analyses. *Res. Synth. Methods*. 2, 238–253. doi: 10.1002/jrsm.53

Lau, J., Antman, E., and M. (1992). Cumulative meta-analysis of therapeutic trials for myocardial infarction. *N. Engl. J. Med*. 327, 248–254. doi: 10.1056/NEJM199207233270406

Li, S., Ye, Z., Du, C., Wei, Q., and He, C. (2020). The residents' mental health status and community's role during the COVID-19 pandemic: a community-based cross-sectional study in China. *Ann. Transl. Med.* 8:1321. doi: 10.21037/atm-20-6687

Li, W., Zhang, C., Luo, J., Zhang, H., Wu, H., Yang, B., et al. (2020). Psychological status among different populations during COVID-19 epidemic: a systematic review and meta-analysis. *J. Tongji Univ.* 41, 147–154. doi: 10.16118/j.1008-0392.2020.02.002

Li, Y., Wang, X., Zhang, J., Du, S., and Zeng, L. (2020). Psychological survey of the general population during COVID-19 (in Chinese). *Infect. Int.* 9, 308–310.

Liang, L., Ren, H., Cao, R., Hu, Y., Qin, Z., Li, C., et al. (2020). The effect of COVID-19 on youth mental health. *Psychiatr. Q.* 91, 841–852. doi: 10.1007/s11126-020-09744-3

Lin, G., Zhao, C., Zhang, F., Feng, H., Lin, L., and Zhai, Y. (2020). Survey and analysis of anxiety of 804 residents in Hainan during the COVID-19 epidemic (in Chinese). *J. Hainan Med. Univ.* 26, 646–650. doi: 10.13210/j.cnki.jhmu.20200424.003

Lin, L., Wang, T., Pi, L., Chen, L., He, M., Yu, W., et al. (2020). Survey of emotion, stress and five viscera symptoms of population during the epidemic of Corona Virus Disease 2019 based on internet questionnaire (in Chinese). *Chin. J. Tradit. Chin. Med. Pharm.* 35, 1390–1394.

Lin, L.-Y., Wang, J., Ou-Yang, X.-Y., Miao, Q., Chen, R., Liang, F.-X., et al. (2020). The immediate impact of the 2019 novel coronavirus (COVID-19) outbreak on subjective sleep status. *Sleep Med.* 77, 348–354. doi: 10.1016/j.sleep.2020.05.018

Lin, Y., Hu, Z., Alias, H., and Wong, L. P. (2020). Knowledge, attitudes, impact, and anxiety regarding COVID-19 infection among the public in China. *Front. Public Health* 8:236. doi: 10.3389/fpubh.2020.00236

Liu, X., Kakade, M., Fuller, C. J., Fan, B., Fang, Y., Kong, J., et al. (2012). Depression after exposure to stressful events: lessons learned from the severe acute respiratory syndrome epidemic. *Compr. Psychiatry* 53, 15–23. doi: 10.1016/j.comppsych.2011.02.003

Liu, X., Luo, W.-T., Li, Y., Li, C.-N., Hong, Z.-S., Chen, H.-L., et al. (2020). Psychological status and behavior changes of the public during the COVID-19 epidemic in China. *Infect. Dis. Poverty* 9, 58–58. doi: 10.1186/s40249-020-00678-3

Liu, Y., Chen, Y., and Luo, J. (2020). Study on the status of public mental health during the epidemic period of COVID-19 (in Chinese). *J. Gannan Med. Univ.* 40, 330–334. doi: 10.3969/j.issn.1001-5779.2020.04.002

Liu, Z., Zhang, X., Lv, Z., Liang, J., Deng, Y., and Feng, L. (2020). Mental health status and its influencing factors among general population and medical personnel in Guangdong Province during COVID-19 pandemic (in Chinese). *J. Southern Med. Univ.* 40, 1530–1537. doi: 10.12122/j.issn.1673-4254.2020.10.22

Luo, F., Luo, D., Wang, B., Lai, S., Chen, Y., Peng, W., et al. (2020). Analysis of anxiety and depression of residents outside Wuhan in Hubei Province during the outbreak of COVID-19 and its influencing factors (in Chinese). *Chin. J. Dis. Control Prev.* 24, 643–648.

Luo, M., Guo, L., Yu, M., Jiang, W., and Wang, H. (2020). The psychological and mental impact of coronavirus disease 2019 (COVID-19) on medical staff and general public - A systematic review and meta-analysis. *Psychiatry Res.* 291:113190. doi: 10.1016/j.psychres.2020.113190

Mak, I. W. C., Chu, C., Pan, P. C., Yiu, M. G. C., and Chan, V. L. (2009). Long-term psychiatric morbidities among SARS survivors. *Gen. Hosp. Psychiatry* 31, 318–326. doi: 10.1016/j.genhosppsych.2009.03.001

Pan, A., Liu, L., Wang, C., Guo, H., Hao, X., Wang, Q., et al. (2020). Association of public health interventions with the epidemiology of the COVID-19 outbreak in Wuhan, China. *JAMA*. 323, 1915–1923. doi: 10.1001/jama.2020.6130

Person, B., SY, F., Holton, K., Govert, B., Liang, A., Garza, B., et al. (2004). Fear and stigma: the epidemic within the SARS outbreak. *Emerg. Infect. Dis.* 10, 358–363. doi: 10.3201/eid1002.030750

Prati, G., Catufi, V., and Pietrantoni, L. (2012). Emotional and behavioural reactions to tremors of the Umbria-Marche earthquake. *Disasters* 36, 439–451. doi: 10.1111/j.1467-7717.2011.01264.x

Qi, M., Li, P., Moyle, W., Weeks, B., and jones, C. (2020). Physical activity, health-related quality of life, and stress among the Chinese adult population during the COVID-19 pandemic. *Int. J. Environ. Res. Public Health* 17:6494. doi: 10.3390/ijerph17186494

Qiu, J., Shen, B., Zhao, M., Wang, Z., Xie, B., and Xu, Y. (2020). A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: implications and policy recommendations. *Gen Psychiatr.* 33:e100213. doi: 10.1136/gpsych-2020-100213

Ran, L., Wang, W., Ai, M., Kong, Y., Chen, J., and Kuang, L. (2020). Psychological resilience, depression, anxiety, and somatization symptoms in response to COVID-19: a study of the general population in China at the peak of its epidemic. *Soc. Sci. Med.* 262:113261. doi: 10.1016/j.socscimed.2020.113261

Ren, X., Huang, W., Pan, H., Huang, T., Wang, X., and Ma, Y. (2020). Mental health during the COVID-19 outbreak in China: a meta-analysis. *Psychiatr. Q.* 91, 1033–1045. doi: 10.1007/s11126-020-09796-5

Ren, Y., Qian, W., Li, Z., Liu, Z., Zhou, Y., Wang, R., et al. (2020). Public mental health under the long-term influence of COVID-19 in China: geographical and temporal distribution. *J. Affect. Disord.* 277, 893–900. doi: 10.1016/j.jad.2020.08.045

Ren, Z., Zhou, Y., and Liu, Y. (2020). The psychological burden experienced by Chinese citizens during the COVID-19 outbreak: prevalence and determinants. *BMC Public Health* 20:1617. doi: 10.1186/s12889-020-09723-0

Santos-Reyes, J., and Gouzeva, T. (2020). Mexico city's residents emotional and behavioural reactions to the 19 September 2017 earthquake. *Environ. Res.* 186:109482. doi: 10.1016/j.envres.2020.109482

Shi, L., Lu, Z.-A., Que, J.-Y., Huang, X.-L., Liu, L., Ran, M.-S., et al. (2020). Prevalence of and risk factors associated with mental health symptoms among the general population in China during the coronavirus disease 2019 pandemic. *JAMA Network Open* 3:e2014053. doi: 10.1001/jamanetworkopen.2020.14053

Shultz, J. M., Cooper, J. L., Baingana, F., Oquendo, M. A., Espinel, Z., Althouse, B. M., et al. (2016). The role of fear-related behaviors in the 2013–2016 West Africa ebola virus disease outbreak. *Curr. Psychiatry Rep.* 18:104. doi: 10.1007/s11920-016-0741-y

Song, F., Wang, X., Ju, Z., Liu, A., Liu, J., and Wang, T. (2020). Mental health status and related influencing factors during the epidemic of coronavirus disease 2019(COVID-19) (in Chinese). *J. Public Health Prev. Med.* 31, 23–27. doi: 10.3969/j.issn.1006-2483.2020.02.006

Song, J. Y., Jeong, K. S., Choi, K. S., Kim, M. G., and Ahn, Y. S. (2018). Psychological risk factors for posttraumatic stress disorder in workers after toxic chemical spill in gumi, South Korea. *Workplace Health Saf.* 66, 393–402. doi: 10.1177/2165079917750168

Song, L., Wang, Y., Li, Z., Yang, Y., and Li, H. (2020). Mental health and work attitudes among people resuming work during the COVID-19 pandemic: a cross-sectional study in China. *Int. J. Environ. Res. Public Health* 17:5059. doi: 10.3390/ijerph17145059

Sun, L., Sun, Z., Wu, L., Zhu, Z., Zhang, F., Shang, Z., et al. (2021). Prevalence and risk factors for acute posttraumatic stress disorder during the COVID-19 outbreak. *J. Affect. Disord.* 283, 123–129. doi: 10.1016/j.jad.2021.01.050

Sun, M., Li, S., Yue, H., Li, X., Li, W., and Xu, S. (2020). Analysis on anxiety status of Chinese netizens under the outbreak of the coronavirus disease 2019(COVID-19) and its influencing factors (in Chinese). *World Sci. Technol. Modern. Tradit. Chin. Med.* 22, 703–708. doi: 10.11842/wst.20200301003

Sun, Q., Qin, Q., Chen, B., Shao, R., Zhang, J., and Li, Y. (2020). Stress, anxiety, depression and insomnia in adults outside Hubei province during the COVID-19 pandemic (in Chinese). *Natl. Med. J. China* 100, 3419–3424. doi: 10.3760/cma.j.cn112137-20200302-00557

Tan, W., Hao, F., Mcintyre, R. S., Jiang, L., Jiang, X., Zhang, L., et al. (2020). Is returning to work during the COVID-19 pandemic stressful? A study on immediate mental health status and psychoneuroimmunity prevention measures of Chinese workforce. *Brain Behav. Immun.* 87, 84–92. doi: 10.1016/j.bbi.2020.04.055

The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team (2020). The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19)-China, 2020. *China CDC Weekly* 2, 113–122. doi: 10.46234/ccdcw2020.032

Tian, F., Li, H., Tian, S., Yang, J., Shao, J., and Tian, C. (2020). Psychological symptoms of ordinary Chinese citizens based on SCL-90 during the level I emergency response to COVID-19. *Psychiatry Res.* 288:112992. doi: 10.1016/j.psychres.2020.112992

Vandenbroucke, J. P., Von Elm, E., Altman, D. G., Gøtzsche, P. C., Mulrow, C. D., Pocock, S. J., et al. (2007). Strengthening the reporting of observational studies in epidemiology (STROBE). *Epidemiology* 18, 805–835. doi: 10.1097/EDE.0b013e3181577511

Viechtbauer, W. (2010). Conducting meta-analyses in R with the metafor package. *J. Stat. Softw.* 36:48. doi: 10.18637/jss.v036.i03

Wallace, B. C., Dahabreh, I. J., Trikalinos, T. A., Lau, J., Trow, P., and Schmid, C. H. (2012). Closing the gap between methodologists and end-users: R as a computational back-end. *J. Stat. Softw.* 49:15. doi: 10.18637/jss.v049.i05

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., et al. (2020). Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *Int. J. Environ. Res. Public Health* 17:1729. doi: 10.3390/ijerph17051729

Wang, J., Gong, Y., Chen, Z., Wu, J., Feng, J., Yan, S., et al. (2020). Sleep disturbances among Chinese residents during the coronavirus disease 2019 outbreak and associated factors. *Sleep Med.* 74, 199–203. doi: 10.1016/j.sleep.2020.08.002

Wang, J., Wu, X., Lai, W., Long, E., Zhang, X., Li, W., et al. (2017). Prevalence of depression and depressive symptoms among outpatients: a systematic review and meta-analysis. *BMJ Open* 7:e017173. doi: 10.1136/bmjopen-2017-017173

Wang, M., Liu, X., Guo, H., Fan, H., Jiang, R., and Tan, S. (2020). Mental health of middle-aged and elderly population during outbreak of corona-virus disease 2019 (in Chinese). *Chin. J. Mult. Organ Dis. Elderly* 19, 241–245. doi: 10.11915/j.issn.1671-5403.2020.04.056

Wang, Y., Gao, J., Chen, H., Mao, Y., Chen, S., Dai, J., et al. (2020a). The relationship between media exposure and mental health problems during COVID-19 outbreak (in Chinese). *Fudan Univ. J. Med. Sci.* 47, 173–178. doi: 10.3969/j.issn.1672-8467.2020.02.005

Wang, Y., Wang, C., Liao, Z., Zhang, X., and Zhao, M. (2020b). A comparative analysis of anxiety and depression level among people and epidemic characteristics between COVID-19 and SARS (in Chinese). *Life Sci. Res.* 24, 180–186. doi: 10.16605/j.cnki.1007-7847.2020.03.002

World Health Organization (2020). *WHO Coronavirus Disease (COVID-19) Dashboard [Online]*. Available online at: https://covid19.who.int/ (accessed July 1, 2020).

Wu, M., Han, H., Lin, T., Chen, M., Wu, J., Du, X., et al. (2020). Prevalence and risk factors of mental distress in China during the outbreak of COVID-19: a national cross-sectional survey. *Brain Behav.* 10:e01818. doi: 10.1002/brb3.1818

Wu, P., Fang, Y., Guan, Z., Fan, B., Kong, J., Yao, Z., et al. (2009). The psychological impact of the SARS epidemic on hospital employees in China: exposure, risk perception, and altruistic acceptance of risk. *Can. J. Psychiatry* 54, 302–311. doi: 10.1177/070674370905400504

Wu, T., Jia, X., Shi, H., Niu, J., Yin, X., Xie, J., et al. (2020). Prevalence of mental health problems during the COVID-19 pandemic: a systematic review and meta-analysis. *J. Affect. Disord.* 281, 91–98. doi: 10.1016/j.jad.2020.11.117

Xiao, J., Chen, Y., Fang, F., Liu, W., Zhong, Y., Tao, J., et al. (2020). Public anxiety and depression and its influencing factors under public health emergencies (in Chinese). *Mod. Prev. Med.* 47, 3557–3562.

Yáñez, J. A., Afshar Jahanshahi, A., Alvarez-Risco, A., Li, J., and Zhang, S. X. (2020). Anxiety, distress, and turnover intention of healthcare workers in peru by their distance to the epicenter during the COVID-19 crisis. *Am. J. Trop. Med. Hyg.* 103, 1614–1620. doi: 10.4269/ajtmh.20-0800

Yang, B., Yang, Y., Jia, Y., Li, Z., Qin, X., and Duan, J. (2020). Survey on the psychological state of the masses in the plain area of chengdu during the epidemic of COVID-19 (in Chinese). *World Latest Med. Inf.* 20, 251–253. doi: 10.3969/j.issn.1671-3141.2020.43.134

Yang, L., Zhang, Y., Xu, Y., Zheng, J., and Lin, Z. (2020). Investigation on psychological stress in fighting against corona virus disease 2019 among community residents (in Chinese). *Chin. Nurs. Res.* 34, 1140–1145. doi: 10.12102/j.issn.1009-6493.2020.07.009

Yang, S., Lin, H., Zhu, J., Chen, Y., Wang, N., Zhao, Q., et al. (2020). Depression and anxiety symptoms among returning workers during the COVID-19 period in East China. *Soc. Psychiatry Psychiatr. Epidemiol.* doi: 10.1007/s00127-020-01983-w. [Epub ahead of print].

Yang, T., Qu, X., and Wang, H. (2020). Mental health of community residents in Wuhan during the epidemic of COVID-19 and the influencing factors (in Chinese). *J. Nurs. Sci.* 35, 76–78. doi: 10.3870/j.issn.1001-4152.2020.13.076

Yang, X., Xiong, Z., Li, Z., Li, X., Xiang, W., Yuan, Y., et al. (2020). Perceived psychological stress and associated factors in the early stages of the coronavirus disease 2019 (COVID-19) epidemic: evidence from the general Chinese population. *PLoS ONE* 15:e0243605. doi: 10.1371/journal.pone.0243605

Yang, Y., Liu, K., Li, S., and Shu, M. (2020). Social media activities, emotion regulation strategies, and their interactions on people's mental health in covid-19 pandemic. *Int. J. Environ. Res. Public Health* 17, 1–16. doi: 10.3390/ijerph17238931

Yao, H., Chen, J.-H., and Xu, Y.-F. (2020). Patients with mental health disorders in the COVID-19 epidemic. *Lancet Psychiatry* 7:e21. doi: 10.1016/S2215-0366(20)30090-0

Yu, Y., Tan, D., Wan, Y., Wang, Y., and Jiang, X. (2020). Investigation and analysis of anxiety state of residents in enshi during the COVID-19 (in Chinese). *World Latest Med. Inf.* 20, 267–269. doi: 10.3969/j.issn.1671-3141.2020.78.117

Zhang, J., Li, P., and Li, Z. (2020). Analysis of influencing factors of community female residents' psychology and evaluation of intervention effect during the outbreak of novel coronavirus pneumonia (in Chinese). *J. Changzhi Med. Coll.* 34, 81–86.

Zhang, L., Ma, M., Li, D., and Xin, Z. (2020a). The psychological typhoon eye effect during the COVID-19 outbreak in China: the role of coping efficacy and perceived threat. *Global. Health* 16:105. doi: 10.1186/s12992-020-00626-8

Zhang, L., Zhang, B., and Hu, L. (2020b). The relationship between perceived stress and sleep quality of Wuhan residents during COVID-19 outbreak: psychological resilience as a moderator (in Chinese). *Chin. J. Dis. Control Prev.* 24, 638–642. doi: 10.16462/j.cnki.zhjbkz.2020.06.004

Zhang, S. X., Huang, H., and Wei, F. (2020). Geographical distance to the epicenter of Covid-19 predicts the burnout of the working population: ripple effect or typhoon eye effect? *Psychiatry Res.* 288:112998. doi: 10.1016/j.psychres.2020.112998

Zhang, Y., Cao, X., Wang, P., Wang, G., Lei, G., Shou, Z., et al. (2020). Emotional "inflection point" in public health emergencies with the 2019 new coronavirus pneumonia (NCP) in China. *J. Affect. Disord.* 276, 797–803. doi: 10.1016/j.jad.2020.07.097

Zhao, X., Lan, M., Li, H., and Yang, J. (2020). Perceived stress and sleep quality among the non-diseased general public in China during the 2019 coronavirus disease: a moderated mediation model. *Sleep Med.* 77, 339–345. doi: 10.1016/j.sleep.2020.05.021

Zhen, R., and Zhou, X. (2020). Predictive factors of public anxiety under the outbreak of COVID-19 (in Chinese). *Chin. J. Appl. Psychol.* 26, 99–107.

Zhong, X., Yuan, D., and Wang, B. (2020). Detection status and influencing factors of residents with symptoms of acute stress disorder during the COVID-19 (in Chinese). *Sichuan Mental Health* 33, 398–402. doi: 10.11886/scjsws20200419001

Zhou, Y., and Liu, Q. (2020). Analysis of the emotional response of residents under COVID-19 and its influencing factors (in Chinese). *J. Front. Med.* 10, 252–254.

Zhu, J., Su, L., Zhou, Y., Qiao, J., and Hu, W. (2020a). The effect of nationwide quarantine on anxiety levels during the COVID-19 outbreak in China. *Brain Behav.* 11:e01938. doi: 10.1002/brb3.1938

Zhu, J., Xu, N., Pan, Y., Ying, P., Ye, J., Liu, C., et al. (2020b). Investigation research on cognition, prevention and control behavior and psychosomatichealthy status of different types of adults during the epidemic period of corona virus disease-19 (in Chinese). *China Med.* 15, 816–820. doi: 10.3760/j.issn.1673-4777.2020.06.004

Zhu, X., Liu, D., Yan, F., Qu, W., Fan, H., Zhao, Y., et al. (2020). Psychological status of school students and employees during the COVID-19 epidemic (in Chinese). *Chin. Mental Health J.* 34, 549–554. doi: 10.3969/j.issn.1000-6729.2020.6.013

Zhu, Z., Liu, Q., Jiang, X., Manandhar, U., Luo, Z., Zheng, X., et al. (2020). The psychological status of people affected by the COVID-19 outbreak in China. *J. Psychiatr. Res.* 129, 1–7. doi: 10.1016/j.jpsychires.2020.05.026

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 20 May 2021
doi: 10.3389/fpsyg.2021.633433

A Conditional Process Model to Explain Somatization During Coronavirus Disease 2019 Epidemic: The Interaction Among Resilience, Perceived Stress, and Sex

Fangfang Shangguan[1†], Chenhao Zhou[1†], Wei Qian[2,3†], Chen Zhang[1], Zhengkui Liu[2,3] and Xiang Yang Zhang[2,3*]*

[1] *Beijing Key Laboratory of Learning and Cognition, School of Psychology, Capital Normal University, Beijing, China,* [2] *CAS Key Laboratory of Mental Health, Institute of Psychology, Chinese Academy of Sciences, Beijing, China,* [3] *Department of Psychology, University of Chinese Academy of Sciences, Beijing, China*

OPEN ACCESS

Edited by:
Jason H. Huang, Baylor Scott & White Health, United States

Reviewed by:
Federica Prinelli, Institute of Biomedical Technologies, Italian National Research Council, Italy
Hongyu Xu, Virginia Commonwealth University, United States

***Correspondence:**
Zhengkui Liu
liuzk@psych.ac.cn
Xiang Yang Zhang
zhangxy@psych.ac.cn

[†] *These authors have contributed equally to this work*

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *25 November 2020*
Accepted: *29 March 2021*
Published: *20 May 2021*

Citation:
Shangguan F, Zhou C, Qian W, Zhang C, Liu Z and Zhang XY (2021) A Conditional Process Model to Explain Somatization During Coronavirus Disease 2019 Epidemic: The Interaction Among Resilience, Perceived Stress, and Sex. Front. Psychol. 12:633433. doi: 10.3389/fpsyg.2021.633433

Background: More than 15% of Chinese respondents reported somatic symptoms in the last week of January 2020. Promoting resilience is a possible target in crisis intervention that can alleviate somatization.

Objectives: This study aims to investigate the relationship between resilience and somatization, as well as the underlying possible mediating and moderating mechanism, in a large sample of Chinese participants receiving a crisis intervention during the coronavirus disease 2019 epidemic.

Methods: Participants were invited online to complete demographic information and questionnaires. The Symptom Checklist-90 somatization subscale, 10-item Connor–Davidson resilience scale, and 10-item Perceived Stress Scale were measured.

Results: A total of 2,557 participants were included. Spearman correlation analysis revealed that lower resilience was associated with more somatic symptoms ($p < 0.001$). The conditional process model was proved (indirect effect = −0.01, 95% confidence interval = [−0.015, −0.002]). The interaction effects between perceived stress and sex predicted somatization ($b = 0.05$, $p = 0.006$).

Conclusion: Resilience is a key predictor of somatization. The mediating effects of perceived stress between resilience and somatization work in the context of sex difference. Sex-specific intervention by enhancing resilience is of implication for alleviating somatization during the coronavirus disease 2019 epidemic.

Keywords: resilience (psychological), perceived stress, somatic symptom, somatization, gender, conditional process analysis

INTRODUCTION

Somatization is common in primary care across cultures (Gureje et al., 1997). Approximately 20% of primary care patients report "non-specific, functional, and somatoform bodily complaints" (Schaefert et al., 2012). A variety of physical symptoms were possible manifestations of somatization, including dizziness (Russo et al., 1994), pains (Asmundson and Katz, 2009), fatigue (Vassend et al., 2018), musculoskeletal complaints (Vassend et al., 2017), and miscellaneous symptoms. People with somatic symptoms always tend to seek medical or non-medical help for reassurance (Zantinge et al., 2005; Budtz-Lilly et al., 2015), but somatization is difficult to treat (Zantinge et al., 2005; Jones and de C Williams, 2019). Moreover, it hinders the understanding of somatization in view of the heterogeneity of somatic symptoms and the difficulty of collecting data from a big sample size within a limited time. Currently, the coronavirus disease 2019 (COVID-19) epidemic has become a public health emergency of international concern (January 31 to February 2, 2020) (Wang et al., 2020), which provided a natural circumstance for a better understanding of epidemic-related somatization during this period. A nationwide survey during the COVID-19 epidemic, covering respondents from 194 cities in China, showed that 5.62% of the respondents reported three physical symptoms, 9.42% reported two physical symptoms, and 15.04% reported one physical symptom (Wang et al., 2020). Therefore, it is of significance to screen risk factors and protective factors for somatization.

Resilience is a dynamic, modifiable factor, and it helps individuals to endure adversities ranging from daily hassles to trauma (Rutter, 1987; Norris et al., 2009; Lehrer et al., 2020). Prior empirical researches have addressed the importance of resilience in the development of somatic symptoms, but the results were inconsistent. The majority of the existing studies are in line with the notion that higher resilience could predict lower levels of somatization (Malarkey et al., 2016; Der Ven Dewsaran-van et al., 2018; Behnke et al., 2019), although very few studies reported different findings (e.g., Um et al., 2014).

Perceived stress is the cognitive appraisal of the objective stressors (Cohen et al., 1983; Hewitt et al., 1992). Recent studies have found that lower levels of perceived stress are associated with higher resilience (Sarrionandia et al., 2018; Smith et al., 2018; Thompson et al., 2018; Sahu et al., 2019). Moreover, it is well known that stress-related etiology is crucial for understanding somatization (e.g., Hewitt et al., 1992; Mischkowski et al., 2019). For instance, perceived stress was a significant predictor of variance across the Symptom Checklist-90 – Revised dimensions in women with systemic lupus erythematosus (Peralta-Ramírez et al., 2018). Notably, stress and physical symptoms may be closely related at multiple levels. A recent review has suggested that both stress and pain are jointly modulated by other psychosocial factors such as beliefs, fears, goals, and the social context (Timmers et al., 2019). Therefore, stressors in the COVID-19 epidemic, such as uncertainty about health (Rothe et al., 2020) and health-related information (Tang et al., 2018; World Health Organization [WHO], 2020 situation report-13), loss of income, social distance, may trigger physical symptoms in a proportion of the general population.

It is worth noting that sex may play an important role in somatization. A study in adolescents found that sex was a moderator in the relationship between the experience of life stress and somatic symptoms (Rehna et al., 2016). A recent study compared three cross-sectional surveys in the general German population in the last four decades and found the prevalence of somatic symptoms was lower in the more recent survey in both men and women, especially in women (Beutel et al., 2020). Therefore, the indirect association between resilience and somatization may also be moderated by sex in Chinese adults.

Taken together, no study was investigating the indirect link between resilience and somatization *via* perceived stress. Moreover, the links between resilience, perceived stress, and somatization have not been investigated during an infectious disease epidemic. In this study, we aim to explore if resilience would be negatively associated with somatization in people seeking crisis intervention during the COVID-19 epidemic. Such an association might be mediated by perceived stress, and this mediation model might be moderated by sex. We synthesize our hypotheses in a "conditional process" (or moderated mediation) model, depicted conceptually in **Figure 1A**. First, the interactive effects of sex were estimated on perceived stress and on somatization. Second, we examined the nature of the moderation effects in the model.

MATERIALS AND METHODS

Participants

This study recruited a total of 4,107 (1,345 males and 2,762 females) participants in 31 provinces of China, and they completed the questionnaires before they started an online self-help crisis intervention. One of the participants was excluded due to too short submission time, and 1,048 of them were excluded due to primary school education or less. Another 15 of them were excluded because they lived outside of China. Moreover, considering that some factors might influence the results of this study, 15 of the participants were excluded because their relatives or friends were infected with COVID-19, and 189 participants were excluded because they have a history of mental disorder or are taking medication. Finally, after dropping 282 questionnaires with high repetition rates in response and scores beyond plus or minus three standard deviations, a sample of 2,557 participants was analyzed. In the remaining sample, there were 1,210 subjects from Guangdong province, 812 subjects from Qinghai, 81 subjects from Beijing, and 57 from Sichuan. In addition, 101 subjects were from Hubei, and 68 of them were from Wuhan City. The other 296 subjects were from other provinces.

Measures

Ten-Item Connor–Davidson Resilience Scale

The Connor–Davidson resilience scale (CD-RISC) measures the ability to recover quickly from stress (Connor and Davidson, 2003). Campbell-Sills and Stein (2007) simplified the original

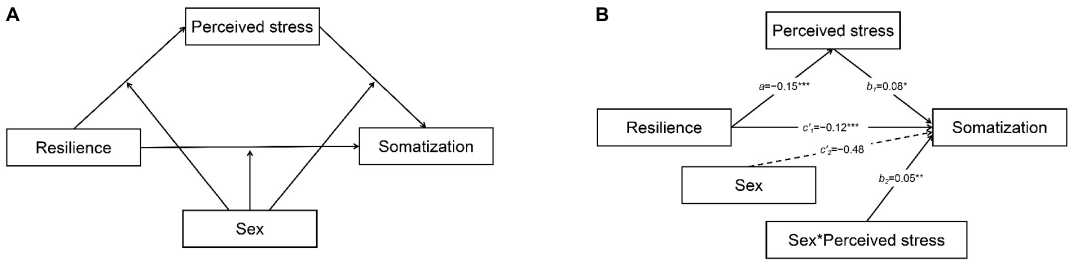


FIGURE 1 | (A) Conditional process model of sex on the link between resilience and somatization through perceived stress in conceptual form. **(B)** Conditional process model of sex on the link between resilience and somatization through perceived stress. Dashed lines indicated that statistically insignificant paths between variables. Solid lines indicated that statistically significant paths between variables.

25 items and retained 10 items reflecting the ability to tolerate challenges such as item 8 ("Tend to bounce back after illness or hardship"). The new 10-item unidimensional scale (CD-RISC) has a good internal consistency (Cronbach's alpha = 0.85). Every item is rated on a five-point scale (0 = "not true at all" to 4 = "true nearly all of the time"). The Chinese version was modified, and its reliability and validity have been examined in the Chinese population (Yu and Zhang, 2007). In the present study, the Cronbach's alpha value of 0.95 indicated good reliability.

Chinese Version of the Symptom Checklist-90 Somatization Subscale

The Symptom Checklist-90 somatization subscale (SCL-90-SOM) has a good internal consistency (Cronbach's α = 0.86) to summarize people's complaints of bodily dysfunction with (Derogatis et al., 1976). It contains 12 items, with each item rated on five points (1 = "not at all" to 5 = "extremely serious"). The Chinese version of SCL-90 was validated and widely used in Chinese mental health research (e.g., Ren, 2009). In the current study, the Cronbach's α coefficient of the SCL-90-SOM was 0.87. The scores on SCL-90-SOM were applied to index the severity of somatic symptoms in the general population.

Ten-Item Perceived Stress Scale

The Perceived Stress Scale (PSS) is a self-report psychometric measure conducted to detect one's level of perceived stress in terms of unpredictability, lack of control, and overload (Cohen et al., 1983). Each items is scored on a five-point Likert scale (0 = never, 1 = almost never, 2 = sometimes, 3 = fairly often, and 4 = very often). Six of the items evaluated the frequency of negative thoughts (e.g., "how often have you found that you could not cope with all the things that you had to do"), and the remaining items evaluated the frequency of positive thoughts (e.g., "how often have you felt that you were on top of things?"). A total score is calculated by reverse scoring for the four positive items and adding the scores for all items. The Chinese version of the scale has been widely used and demonstrated good reliability and validity (e.g., Ng, 2013). In the current study, Cronbach's alpha value for this scale was 0.85.

Demographic Information

The demographic information included age, sex, height, body weight, education (primary school or less, middle school, high school, etc.), occupation (mainly teachers, students, medical staff), marital status (unmarried, married, widowed, divorced, or remarried), severe acute respiratory syndrome (SARS) experience, annual household incomes, history of chronic illness or psychiatric diagnosis, medication, smoking and drinking status, etc. The participants answered yes or no to a question about the SARS experience (Have you ever experienced the SARS epidemic in person?). The history of chronic illness included chronic illness in the kidney, liver, cardiovascular system, endocrinological system, etc. The history of psychiatric diagnosis was also asked. Besides, in the questions about smoking and drinking status, participants were asked to choose one of three options (yes, has quit, never).

Procedure

Participants in the COVID-19 crisis intervention were invited online by a WeChat Mini-Program to minimize face-to-face interaction. They were asked to complete demographic information and a set of questionnaires embedded in the WeChat crisis intervention Mini-program. The 7-day self-help intervention was based on a low-intensity psychological intervention, Problem Management Plus (PM+) (Dawson et al., 2015). The main purpose of the intervention, stress reduction, was showed on the webpage. The intervention was designed as 10–20 min per day and invited the participants to complete the courses in 7 consecutive days. Before they started the self-help intervention, participants saw themes of every day, including relaxation, stability, self-efficacy, social support, keeping healthy, hope, and a sense of control. All this information might help them decide whether to complete the questionnaire and start the intervention. The Institutional Review Board of the Institute of Psychology, Chinese Academy of Sciences, approved the carryout of this study. The enrollment of participants was carried out in accordance with the Declaration of Helsinki. Online informed consent was obtained from all participants, and they were guaranteed that their privacy would be protected. Data were collected during the period from April 10 to July 31, 2020, when online interventions were carried out in the general population to help people cope with the COVID-19 outbreak.

Statistical Analyses

SPSS Statistic v26.0 and the SPSS macro program PROCESS v3.4 created by Hayes were applied in our analyses. First, normal distribution was tested with Kolmogorov–Smirnov test

for every variable, and no variable was found to be normally distributed (all $p < 0.001$). Descriptive statistics were computed by sex and occupation for the demographic information and main study variables. Education was calculated according to the academic year required to obtain the degree (e.g., if a participant has obtained a bachelor's degree, the participant's education is recorded as 16). Marital status was divided into two categories, married (including married and remarried) or unmarried (including unmarried, divorced, and widowed). Categorical variables, such as marital status and smoking, were expressed using percentages. Continuous variables, such as age and SCL-90-SOM scores, were presented as mean and standard deviation. Second, Spearman correlation analysis was performed among 10-item CD-RISC, PSS, and SCL-90-SOM scores. Third, according to our hypotheses, the current study used a conditional process analysis (Hayes, 2018) to estimate the influences of sex (moderator) and perceived stress (mediator) on the relationship between resilience and somatization. We used ordinary least squares regression and estimated the 95% bias-corrected confidence interval (CI) for conditional indirect effects with 5,000 resampled samples to test the theoretical hypothesis model (**Figure 1A**). If the 95% CI at different values of the moderator or the difference between the conditional indirect effects of predictor variable at those values does not include zero, it means that statistics are significant (Hayes and Rockwood, 2020). Model 59 was used to test the moderating effect of sex between resilience, perceived stress, and somatization. After controlling for occupation, only the moderating effect of sex between perceived stress and somatization was significant ($b = 0.05$, $p = 0.012$, 95% CI = [0.011, 0.089]). The difference of sex between conditional indirect effects was not significant (index = −0.01, 95% CI = [−0.025, 0.003]). Therefore, Model 14 was used to examine our hypotheses further.

RESULTS

Demographic Characteristics

The average age of all participants was 30.56 years (SD = 10.78), and among them, 48.5% had a high school education or less. Besides, 0.5% of the annual income of the family exceeded 1,000,000 RMB, and 49.4% of the family earned less than 80,000 RMB annually. Of the participants, 78.5% reported a body mass index <24 kg/m^2 (21.51 ± 3.39 kg/m^2). In addition, 4.5% were smokers, and 7.8% drank alcohol in their daily lives. Sex difference was significant in marital status ($p < 0.001$). According to the results, the results indicated significant sex differences in resilience ($p < 0.001$), perceived stress ($p < 0.001$), and somatic symptoms ($p < 0.001$), with the female having lower resilience and suffering more stress as well as more somatic symptoms (see **Table 1**). In addition, marital status and annual household incomes were both significantly different among occupations (both $p < 0.001$). The results also indicated significant differences in resilience ($p = 0.010$), perceived stress ($p < 0.001$), and somatization ($p < 0.001$) among teachers, students, medical workers, and other occupations. Multiple comparisons showed that only students had significantly lower resilience than people with other occupations ($p = 0.042$). Students had less somatization than medical workers ($p < 0.001$) and teachers ($p < 0.001$). Medical workers had higher perceived stress than three other types (all $p < 0.001$; see **Table 2**).

Correlations Among Study Variables

Spearman correlation analysis revealed that CD-RISC scores were negatively associated with SCL-90-SOM scores ($r = -0.33$, $p < 0.001$, Bonferroni corrected $p < 0.01$). In addition, a negative association was found between CD-RISC and PSS scores ($r = -0.20$, $p < 0.001$, Bonferroni corrected $p < 0.01$). PSS scores were positively associated with SCL-90-SOM scores ($r = 0.46$, $p < 0.001$, Bonferroni corrected $p < 0.01$).

Conditional Process Analysis for the Proposed Model

A conditional process model was estimated to test whether the mediating role of perceived stress and the moderating role of sex between resilience and somatization after controlling for occupation. As depicted in **Table 3**, resilience was significantly negatively correlated with perceived stress ($b = -0.15$, $p < 0.001$), and perceived stress was significantly positively correlated with somatization ($b = 0.08$, $p = 0.021$). The results of the conditional process model indicated that the interaction effect between perceived stress and sex significantly predicted somatization ($b = 0.05$, $p = 0.006$).

The results showed that the indirect effect of perceived stress in mediating the association between resilience and somatization was −0.02 among male (95% CI = [−0.027, −0.014]) and −0.03 among female (95% CI = [−0.036, −0.020]), but the index of moderated mediation and associated bias-corrected bootstrap confidence intervals indicated the conditional process model still holds (index = −0.01, 95% CI = [−0.015, −0.002]). The bootstrapped 95% CI did not include 0 for the pairwise contrasts between the conditional indirect effects. The statistical significance of this test means that two conditional indirect effects are significantly different in the estimation of values of the moderator (Hayes, 2015). Thus, the results in the present study indicated sex moderated the indirect effect (through perceived stress) of resilience on somatization, as shown in **Figure 1B**.

Further simple slope analysis in **Figure 2** revealed that perceived stress was positively associated with somatization differently in male and female (male: $b = 0.14$, $p < 0.001$; female: $b = 0.19$, $p < 0.001$).

DISCUSSION

To our best knowledge, this study is the first attempt to evaluate the relationship between resilience and somatization in the context of infectious disease pandemics. We found that lower resilience was associated with higher somatization. Based on a conditional process model, the results showed that the effect of resilience on somatization was moderated by sex and mediated by perceived stress. This indirect relationship was moderated by sex in the second stage of the mediation process. Our findings contribute to understanding the possible sex-specific indirect

TABLE 1 | Descriptive statistics and differences of sex for all variables.

	Total	Male	Female	χ^2 or Z	*p*
Variables	**(*N* = 2,557)**	**(*N* = 626)**	**(*N* = 1,931)**		
Age (years)***	30.56 ± 10.78	27.97 ± 12.73	31.40 ± 9.93	−5.58	<0.001
BMI (kg/m^2)***	21.51 ± 3.39	22.05 ± 4.03	21.34 ± 3.14	−4.04	<0.001
Education (years)***	13.01 ± 3.39	12.24 ± 3.30	13.26 ± 3.39	−6.89	<0.001
Resilience***	28.47 ± 8.27	29.44 ± 8.68	28.15 ± 8.11	−4.11	<0.001
Perceived stress***	15.24 ± 7.47	13.97 ± 7.83	15.66 ± 7.30	−5.06	<0.001
Somatization***	14.76 ± 3.74	14.19 ± 3.48	14.94 ± 3.80	−5.50	<0.001
Marital status* **				83.98	<0.001
Married	61.0%	11.1%	49.9%		
Unmarried	39.0%	13.3%	35.6%		
SARS experienced				0.04	0.834
Yes	39.8%	9.7%	30.2%		
No	60.2%	14.8%	45.4%		
Annual household incomes				0.61	0.895
30,000–80,000 RMB	49.4%	12.2%	37.1%		
80,000–300,000 RMB	44.6%	10.8%	33.8%		
300,000–1,000,000 RMB	5.0%	1.3%	4.3%		
More than 1,000,000 RMB	0.5%	0.2%	0.4%		
History of chronic illness*				4.57	0.033
Yes	13.7%	2.7%	11.0%		
No	86.3%	21.6%	64.7%		
Smoking				0.74	0.693
Yes	4.5%	1.3%	3.2%		
Has quit	1.6%	0.4%	1.3%		
Never	93.9%	22.8%	71.0%		
Drinking**				9.89	0.007
Yes	7.8%	2.4%	5.4%		
Has quit	2.8%	1.0%	1.8%		
Never	89.4%	21.1%	68.3%		

*N = 2,557. Contingency table analyses and Mann–Whitney U tests were used to examine differences of sex. All data provided as mean ± SD unless indicated otherwise. SD, standard deviation; Education, calculated by academic year, e.g., "middle school" is 9, "technical secondary school" is 11, "high school" is 12, "junior college" is 15, "undergraduate" is 16, "master" is 19, and "doctor" is 23. χ2, Z, and p values have been corrected. *P < 0.05; **P < 0.01; ***P < 0.001.*

ways in which resilience influences somatic symptoms through perceived stress.

Resilience and Somatization

This study revealed that lower resilience was related to higher somatization in participants during COVID-19. This is consistent with some previous studies using different measurements and bearing different cultural backgrounds (Um et al., 2014; Malarkey et al., 2016; Der Ven Dewsaran-van et al., 2018). For example, Malarkey et al. (2016) reviewed recorded symptoms at an outpatient clinic at a United States university, and yielded five clusters of symptoms, which partly overlapped with the SCL-90-SOM items. Although they used another resilience scale different from the current study, negative associations were also found between resilience and the five clusters of symptoms. Recently, some studies found several resilience factors (self-compassion and sense of coherence) were independently associated with less somatic symptoms (Der Ven Dewsaran-van et al., 2018; Behnke et al., 2019). On the contrary, a positive association between resilience and somatization was observed in a Korean sample (Um et al., 2014). It was found that patients who embraced both high depression and high resilience had the highest somatization level compared with those with low depression or low resilience. Um et al. (2014) recruited patients with a diagnosis of depressive disorders, whereas we recruited the general public interested in the crisis intervention during COVID-19. The inconsistency may be attributed to sampling characteristics and sample size in the Korean study or other possible moderators.

Besides, a few studies had suggested positive outcome of intervention on resilience before or after SARS or H1N1 influenza epidemic with various treatments and measurements, whereas somatization was not among the main outcomes concerned (Ng et al., 2006; Maunder et al., 2010; Aiello et al., 2011). To reduce stress and build resilience, Aiello et al. (2011) and his colleagues detected the significant effect of a training session on coping ability among a proportion of participants experiencing the H1N1 pandemic. Similarly, Ng et al. (2006) tried a 1-day body–mind–spirit group debriefing to develop resilience in a Hong Kong community sample of people living with chronic diseases right after the SARS outbreak. The participants reported

TABLE 2 | Descriptive statistics and differences of occupation for all variables.

Variables	Medical workers (*N* = 54)	Students (*N* = 604)	Teachers (*N* = 683)	Others (*N* = 1,216)	χ^2 or H	*p*
Age (years)***	36.20 ± 6.99	16.07 ± 4.09	33.99 ± 8.25	35.58 ± 7.63	1263.44	<0.001
BMI (kg/m^2)***	22.71 ± 3.35	19.65 ± 3.47	21.66 ± 3.10	22.31 ± 3.15	308.53	<0.001
Education (years)***	16.85 ± 2.03	10.95 ± 3.24	15.99 ± 1.25	12.19 ± 3.08	961.17	<0.001
Resilience**	27.70 ± 6.33	27.97 ± 8.36	28.07 ± 7.84	28.97 ± 8.52	11.40	0.010
Perceived stress***	19.46 ± 5.93	14.62 ± 7.51	15.89 ± 7.11	15.01 ± 7.63	37.80	<0.001
Somatization***	15.89 ± 3.29	14.17 ± 3.64	15.82 ± 4.09	14.40 ± 3.46	128.19	<0.001
Marital status* **					1,256.06	<0.001
Married	1.6%	0.2%	18.7%	40.6%		
Unmarried	0.5%	23.5%	8.0%	7.0%		
SARS experienced* **					273.39	<0.001
Yes	1.0%	2.7%	14.1%	22.1%		
No	1.1%	20.9%	12.6%	25.5%		
Annual household incomes* **					58.70	<0.001
30,000–80,000 RMB	0.4%	12.6%	14.4%	22.0%		
80,000–300,000 RMB	1.4%	9.6%	11.7%	21.9%		
300,000–1,000,000 RMB	0.3%	1.3%	0.6%	3.3%		
More than 1,000,000 RMB	0%	0.1%	0%	0.4%		
History of chronic illness* **					44.63	<0.001
Yes	0.5%	1.5%	4.9%	6.8%		
No	1.6%	22.0%	21.9%	40.8%		
Smoking					6.63	0.356
Yes	0.2%	0.9%	1.2%	2.2%		
Has quit	0%	0.3%	0.3%	1.0%		
Never	2.0%	22.4%	25.2%	44.3%		
Drinking					3.35	0.763
Yes	0.3%	1.8%	2.2%	3.5%		
Has quit	0.1%	0.8%	0.7%	1.3%		
Never	1.8%	21.0%	23.8%	42.8%		

*N = 2,557. Contingency table analyses and Kruskal–Wallis test were used to examine differences in occupation. All data provided as mean ± SD unless indicated otherwise. SD, standard deviation; Education, calculated by academic year, e.g., "middle school" is 9, "technical secondary school" is 11, "high school" is 12, "junior college" is 15, "undergraduate" is 16, "master" is 19, and "doctor" is 23. χ2, H, and p-values have been corrected. *P < 0.05; **P < 0.01; ***P < 0.001.*

TABLE 3 | Model coefficients for the conditional process model.

		Consequent variables								
		M (Perceived stress)					Y (Somatization)			
Antecedent variables		*b*	SE	*t*	*p*		*b*	SE	*t*	*p*
X (Resilience)	*a*	−0.15	0.02	−8.35	<0.001	c'_1	−0.12	0.01	−15.22	<0.001
M (Perceived stress)		–	–	–	–	b_1	0.08	0.04	2.32	0.021
W (Sex)		–	–	–	–	c'_2	−0.48	0.32	−1.49	0.137
M × W		–	–	–	–	b_2	0.05	0.02	2.75	0.006
Constant		19.80	0.73	27.14	<0.001		16.39	0.64	25.61	<0.001
Covariate (Occupation)		−0.11	0.17	−0.67	0.501		−0.01	0.08	−0.17	0.864
		R^2 = 0.03					R^2 = 0.23			
		F(2,2554) = 35.51***					F(5,1128) = 154.53***			

*N = 2557. Regression coefficients are shown in each cell; *P < 0.05; **P < 0.01; ***P < 0.001.*

a significant decrease in depression and negative self-appraisal, which was sustained until the 1-month follow-up. Interestingly, a computer-assisted training course was effective in building resilience in health-care workers well before the H1N1 influenza pandemic (Maunder et al., 2010). Moreover, a recent study suggested that resilience might serve as a stress buffer, as well

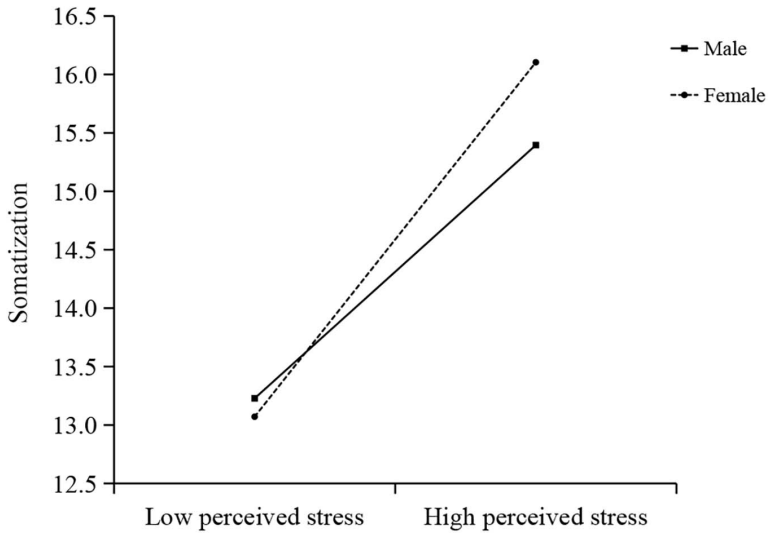


FIGURE 2 | Simple slope analysis showed that sex moderated the relationship between perceived stress and somatization.

as a direct determinant of cardiometabolic health (Lehrer et al., 2020). Taken together, improving an individual's resilience should be considered as an alternative treatment to desomatization in the future, and evaluation of somatization should be designed in the interventions on resilience during or after infectious disease epidemic.

Moderating Role of Sex

To our best knowledge, this is the first study to explore whether sex will moderate the relationship between perceived stress and somatization in the general population during an infectious disease pandemic. To be specific, the relationship between perceived stress and somatization was stronger in females than in males. However, Ramírez-Maestre and Esteve (2014) only observed the association between fear-avoidance and pain intensity in patients with chronic pain in men. The reason for the existing inconsistent findings may be cultural differences, sex role, recall bias, features of stressors, or perceived social support or emotion regulation strategies during the COVID-19 epidemic, which need more evidence to support (Houtveen and Oei, 2007; Wang et al., 2019).

For the link between resilience and perceived stress, the results showed that the relationship between resilience and perceived stress was not moderated by sex, although we found significant sex differences in both resilience and perceived stress. No concordant results were yielded on sex difference in perceived stress in previous studies (e.g., Thompson et al., 2018; Lehrer et al., 2020). However, several prior pieces of the research reported that resilience showed sex differences in various populations (e.g., Sun and Stewart, 2007; Erdogan et al., 2015; Masood et al., 2016). Sex hormone-related neuropsychological mechanisms are potential explanations to unravel the sex difference in resilience partly. For instance, low psychological resilience was related to compromised control of neural circuits involved in emotion regulation (Southwick and Charney, 2012; Gupta et al., 2017; Liu et al., 2019), and these circuits were influenced by sex hormones (Van Honk and Schutter, 2006; Liu et al., 2019). Furthermore, inconsistent findings were reported about sex differences in the association between resilience and perceived stress. For example, two previous studies found that female medical students reported significantly lower resilience and higher perceived stress compared with males (Rahimi et al., 2014; Thompson et al., 2018). Another study also found that the association between resilience and perceived stress was significant in both female and male young adults, with a stronger interrelationship in females (Yalcin-Siedentopf et al., 2020). However, a study reported that trait resilience mediated the association of childhood maltreatment with perceived stress in young female adults, whereas no significant mediating effects were found in males (Hong et al., 2018). The COVID-19 epidemic and the specific population might contribute to these inconsistencies between the findings of previous studies and the current study.

Limitations

This study has several limitations. First, the observational nature and the cross-sectional design limit the interpretability of the mediation analysis. A longitudinal study with the same sample should be conducted to detect the causal link between resilience and somatization with the development of infectious disease epidemics. Second, this self-selected sample was obtained from the population consisted of people who were intended to use online self-help intervention, so our findings might not be suitable for the general population. Third, self-reported physical symptoms may not always be as reliable as the assessment by professionals. Symptom reports in people with somatic symptoms might increase as time passed by, and the reason might be a shift from episodic knowledge to semantic beliefs (Houtveen and Oei, 2007). Fourth, we did not consider whether some participants experienced childhood trauma before, as traumatic

stress was also reported to foster the development of somatization (Berger et al., 2014). Fifth, female sample constitutes the majority of this study, and significant sex differences are found in age, body mass index, education, marital status, and drinking. We carried out multiple regression analyses and found that none of these variables are predictive of somatization in males or females.

CONCLUSION

Resilience is a key predictor of somatization. Sex differences should be noticed in the associations among resilience, perceived stress, and somatization. The findings in the current study have important implications on crisis intervention during and after the COVID-19 epidemic. First, promoting resilience should be included as the main purpose in crisis intervention. Because resilience is a multidimensional construct with various measurements, the related treatment components and measurements should be chosen with intention. Second, coping strategies on somatization may be delivered in a sex-specific way. Third, cultural sensitive tools for resilience should be considered in the future studies and clinical 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 of Institute of Psychology, Chinese Academy of Sciences. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

FS: conceptualization, formal analysis, methodology, writing – original draft, and writing – review and editing. CZo: data curation, formal analysis, and writing – original draft. WQ: data curation. CZa: writing – original draft. ZL: conceptualization, methodology, project administration, and investigation. XZ: investigation and writing – review and editing. All authors contributed to the article and approved the submitted version.

FUNDING

This research was supported by the Shenzhen-Hong Kong Institute of Brain Science-Shenzhen Fundamental Research Institutions (NYKFKT 2020002), the National Natural Science Foundation of China (grant no. 31771223), and the Beijing Municipal Education Commission (SZ201810028014).

ACKNOWLEDGMENTS

We thank Yongjie Zhou for her outstanding work in organizing data collection and editing. We are also grateful to all the other colleagues who contributed to data collection and editing.

REFERENCES

Aiello, A., Khayeri, M. Y., Raja, S., Peladeau, N., Romano, D., Leszcz, M., et al. (2011). Resilience training for hospital workers in anticipation of an influenza pandemic. *J. Contin. Educ. Health Prof.* 31, 15–20. doi: 10.1002/chp.20096

Asmundson, G. J., and Katz, J. (2009). Understanding the co-occurrence of anxiety disorders and chronic pain: state-of-the-art. *Depress. Anxiety* 26, 888–901. doi: 10.1002/da.20600

Behnke, A., Conrad, D., Kolassa, I. T., and Rojas, R. (2019). Higher sense of coherence is associated with better mental and physical health in emergency medical services: results from investigations on the revised sense of coherence scale (SOC-R) in rescue workers. *Eur. J. Psychotraumatol.* 10:1606628. doi: 10.1080/20008198.2019.1606628

Berger, M., Piralic-Spitzl, S., and Aigner, M. (2014). Trauma and posttraumatic stress disorder in transcultural patients with chronic pain. *Neuropsychiatr* 28, 185–191.

Beutel, M. E., Klein, E. M., Henning, M., Werner, A. M., Burghardt, J., Tibubos, A. N., et al. (2020). Somatic symptoms in the german general population from 1975 to 2013. *Sci. Rep.* 10:1595. doi: 10.1038/s41598-020-58602-6

Budtz-Lilly, A., Schröder, A., Rask, M. T., Fink, P., Vestergaard, M., and Rosendal, M. (2015). Bodily distress syndrome: a new diagnosis for functional disorders in primary care? *BMC Fam. Pract.* 16:180. doi: 10.1186/s12875-015-0393-8

Campbell-Sills, L., and Stein, M. B. (2007). Psychometric analysis and refinement of the connor-davidson resilience scale (CD-RISC): validation of a 10-item measure of resilience. *J. Trauma Stress* 20, 1019–1028. doi: 10.1002/jts.20271

Cohen, S., Kamarck, T., and Mermelstein, R. (1983). A global measure of perceived stress. *J. Health Soc. Behav.* 24, 385–396.

Connor, K. M., and Davidson, J. R. (2003). Development of a new resilience scale: the connor-davidson resilience scale (CD-RISC). *Depress. Anxiety* 18, 76–82. doi: 10.1002/da.10113

Dawson, K. S., Bryant, R. A., Harper, M., Tay, A. K., Rahman, A., and Schafer, A. (2015). Problem management plus (PM+): a WHO transdiagnostic psychological intervention for common mental health problems. *World Psychiatry* 14, 354–357. doi: 10.1002/wps.20255

Derogatis, L. R., Rickels, K., and Rock, A. F. (1976). The SCL-90 and the MMPI: a step in the validation of a new self-report scale. *Br. J. Psychiatry.* 128, 280–289. doi: 10.1192/bjp.128.3.280

Der Ven Dewsaran-van, C., Van Broeckhuysen-Kloth, S., Thorsell, S., Scholten, R., De Gucht, V., and Geenen, R. (2018). Self-compassion in somatoform disorder. *Psychiatry Res.* 262, 34–39. doi: 10.1016/j.psychres.2017.12.013

Erdogan, E., Ozdogan, O., and Erdogan, M. (2015). University students' resilience level: the effect of gender and faculty. *Proc. Soc. Behav. Sci.* 186, 1262–1267. doi: 10.1016/j.sbspro.2015.04.047

Gupta, A., Love, A., Kilpatrick, L. A., Labus, J. S., Bhatt, R., Chang, L., et al. (2017). Morphological brain measures of cortico-limbic inhibition related to resilience. *J. Neurosci. Res.* 95, 1760–1775. doi: 10.1002/jnr.24007

Gureje, O., Simon, G. E., Ustun, T. B., and Goldberg, D. P. (1997). Somatization in cross-cultural perspective: a World Health Organization study in primary care. *Am. J. Psychiatry* 154, 989–995. doi: 10.1176/ajp.154.7.989

Hayes, A. F. (2015). An index and test of linear moderated mediation. *Mult. Behav. Res.* 50, 1–22. doi: 10.1080/00273171.2014.962683

Hayes, A. F. (2018). *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*. New York, NY: Guilford Press.

Hayes, A. F., and Rockwood, N. J. (2020). Conditional process analysis: concepts, computation, and advances in the modeling of the contingencies of mechanisms. *Am. Behav. Sci.* 64, 19–54. doi: 10.1177/0002764219859633

Hewitt, P. L., Flett, G. L., and Mosher, S. W. (1992). The perceived stress scale: factor structure and relation to depression symptoms in a psychiatric sample. *J. Psychopathol. Behav. Assess.* 14, 247–257. doi: 10.1007/BF00962631

Hong, F., Tarullo, A. R., Mercurio, A. E., Liu, S., Cai, Q., and Malley-Morrison, K. (2018). Childhood maltreatment and perceived stress in young adults: the role of emotion regulation strategies, self-efficacy, and resilience. *Child Abuse Neglect* 86, 136–146.

Houtveen, J. H., and Oei, N. Y. (2007). Recall bias in reporting medically unexplained symptoms comes from semantic memory. *J. Psychos. Res.* 62, 277–282.

Jones, B., and de C Williams, A. C. (2019). CBT to reduce healthcare use for medically unexplained symptoms: systematic review and meta-analysis. *Br. J. Gen. Pract.* 69:e262. doi: 10.3399/bjgp19X701273

Lehrer, H. M., Steinhardt, M. A., Dubois, S. K., and Laudenslager, M. L. (2020). Perceived stress, psychological resilience, hair cortisol concentration, and metabolic syndrome severity: a moderated mediation model. *Psychoneuroendocrinology* 113:104510.

Liu, T., Li, D., Shangguan, F., and Shi, J. (2019). The relationships among testosterone, cortisol, and cognitive control of emotion as underlying mechanisms of emotional intelligence of 10- to 11-year-old children. *Front. Behav. Neurosci.* 13:273. doi: 10.3389/fnbeh.2019.00273

Malarkey, W. B., David, P., Gouin, J. P., Edwards, M. C., Klatt, M., and Zautra, A. J. (2016). REMAP-a resilience resources measure for prediction and management of somatic symptoms. *Int. J. Behav. Med.* 23, 738–745. doi: 10.1007/s12529-016-9559-6

Masood, A., Masud, Y., and Mazahir, S. (2016). Gender differences in resilience and psychological distress of patients with burns. *Burns* 42, 300–306. doi: 10.1016/j.burns.2015.10.006

Maunder, R. G., Lancee, W. J., Mae, R., Vincent, L., Peladeau, N., Beduz, M. A., et al. (2010). Computer-assisted resilience training to prepare healthcare workers for pandemic influenza: a randomized trial of the optimal dose of training. *BMC Health Serv. Res.* 10:72. doi: 10.1186/1472-6963-10-72

Mischkowski, D., Palacios-Barrios, E. E., Banker, L., Dildine, T. C., and Atlas, L. Y. (2019). Pain or nociception? Subjective experience mediates the effects of acute noxious heat on autonomic responses - corrected and republished. *Pain* 160, 1469–1481.

Ng, S. M. (2013). Validation of the 10-item Chinese perceived stress scale in elderly service workers: one-factor versus two-factor structure. *BMC Psychol.* 1:9. doi: 10.1186/2050-7283-1-9

Ng, S. M., Chan, T. H., Chan, C. L., Lee, A. M., Yau, J. K., Chan, C. H., et al. (2006). Group debriefing for people with chronic diseases during the SARS pandemic: strength-focused and meaning-oriented approach for resilience and transformation (SMART). *Commun. Ment. Health J.* 42, 53–63. doi: 10.1007/s10597-005-9002-y

Norris, F. H., Tracy, M., and Galea, S. (2009). Looking for resilience: understanding the longitudinal trajectories of responses to stress. *Soc. Sci. Med.* 68, 2190–2198. doi: 10.1016/j.socscimed.2009.03.043

Peralta-Ramírez, M. I., Pérez-Mármol, J. M., Castañeda-Cabestany, M., Santos-Ruiz, A. M., Montero-López, E., Callejas-Rubio, J. L., et al. (2018). Association between perceived level of stress, clinical characteristics and psychopathological symptoms in women with systemic lupus erythematosus. *Clin. Exp. Rheumatol.* 36, 434–441.

Rahimi, B., Baetz, M., Bowen, R., and Balbuena, L. (2014). Resilience, stress, and coping among Canadian medical students. *Can. Med. Educ. J.* 5, e5–e12.

Ramírez-Maestre, C., and Esteve, R. (2014). The role of sex/gender in the experience of pain: resilience, fear, and acceptance as central variables in the adjustment of men and women with chronic Pain. *J. Pain* 15, 608.e1–618.e1.

Rehna, T., Hanif, R., and Ali, S. Z. (2016). Life stress and somatic symptoms among adolescents: gender as moderator. *J. Pakistan Med. Assoc.* 66, 1448–1451.

Ren, J. (2009). Study on College Students' mental health status and a reflection on the SCL-90. *China J. Health Psychol.* 17, 958–961. doi: 10.13342/j.cnki.cjhp.2009.08.029

Rothe, C., Schunk, M., Sothmann, P., Bretzel, G., Froeschl, G., Wallrauch, C., et al. (2020). Transmission of 2019-nCoV infection from an asymptomatic contact in Germany. *New Eng. J. Med.* 382, 970–971. doi: 10.1056/NEJMc2001468

Russo, J., Katon, W., Sullivan, M., Clark, M., and Buchwald, D. (1994). Severity of somatization and its relationship to psychiatric disorders and personality. *Psychosomatics* 35, 546–556. doi: 10.1016/S0033-3182(94)71723-0

Rutter, M. (1987). Psychosocial resilience and protective mechanisms. *Am. J. Ortho Psychiatry* 57, 316–331. doi: 10.1111/j.1939-0025.1987.tb03541.x

Sahu, M., Gandhi, S., Sharma, M. K., and Marimuthu, P. (2019). Perceived stress and resilience and their relationship with the use of mobile phone among nursing students. *Invest. Educ. Enferm.* 37:e05. doi: 10.17533/udea.iee.v37n3e05

Sarrionandia, A., Ramos-Diaz, E., and Fernandez-Lasarte, O. (2018). Resilience as a mediator of emotional intelligence and perceived stress: a cross-country study. *Front. Psychol.* 9:2653. doi: 10.3389/fpsyg.2018.02653

Schaefert, R., Hausteiner-Wiehle, C., Häuser, W., Ronel, J., Herrmann, M., and Henningsen, P. (2012). Non-specific, functional, and somatoform bodily complaints. *Deutsch. Arztebl. Int.* 109, 803–813. doi: 10.3238/arztebl.2012.0803

Smith, B., Shatte, A., Perlman, A., Siers, M., and Lynch, W. D. (2018). Improvements in resilience, stress, and somatic symptoms following online resilience training: a dose-response effect. *J. Occup. Environ. Med.* 60, 1–5. doi: 10.1097/jom.0000000000001142

Southwick, S. M., and Charney, D. S. (2012). The science of resilience: implications for the prevention and treatment of depression. *Science* 338, 79–82. doi: 10.1126/science.1222942

Sun, J., and Stewart, D. (2007). Age and gender effects on resilience in children and adolescents. *Int. J. Ment. Health Promot.* 19, 16–25.

Tang, L., Bie, B., Park, S. E., and Zhi, D. (2018). Social media and outbreaks of emerging infectious diseases: a systematic review of literature. *Am. J. Infect. Control* 46, 962–972. doi: 10.1016/j.ajic.2018.02.010

Thompson, G., Wrath, A., Trinder, K., and Adams, G. C. (2018). The roles of attachment and resilience in perceived stress in medical students. *Can. Med. Educ. J.* 9, e69–e77.

Timmers, I., Quaedflieg, C., Hsu, C., Heathcote, L. C., Rovnaghi, C. R., and Simons, L. E. (2019). The interaction between stress and chronic pain through the lens of threat learning. *Neurosci. Biobehav. Rev.* 107, 641–655. doi: 10.1016/j.neubiorev.2019.10.007

Um, Y. H., Huh, H. J., Kim, S. Y., and Chae, J. H. (2014). Possible cultural effects on the increments of somatic symptoms in subjectively resilient depressed patients. *Asia Pacific Psychiatry* 6, 259–266. doi: 10.1111/appy.12143

Van Honk, J., and Schutter, D. J. (2006). Unmasking feigned sanity: a neurobiological model of emotion processing in primary psychopathy. *Cogn. Neuropsychiatry* 11, 285–306.

Vassend, O., Røysamb, E., Nielsen, C. S., and Czajkowski, N. O. (2017). Musculoskeletal complaints, anxiety-depression symptoms, and neuroticism: a study of middle-aged twins. *Health Psychol.* 36, 729–739. doi: 10.1037/hea0000484

Vassend, O., Røysamb, E., Nielsen, C. S., and Czajkowski, N. O. (2018). Fatigue symptoms in relation to neuroticism, anxiety-depression, and musculoskeletal pain. A longitudinal twin study. *PLoS One* 13:e0198594. doi: 10.1371/journal.pone.0198594

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., et al. (2020). Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *Int. J. Environ. Res. Public Health* 17:1729. doi: 10.3390/ijerph17051729

Wang, S., Zhao, Y., Zhang, L., Wang, X., Cheng, B., Luo, K., et al. (2019). Stress and the brain: perceived stress mediates the impact of the superior frontal gyrus spontaneous activity on depressive symptoms in late adolescence. *Hum. Brain Mapp.* 40, 4982–4993. doi: 10.1002/hbm.24752

World Health Organization [WHO] (2020). *Coronavirus Disease 2019 (COVID-19) Situation Report–13*. Avaliable at: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200202-sitrep-13-ncov-v3.pdf?sfvrsn=195f4010_6 (accessed February 2, 2020).

Yalcin-Siedentopf, N., Pichler, T., Welte, A. S., Hoertnagl, C. M., Klasen, C. C., Kemmler, G., et al. (2020). Sex matters: stress perception and the relevance of resilience and perceived social support in emerging adults. *Arch. Women's Ment. Health* [Epub ahead of print]. doi: 10.1007/s00737-020-01076-2

Yu, X. N., and Zhang, J. X. (2007). Factor analysis and psychometric evaluation of the Connor-davidson resilience scale (CD-RISC) with Chinese people. *Soc. Behav. Personal.* 35, 19–30. doi: 10.2224/sbp.2007.35.1.19

Zantinge, E. M., Verhaak, P. F., Kerssens, J. J., and Bensing, J. M. (2005). The workload of GPs: consultations of patients with psychological and somatic problems compared. *Br. J. Gen. Pract.* 55, 609–614.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 25 May 2021
doi: 10.3389/fpsyg.2021.622339

Prevalence of Risk Factors Associated With Mental Health Symptoms Among the Outpatient Psychiatric Patients and Their Family Members in China During the Coronavirus Disease 2019 Pandemic

Yan Qiu[1], Jing Huang[1], Jinghui Sun[2], Jiaxu Zhao[2], Apian Chen[2], Jindong Chen[1], Renrong Wu[1], Sujuan Li[1], Ziwei Teng[1], Yuxi Tan[1], Bolun Wang[3] and Haishan Wu[1]**

[1] Department of Psychiatry, National Clinical Research Center for Mental Disorders, China National Technology Institute on Mental Disorders, The Second Xiangya Hospital of Central South University, Changsha, China, [2] Department of Psychology, School of Educational Science, Hunan Normal University, Changsha, China, [3] Department of Radiology, The Second Xiangya Hospital of Central South University, Changsha, China

OPEN ACCESS

Edited by:
Fushun Wang,
Nanjing University of Chinese Medicine, China

Reviewed by:
Elena Commodari,
University of Catania, Italy
Ghulam Nabi,
Hebei Normal University, China

***Correspondence:**
Haishan Wu
wuhaishan@csu.edu.cn
Bolun Wang
wangbolun@csu.edu.cn

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: 28 October 2020
Accepted: 29 April 2021
Published: 25 May 2021

Citation:
Qiu Y, Huang J, Sun J, Zhao J, Chen A, Chen J, Wu R, Li S, Teng Z, Tan Y, Wang B and Wu H (2021) Prevalence of Risk Factors Associated With Mental Health Symptoms Among the Outpatient Psychiatric Patients and Their Family Members in China During the Coronavirus Disease 2019 Pandemic. Front. Psychol. 12:622339. doi: 10.3389/fpsyg.2021.622339

Objective: To investigate the prevalence of and risk factors associated with mental health symptoms in psychiatric outpatients and their family members in China during the COVID-19 pandemic.

Methods: This cross-sectional, survey-based, region-stratified study collected demographic data and mental health measurements for depression, anxiety and acute stress from 269 psychiatric patients and 231 family members in the Second Xiangya Hospital in China from April 27, 2020 to May 8, 2020. Binary logistic regression analysis was performed to identify risk factors associated with mental health outcomes.

Result: The results of this survey revealed that symptoms of depression, anxiety, and acute stress were highly prevalent symptoms in the psychiatric patient group. Respondents who were female, unmarried or highly educated were significantly more likely to have the above symptoms. In the family member group, more than half of them felt that the burden of nursing had increased during the epidemic. Subjects with a high degree of burden of care were significantly more likely to exhibit the above mental health symptoms, while females were significantly more likely to have acute stress.

Conclusions: The results of this survey revealed a high prevalence of mental health disorder symptoms among psychiatric patients and an increased burden of nursing among their family members after the COVID-19 outbreak in China. Understanding the risk factors in those particular groups of people help improve the public health service system for mental health problems during public health events. For further study, exploration of the needs of mental health services and dynamic change tracking will be needed.

Keywords: psychiatric patients, family members, depression, anxiety, acute stress, COVID-19

INTRODUCTION

Coronavirus Disease 2019 (COVID-19), a highly infectious disease characterized by pneumonia and complications like acute respiratory distress syndrome, broke out in December 2019 (JHU, 2020; Khan et al., 2020a). More than 10 million people have been diagnosed globally, including about 80,000 cases in China (Khan et al., 2020b). Following the timely response, the current status of prevention and control in China has become relatively stable, and even places with a high risk of infection, such as hospitals, have also reopened and restored their functions under strict quarantine rules. The COVID-19 pandemic has increased the risk of mental illness, such as anxiety, depression, and other mental disorders, as well as changed people's daily routines, including sleep, exercise, work, or medical treatment (Khan et al., 2021; Nakamura et al., 2021). During the early stages of the COVID-19 epidemic, global attention was mainly focused on infected patients, frontline medical staff and populations in some special stages. Previous researchers had reported that infected individuals had an increased risk of mental illness, that frontline medical staff had greater occupational hazards and stress than other medical staff, that adolescents had a low perception of their susceptibility to and the seriousness of COVID-19, and that pregnant women displayed a decreased level of physical activity and quality of life (Biviá-Roig et al., 2020; Commodari and La Rosa, 2020; Khan et al., 2020c; Zhang et al., 2020). However, some marginalized groups of people might have been neglected, such as patients with mental disorders and/or other chronic diseases (Wright et al., 2020).

Although 173 million people in China are suffering from mental illnesses, it is still common to see psychiatric patients being neglected and discriminated against (Xiang et al., 2012). When an epidemic occurs, people with mental disorders are usually more susceptible to infection due to a poor awareness of the risk of spreading, the confined conditions in psychiatric wards, as well as diminished efforts regarding personal protection for patients (Kim et al., 2019). It was reported that large-scale COVID-19 nosocomial infections occurred in Wuhan Mental Health Center as well as a psychiatric hospital in South Korea (Ji et al., 2020). In addition to the inpatients hospitalized in mental health institutions, most psychiatric patients are stable and living in the community. Due to national travel and quarantine regulations, those psychiatric patients who should have received regular evaluation and medication in outpatient clinics did not receive such care. Even though emergency service systems such as remote consultation, online consultation, and medication delivery *via* mail have been launched to provide services for community psychiatric patients (Li et al., 2020), it is still far from meeting their demands. Compared with the normal population, these community patients with mental health problems are more sensitive to stress from COVID-19 and more susceptible to emotional reactions related to COVID-19, which may lead to recurrence or deterioration of existing mental health problems (Melamed et al., 2020). So far, the emotional changes these patients have encountered and their respective impacts are rarely reported. Ignoring the impact of the epidemic on people with mental illnesses will not only increase the difficulty of the prevention and control of COVID-19 but also exacerbate the existing issue of health care inequalities.

Patients with long-lasting severe mental disorders are frequently found unable to fulfill typical roles expected by society at their age and intellectual ability (Dziwota et al., 2018). Most people with mental illnesses are now undergoing community care from their family members. Due to the stigma of psychiatric disorders, family members of psychiatric patients are often discriminated against and have an inferiority complex, which makes them unknowingly avoid social activities or change their lifestyles, thus greatly impacting their lives (van der Sanden et al., 2016). In addition, psychiatric illness and distress bring heavy psychological pressure and financial burden to families of psychiatric patients, and heavy care work also increases their physical exertion, which is prone to cause various emotional disorders (Niu and Zhang, 2020).

Due to strict social distancing rules, face-to-face investigations were more often replaced with online data collection in previous studies. However, concerns have been expressed about the selection bias regarding online data collection. One study reported that significantly more young people and mildly ill patients were recruited due to the switch of investigation method from offline to online (Hao et al., 2020). To reduce selection bias, this study issued paper questionnaires on site to investigate and evaluate the emotional changes and psychological shocks in psychiatric patients and their family members. As one-third of the general population in China exhibited symptoms of depression or anxiety due to the impact of COVID-19 (Wang et al., 2020a), we hypothesized that depression or anxiety of greater severity could have happened in patients with mental illness and their family members. This survey aims to reveal the characteristics of mental health needs in psychiatric patients and their family members during the COVID-19 epidemic and also help to improve psychiatric services in case of other future disease epidemics.

METHODS

Participants

Participants (patients and family members) were recruited at the psychiatric outpatient department of the Second Xiangya Hospital of Central South University, China, from April 27 to May 8, 2020, when the hospital had just begun its full resumption of outpatient service. Four trained researchers conducted recruitment among patients and family members waiting in outpatient clinics using convenience sampling. Written informed consent was obtained from all patients and their family members. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration. All procedures involving human subjects/patients were approved by the Ethics Review Committee of Second Xiangya Hospital of Central South University (No. LYF2020125).

Inclusion and Exclusion Criteria

All psychiatric patients must be aged 16 years or above and be previously diagnosed by psychiatrists to suffer from F20 Schizophrenia, F22 Persistent delusional disorders, F23 Acute and transient psychotic disorders, F30 Manic episodes, F31 Bipolar affective disorders, F32 Depressive episodes, F33 Recurrent depressive disorders, F41 other anxiety disorders (including F41.1 generalized anxiety disorders, F41.0 panic disorders, F41.2 mixed anxiety and depressive disorders), F42 Obsessive-compulsive disorder, or F43 Reactions to severe stress, and adjustment disorders based on the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) criteria. Selected family members of the psychiatric patients were aged 18 years or above and did not suffer from psychiatric illnesses, who had caregiving relationship with patients. Exclusion criteria included inability to complete a survey, presence of severe chronic medical disorders (including neurological, cardiovascular, respiratory, endocrine, and inflammatory disorders) and suspected/confirmed cases of COVID-19.

Measures

A paper questionnaire was administered to all participants. The structured questionnaire consisted of questions that covered several areas: (1) demographic data; (2) change of medical care for psychiatric patients and burden of care for family members; (3) Impact of Event Scale-Revised items (IES-R); (4) Patient Health Questionnaire-2 items (PHQ-2); (5) Generalized Anxiety Disorder-2 items (GAD-2).

Demographic data was self-reported by the participants, including gender (male or female), age (16–19, 20–35, 36–40, or >40 years), place of residence (urban or rural), marital status (married or unmarried), educational level (senior middle school or below, college or vocational school, bachelor degree or above), occupation (student, employed, or unemployed), change of treatment and way of getting medical care (only for psychiatric patients), and burden-of-care degree (only for family members). Diagnosis information was collected from medical records and self-reports of patients or their family members.

We focused on symptoms of depression, anxiety, and distress for all participants, using Chinese versions of validated measurement tools as follows. The PHQ-2 is a simplified questionnaire based on the Patient Health Questionnaire-9 items. Mainly used for screening depression, the PHQ-2 only rates depression as having two core symptoms (low mood and loss of interest) with a cutoff value of no <3, sensitivity of 0.97, and specificity of 0.67 (Maurer, 2012). The GAD-2, developed from Generalized Anxiety Disorder-7 items, was used to screen anxiety disorders with two core symptoms (anxiety and uncontrollable worry) with a cutoff value of no <3, sensitivity of 0.88, and specificity of 0.61 (Cano-Vindel et al., 2018). The Impact of Event Scale-Revised (IES-R) was adopted to measure symptoms of post-traumatic stress disorder (PTSD) during the COVID-19 pandemic (Li, 2020). The IES-R is a self-administered questionnaire that has been well-validated in the Chinese population for determining the extent of psychological impact after exposure to a public health crisis within 1 week of exposure (Wu and Chan, 2003).

Statistical Analysis

Data analysis was performed using SPSS statistical software version 25.0 (IBM Corp). The significance level was set at $\alpha = 0.05$, and all tests were 2-tailed. The original scores of the three measurement tools were not normally distributed, so this data was presented as medians with interquartile ranges (IQRs). The ranked data from the counts of each level for symptoms of depression, anxiety, and distress were presented as numbers and percentages. The R*C Chi-square tests were applied to compare the prevalence of depression, anxiety, and acute stress symptoms in two populations by demographic characteristics and epidemic-related factors. To determine potential risk factors for symptoms of depression, anxiety, and distress in participants, binary logistic regression analysis was performed. The associations between risk factors and outcomes were presented as odds ratios (ORs) with 95% confidence intervals adjusting for confounders including sex, age, place of residence, marital status, educational level, occupation, and psychiatric diagnosis (only for patients).

RESULTS

Demographic Characteristics

Of the 298 psychiatric patients, 269 (90.3%) with a mean age of 27.06 (±11.90) years completed the survey. One hundred and twenty-two participants (45.4%) were aged 20–34 year, 168 (62.5%) were female, 187 (69.5%) were unmarried, 91 (33. 8%), were living in the city, 116 (43.4%) were students, and 81 (30.1%) had a bachelor degree level of education or above. The majority of respondents had: bipolar disorder (36.4%), schizophrenia (14.9%), major depression disorder (24.2%), or anxiety disorders (12.3%). Of the 252 family members who were approached, 231 (91.7%) with a mean age of 41.61 (±10.42) years completed the survey. One hundred and six (45.9%) were aged 35–49 years, 129 (55.8%) were female, 191 (82.7%) were married, 83 (35.9%), were living in the city 57 (24.7%) had a bachelor degree level of education or above, and 133 (57.6%) were unemployed (**Table 1**).

Approximately 60% of the patients had no change in medicine during the epidemic, while nearly 30% reduced their doses or stopped taking medicine without consulting their psychiatrists. Up to 40% of the patients failed to see their psychiatrists, in person but 13.8% of them obtained medical advice from doctors online. More than half of the patients' family members reported an increase in the burden of care (**Table 2**).

Prevalence of Depression, Anxiety, and Acute Stress

Thirty percentage of psychiatric patients suffered depression, 27.8% anxiety, and 27.8% acute stress. The median scores for depression, anxiety, and acute stress were 2, 2, and 22, respectively (**Table 3**).

Univariate analyses showed that depression symptoms were more severe among participants who were female, <20 years, unmarried, and primary or lower secondary school students [e.g., depression among female vs. male: 62 [36.9%] vs. 17

TABLE 1 | Descriptive statistics of demographic characteristics and epidemic-related information for the psychiatric patients and their family members.

	Patients (*N* = 269) *n* (%)	Family members (*N* = 231) *n* (%)	*P*-value
Age			
16–19	92 (34.2)	4 (1.7)	<0.001
20–34	122 (45.4)	56 (24.2)	
35–49	33 (12.3)	106 (45.9)	
50–65	22 (8.2)	56 (24.2)	
66–68	/	9 (4.0)	
Gender			
Male	97 (36.1)	98 (42.4)	0.138
Female	168 (62.5)	129 (55.8)	
Unfilled	4 (1.5)	4 (1.7)	
Marital status			
Unmarried	187 (69.5)	32 (13.9)	<0.001
Married	79 (29.4)	191 (82.7)	
Unfilled	3 (1.1)	8 (3.5)	
Urban and rural sources			
City	91 (33.8)	83 (35.9)	0.884
Town	83 (30.9)	55 (23.8)	
Countryside	83 (30.9)	79 (34.2)	
Unfilled	12 (4.5)	14 (6.0)	
Education level			
Senior middle school or below	134 (49.8)	126 (54.5)	0.387
College or vocational school	47 (17.5)	42 (18.2)	
Bachelor degree or above	81 (30.1)	57 (24.7)	
Unfilled	7 (2.6)	6 (2.6)	
Occupation			
Student	116 (43.1)	9 (3.9)	<0.001
Employed	77 (28.6)	74 (32.0)	
Unemployed	63 (23.4)	133 (57.6)	
Unfilled	13 (4.8)	15 (6.0)	
Psychiatric diagnosis			
Bipolar disorder	98 (36.4)	58 (25.1)	N/A
Schizophrenia	40 (14.9)	49 (21.2)	
Major depression disorder	65 (24.2)	57 (24.7)	
Anxiety disorder	33 (12.3)	15 (6.5)	
Other psychiatric diagnosis	26 (9.7)	40 (17.3)	
Unknown	6 (2.2)	12 (5.0)	
Relationship			
Parent	96 (41.6)	N/A	N/A
Spouse	37 (16.0)		
Child	49 (21.2)		
Daughter-in-law or son-in-law	4 (1.7)		
Brother or sister	25 (10.8)		
Other	15 (6.5)		
Unfilled	5 (2.2)		

TABLE 2 | Factor details of epidemic-related influence on change of treatment, way of getting medical care for psychiatric patients and burden of care change for their family members.

Characteristics	*n* (%)
For patients	
Medical treatment	
Take the medicine regularly without changing the dose	150 (55.8)
Take the medicine regularly and reduce it by yourself	24 (8.9)
Take the medicine regularly and reduce it following doctor's advice	15 (5.58)
Stop taking the medicine by yourself	49 (18.2)
Others	29 (10.8)
Unfilled	2 (0.7)
Method of getting medical care	
Psychiatric specialist hospital	60 (22.3)
General hospital	37 (13.8)
Internet hospital	37 (13.8)
Without follow-up by doctor	110 (40.9)
Others	17 (6.3)
Unfilled	8 (2.9)
For family members	
Burden of caring patients	
No increase	65 (28.1)
Mildly increase	79 (34.2)
Moderately increase	41 (17.7)
Severely increase	18 (7.8)
Extremely Severely increase	10 (4.3)
Unfilled	18 (7.8)

[17.5%]; $P = 0.001$]. Females and primary or lower secondary school students also reported experiencing higher levels of anxiety [e.g., anxiety among female vs. male: 54 [32.1%] vs. 19 [19.6%]; $P = 0.028$]. Distress levels were found to be higher among females, primary or lower secondary school students, and patients with bipolar disorder [e.g., acute stress among female vs. male: 59 [35.1%] vs. 15 [15.5%]; $P = 0.001$] (**Supplementary Tables 1, 2**).

8.6% of family members suffered from depression, 10.8% suffered from anxiety, and 10.8% suffered from acute stress. No significant subgroup differences were observed in family members. The median scores for depression, anxiety, and acute stress was 0, 0, and 11, respectively (**Table 3**).

Factors Associated With Depression, Anxiety, and Acute Stress

Binary logistic regression analyses showed that gender (female) and education level were risk factors for depression, anxiety, and acute stress among psychiatric patients. Burden-of-care degree was an independent factor among family members for the three conditions above, while gender (female) was also an independent factor for distress. The detailed results of the logistic analyses are shown in **Table 4**.

In depression models, female (OR, 3.640, 95% CI, 1.706–6.765; $p = 0.001$), unmarried (OR, 2.490; 95% CI, 1.164–5.324; $p = 0.019$), senior middle school or below (OR, 4.105; 95% CI, 1.335–12.624, $p = 0.014$) and bachelor degree or above (OR, 4.168; 95% CI, 1.302–13.347, $p = 0.016$) were selected as independent factors among psychiatric patients.

TABLE 3 | Factor scores of PHQ-2, GAD-2 and IES-R and prevalence of depression, anxiety, and acute stress symptoms between patients and family members.

Characteristics	Patients		Family members	
	Median (IQR)	*N* (%)	Median (IQR)	*N* (%)
Total PHQ-2 score	2 (0.3)	80 (30.0)	0 (0.1)	20 (8.6)
Item 1: Feeling down/depressed/hopeless	1 (0.2)		0 (0.1)	
Item 2: Little interest in doing things	1 (0.2)		1 (0.2)	
Total GAD-2 score	2 (0.3)	74 (27.8)	0 (0.2)	25 (10.8)
Item 1: Feeling nervous/anxious/on edge	1 (0.2)		0 (0.1)	
Item 2: Not being able to stop worrying	1 (0.2)		0 (0.1)	
Total IES-R score	22 (9, 36.5)	74 (27.8)	11 (3.24)	25 (10.8)
Part 1: Intrusive reaction	7 (2.12)		5 (1.9)	
Part 2: High vigilance	7 (2.12)		3 (0.6)	
Part 3: Avoidance response	7 (2.13)		4 (1.10)	

TABLE 4 | Binary logistic regression analysis$^{\Delta}$ of risk factors associated with symptoms of depression, anxiety, and acute stress.

Variables	OR (95% CI)	*P*-value
Models for depression		
Patients		
Gender (female vs. male)	3.640 (1.706, 6.765)	0.001
Marital status (unmarried vs. married)	2.490 (1.164, 5.324)	0.019
Education level (Group 1 vs. Group 2)*	4.105 (1.335, 12.624)	0.014
Education level (Group 3 vs. Group 2)*	4.168 (1.302, 13.347)	0.016
Family members		
Burden of care (score between 0 and 4)	2.187 (1.455, 3.289)	<0.001
Models for anxiety		
Patients		
Gender (female vs. male)	3.173 (1.490, 6.756)	0.003
Education level (Group 1 vs. Group 2)*	4.897 (1.402, 17.106)	0.013
Education level (Group 3 vs. Group 2)*	6.507 (1.806, 23.447)	0.004
Family members		
Burden of care (score between 0 and 4)	2.186 (1.486, 3.216)	<0.001
Models for acute stress		
Patients		
Gender (female vs. male)	3.271 (1.556, 6.875)	0.002
Education level (Group 1 vs. Group 2)*	1.738 (0.668, 4.520)	0.257
Education level (Group 3 vs. Group 2)*	3.634 (1.369, 9.646)	0.010
Family members		
Gender (female vs. male)	3.817 (1.272, 11.455)	0.017
Burden of care (score between 0 and 4)	2.341 (1.545, 3.546)	<0.001

**Education level: Group 1: Senior middle school or below, Group 2: College or vocational school, Group 3: Bachelor degree or above.*

$^{\Delta}$*The regression models for patients included as independent variables: age, gender, marital status, education level, occupation, psychiatric diagnosis, medical treatment and method of getting medical care. The backward selection method was then applied to remove all insignificant variables.*

The regressions for family members included as independent variables: age, gender, marital status, education level, occupation, relationship and burden of care degree, with the backward selection method then applied to remove all insignificant variables.

Two variables were independently associated with anxiety risk factors: gender (female) (OR, 3.173; 95% CI, 1.490–6.756; $p = 0.003$) and education level including senior middle school or below (OR, 4.897, 95% CI, 1.402–17.106; $p = 0.013$), and bachelor degree or above (OR, 6.507; 95% CI, 1.806–23.447; $p = 0.004$).

For acute stress symptoms, psychiatric patients had two risk factors: gender (female) (OR, 3.271; 95% CI, 1.556–6.875; $p = 0.002$) and education level for only bachelor degree or above (OR, 3.634; 95% CI, 1.369–9.646; $p = 0.010$).

DISCUSSION

To the best of our knowledge, this is the first survey on the mental health of psychiatric patients and their family members during the COVID-19 epidemic in China. Our findings present concerns about the psychological well-being of psychiatric patients and their family members during the outbreak of COVID-19. The current study indicates that many psychiatric patients and family members might have experienced several mental health problems and changes in medical treatment or care burden during the epidemic. These findings can provide indirect evidence to other areas of China and other countries to help reduce depression, anxiety and acute stress in psychiatric patients and their family members.

This cross-sectional survey revealed a high prevalence of mental health symptoms among psychiatric patients after the COVID-19 outbreak in China. The prevalence of emotional symptoms and stress symptoms in patients with mental illness found in this study is equivalent to that of another general population investigated in a preliminary online survey in late January 2020, where nearly one-third of the respondents had experienced moderate to severe mental health conditions (Wang et al., 2020a). Another epidemiological survey conducted among the general population in China in early February 2020 also shows that nearly 35% of the respondents displayed psychological distress during the COVID-19 epidemic (Yuan et al., 2020). Although the investigation time of this study was after the peak of the epidemic in China, the incidence of emotional problems among mentally ill patients remains the same. Following this logic, we speculate that psychiatric patients might have experienced more severe symptoms of anxiety,

depression, and stress during the peak of the epidemic compared to the healthy population. Several possible facts can support this speculation. Firstly, that strict social isolation and decreased social activities affect neuroendocrine function (Wang et al., 2020c), possibly increasing the risk of suicide and stress-related aggression in this group of people (Calati et al., 2019; Brooks et al., 2020). Secondly, that social isolation also prevents patients from receiving necessary medical care, aggravating their original psychiatric conditions (Vieta et al., 2012). Thirdly, that despite the introduction of virtual medical care through the internet, its effectiveness is not as much as medical care in person. During the COVID-19 epidemic, a lack of health care in person and failure to administer timely treatment may have caused fluctuations in patients conditions (Li et al., 2020).

Binary logistic regression analysis confirmed that after controlling confounding factors, gender and education level were independent risk factors for depression, anxiety and stress. Among patients with mental illness, women were more susceptible to depression, anxiety and acute stress. It has been shown that with different levels of response to stress, women are more sensitive to the release of corticotropin-releasing factor (CRF) (Bangasser and Wiersielis, 2018). Inappropriate or persistent CRF release is strongly linked to depression and anxiety (Vasconcelos et al., 2020). In addition, hormonal changes in women during the menstrual cycle or menopause can also lead to more pronounced mood changes (Christiansen and Berke, 2020). Psychosocial stress may affect the hypothalamus-pituitary gland-gonads, affecting the hormone levels and further changing mental states (Nabi et al., 2020). In this study, we found that groups with lower or higher education levels had a higher risk of depression, anxiety and stress for COVID-19. For the group with less education, a poor knowledge reserve and ability to analyze information from social media might have limited their capability of coping with the stress from the epidemic, resulting in psychological stress reactions and even some mental illnesses from excessive stress. However, people who received university education and above could also become nervous and anxious during the epidemic due to excessive attention to information related to the epidemic (Myrick and Willoughby, 2019). People with high-level education tend to have a higher expectation for their jobs and sense of value for society than those with low or medium-level education. The impact of COVID-19 on their working status might have created a psychological gap between expectation and reality, followed by anxiety and depression (Lu et al., 2019). In this regard, online or smartphone-based psychological interventions (such as cognitive behavioral therapy) could be provided to this specific group of people in the hope of reducing the risk of depression and anxiety (El Morr et al., 2020).

The prevalence of emotional symptoms and stress symptoms in family members in this study is much lower than that of people with mental illness in the same period. This shows that people without mental disorders have better emotional self-regulation and resistance to stress than patients. At the same time, we have noticed that this proportion is lower than that investigated during the early epidemic for the general population (Wang et al., 2020b). This may be due to relief brought on by an effective prevention system against COVID-19, easing the psychological impact on people without mental disorders.

Several limitations of the current study should be considered. Firstly, that this is a cross-sectional survey that failed to monitor the changes in the mental health of psychiatric patients during the epidemic. Since the same survey was not conducted on the general public in the same period, it is not enough to compare the prevalence with them. Secondly, that all participants in the current study were recruited from outpatient department in one hospital. Selection bias may have been introduced to this study. Given the diverse geographical environment and the management strategies in different hospitals, the extrapolation of these results to psychiatric patients in other regions remains to be verified. Thirdly, that the data of this study was not taken from the peak period of COVID-19 in China, but 2 months after the peak period. Therefore, it may not accurately reflect the emotional changes of psychiatric patients during the initial outbreak. In addition to the above, in future studies, the impact of the epidemic on these two groups in lifestyle habits needs to be considered comprehensively, as well as mental health symptoms, way of seeking medical care, and change of care burden.

CONCLUSION

The results of this study suggest that psychiatric patients and their family members are at risk of depression, anxiety and acute stress symptoms even during the COVID-19 remission period. Given that the global epidemic of COVID-19 is still continuing, it is necessary to follow up these subjects with high-risk factors. From the perspective of psychosocial services, the public health service system for special populations during public health emergencies needs to be further improved. Future research needs to track the characteristics of dynamic changes in mental health and understand the needs of mental health services in this particular group of people.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Materials**, further inquiries can be directed to the corresponding authors.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics Review Committee of Second Xiangya Hospital of Central South University. Written informed consent was obtained from each participant after the study was explained.

AUTHOR CONTRIBUTIONS

HW, BW, JC, and RW: conception and design. YQ, JS, JZ, and AC: recruitment of subjects. YQ, SL, ZT,

and YT: acquisition of data. YQ and JH: analysis and interpretation of data. YQ, HW, and BW: drafting the manuscript. All authors contributed to and have approved the final manuscript.

FUNDING

This study was supported by grants from the National Natural Science Foundation of China (Grant Nos. 81971258, 81270019, and 81501163) and National Science and Technology Major Project of China (Grant No: 2020ZX09201-28).

ACKNOWLEDGMENTS

We thank all subjects who served as research participants. We thank Feng Lin, Adriano Henrique De Matos Moffa, and Angus Dong for modifying the manuscript.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.622339/full#supplementary-material

REFERENCES

Bangasser, D. A., and Wiersielis, K. R. (2018). Sex differences in stress responses: a critical role for corticotropin-releasing factor. *Hormones* 17, 5–13. doi: 10.1007/s42000-018-0002-z

Biviá-Roig, G., La Rosa, V. L., Gómez-Tébar, M., Serrano-Raya, L., Amer-Cuenca, J. J., Caruso, S., et al. (2020). Analysis of the impact of the confinement resulting from COVID-19 on the lifestyle and psychological wellbeing of spanish pregnant women: an internet-based cross-sectional survey. *Int. J. Environ. Res. Public Health* 17:5933. doi: 10.3390/ijerph17165933

Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., et al. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *Lancet* 395, 912–920. doi: 10.1016/S0140-6736(20)30460-8

Calati, R., Ferrari, C., Brittner, M., Oasi, O., Olié E., Carvalho, A. F., et al. (2019). Suicidal thoughts and behaviors and social isolation: a narrative review of the literature. *J. Affect. Disord.* 245, 653–667. doi: 10.1016/j.jad.2018.11.022

Cano-Vindel, A., Muñoz-Navarro, R., Medrano, L. A., Ruiz-Rodríguez, P., González-Blanch, C., Gómez-Castillo, M. D., et al. (2018). A computerized version of the Patient Health Questionnaire-4 as an ultra-brief screening tool to detect emotional disorders in primary care. *J. Affect. Disord.* 234, 247–255. doi: 10.1016/j.jad.2018.01.030

Christiansen, D. M., and Berke, E. T. (2020). Gender- and sex-based contributors to sex differences in PTSD. *Curr. Psychiatry Rep.* 22:19. doi: 10.1007/s11920-020-1140-y

Commodari, E., and La Rosa, V. L. (2020). Adolescents in quarantine during COVID-19 pandemic in Italy: perceived health risk, beliefs, psychological experiences and expectations for the future. *Front. Psychol.* 11:559951. doi: 10.3389/fpsyg.2020.559951

Dziwota, E., Stepulak, M. Z., Włoszczak-Szubzda, A., and Olajossy, M. (2018). Social functioning and the quality of life of patients diagnosed with schizophrenia. *Ann. Agric. Environ. Med.* 25, 50–55. doi: 10.5604/12321966.1233566

El Morr, C., Ritvo, P., Ahmad, F., and Moineddin, R. (2020). Effectiveness of an eight-week web-based mindfulness virtual community intervention for university students on symptoms of stress, anxiety, and depression: a randomized controlled trial. *JMIR Ment. Health* 7:e18595. doi: 10.2196/18595

Hao, F., Tan, W., Jiang, L., Zhang, L., Zhao, X., Zou, Y., et al. (2020). Do psychiatric patients experience more psychiatric symptoms during COVID-19 pandemic and lockdown? A case-control study with service and research implications for immunopsychiatry. *Brain Behav. Immunity* 87, 100–106. doi: 10.1016/j.bbi.2020.04.069

JHU (2020). *COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU)*. Johns Hopkins University (JHU). Available online at: https://coronavirus.jhu.edu/map.html

Ji, H., Liu, L., Huang, T., and Zhu, Y. (2020). Nosocomial infections in psychiatric hospitals during the COVID-19 outbreak. *Euro. J. Psychiatry* 34, 177–179. doi: 10.1016/j.ejpsy.2020.04.001

Khan, S., Ali, A., Shi, H., Siddique, R., Shabana, Nabi, G., et al. (2020a). COVID-19: Clinical aspects and therapeutics responses. *Saudi Pharm. J.* 28, 1004–1008. doi: 10.1016/j.jsps.2020.06.022

Khan, S., Siddique, R., Ali, A., Bai, Q., Li, Z., Li, H., et al. (2020b). The spread of novel coronavirus has created an alarming situation worldwide. *J. Infection Public Health* 13, 469–471. doi: 10.1016/j.jiph.2020.03.005

Khan, S., Siddique, R., Bai, Q., Shabana, Liu, Y., Xue, M., et al. (2020c). Coronaviruses disease 2019 (COVID-19): causative agent, mental health concerns, and potential management options. *J. Infection Public Health* 13, 1840–1844. doi: 10.1016/j.jiph.2020.07.010

Khan, S., Siddique, R., Xiaoyan, W., Zhang, R., Nabi, G., Sohail Afzal, M., et al. (2021). Mental health consequences of infections by coronaviruses including severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). *Brain Behav.* 11:e01901. doi: 10.1002/brb3.1901

Kim, S.-W., Park, W.-Y., Jhon, M., Kim, M., Lee, J.-Y., Kim, S.-Y., et al. (2019). Physical health literacy and health-related behaviors in patients with psychosis. *Clin Psychopharmacol Neurosci.* 17, 279–287. doi: 10.9758/cpn.2019.17.2.279

Li, Q. (2020). Psychosocial and coping responses towards 2019 coronavirus diseases (COVID-19): a cross-sectional study within the Chinese general population. *QJM.* 113, 731–738. doi: 10.1093/qjmed/hcaa226

Li, W., Yang, Y., Liu, Z.-H., Zhao, Y.-J., Zhang, Q., Zhang, L., et al. (2020). Progression of Mental Health Services during the COVID-19 Outbreak in China. *Int. J. Biol. Sci.* 16, 1732–1738. doi: 10.7150/ijbs.45120

Lu, Y. K., Qiao, Y. M., Liang, X., Yao, W., Yan, Z., Wang, H. X., et al. (2019). Reciprocal relationship between psychosocial work stress and quality of life: the role of gender and education from the longitudinal study of the Survey of Health, Ageing and Retirement in Europe. *BMJ Open* 9:e027051. doi: 10.1136/bmjopen-2018-027051

Maurer, D. M. (2012). Screening for depression. *Am Fam Physician* 85, 139–144.

Melamed, O. C., Hahn, M. K., Agarwal, S. M., Taylor, V. H., Mulsant, B. H., and Selby, P. (2020). Physical health among people with serious mental illness in the face of COVID-19: Concerns and mitigation strategies. *Gen Hosp Psychiatry*. 66, 30–33. doi: 10.1016/j.genhosppsych.2020.06.013

Myrick, J. G., and Willoughby, J. F. (2019). Educated but anxious: how emotional states and education levels combine to influence online health information seeking. *Health Informatics J.* 25, 649–660. doi: 10.1177/1460458217719561

Nabi, G., Siddique, R., Xiaoyan, W., Ullah, R., Nawsherwan, Xue, M., et al. (2020). COVID-19 induced psychosocial stressors during gestation: possible maternal and neonatal consequences. *Curr. Med. Res. Opinion* 36, 1633–1634. doi: 10.1080/03007995.2020.1815003

Nakamura, Z. M., Nash, R. P., Laughon, S. L., and Rosenstein, D. L. (2021). Neuropsychiatric complications of COVID-19. *Curr. Psychiatry Rep.* 23:25. doi: 10.1007/s11920-021-01237-9

Niu, B., and Zhang, L. (2020). The burden of mental illness and mental distress on family members. *J. Ment. Health Policy Econ.* 23, 3–17.

van der Sanden, R. L., Pryor, J. B., Stutterheim, S. E., Kok, G., and Bos, A. E. (2016). Stigma by association and family burden among family members of people with mental illness: the mediating role of coping. *Soc. Psychiatry Psychiatric Epidemiol.* 51, 1233–1245. doi: 10.1007/s00127-016-1256-x

Vasconcelos, M., Stein, D. J., Gallas-Lopes, M., Landau, L., and de Almeida, R. M. M. (2020). Corticotropin-releasing factor receptor signaling and modulation: implications for stress response and resilience. *Trends Psychiatry Psychother.* 42, 195–206. doi: 10.1590/2237-6089-2018-0027

Vieta, E., Azorin, J. M., Bauer, M., Frangou, S., Perugi, G., Martinez, G., et al. (2012). Psychiatrists' perceptions of potential reasons for non- and partial adherence to medication: results of a survey in bipolar disorder from eight European countries. *J. Affect. Disord.* 143, 125–130. doi: 10.1016/j.jad.2012.05.041

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., et al. (2020a). Immediate psychological responses and associated factors during the initial stage of the 2019 Coronavirus Disease (COVID-19) Epidemic among the General Population in China. *Int. J Environ. Res. Public Health* 17:1729. doi: 10.3390/ijerph17051729

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., McIntyre, R. S., et al. (2020b). A longitudinal study on the mental health of general population during the COVID-19 epidemic in China. *Brain Behav. Immun.* 87, 40–48. doi: 10.1016/j.bbi.2020.04.028

Wang, L., Nabi, G., Zhang, T., Wu, Y., and Li, D. (2020c). Potential neurochemical and neuroendocrine effects of social distancing amidst the COVID-19 pandemic. *Front. Endocrinol.* 11:582288. doi: 10.3389/fendo.2020.582288

Wright, A., Salazar, A., Mirica, M., Volk, L. A., and Schiff, G. D. (2020). The invisible epidemic: neglected chronic disease management during COVID-19. *J. Gen. Intern. Med.* 35, 2816–2817. doi: 10.1007/s11606-020-06025-4

Wu, K. K., and Chan, K. S. (2003). The development of the Chinese version of Impact of Event Scale–Revised (CIES-R). *Soc. Psychiatry Psychiatric Epidemiol.* 38, 94–98. doi: 10.1007/s00127-003-0611-x

Xiang, Y. T., Yu, X., Sartorius, N., Ungvari, G. S., and Chiu, H. F. (2012). Mental health in China: challenges and progress. *Lancet* 380, 1715–1716. doi: 10.1016/S0140-6736(11)60893-3

Yuan, S., Liao, Z., Huang, H., Jiang, B., Zhang, X., Wang, Y., et al. (2020). Comparison of the indicators of psychological stress in the population of hubei province and non-endemic provinces in china during two weeks during the coronavirus disease 2019 (COVID-19) outbreak in February 2020. *Med. Sci. Monit.* 26:e923767. doi: 10.12659/MSM.923767

Zhang, X., Zhao, K., Zhang, G., Feng, R., Chen, J., Xu, D., et al. (2020). Occupational stress and mental health: a comparison between frontline medical staff and non-frontline medical staff during the 2019 novel coronavirus disease outbreak. *Front. Psychiatry* 11:555703. doi: 10.3389/fpsyt.2020.555703

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 26 May 2021
doi: 10.3389/fpsyg.2021.684222

Protective Predictors Associated With Posttraumatic Stress and Psychological Distress in Chinese Nurses During the Outbreak of COVID-19

Lu Xia[1†], *Yajun Yan*[1†] *and Daxing Wu*[1,2,3*]

[1] *Medical Psychological Center, The Second Xiangya Hospital, Central South University, Changsha, China,* [2] *Medical Psychological Institute of Central South University, Changsha, China,* [3] *National Clinical Research Center on Mental Disorders, Changsha, China*

OPEN ACCESS

Edited by:
Fushun Wang,
Nanjing University of Chinese Medicine, China

Reviewed by:
Jerrald Lau,
National University of Singapore, Singapore
Delia Virga,
West University of Timişoara, Romania

***Correspondence:**
Daxing Wu
wudaxing2017@csu.edu.cn;
wudaxing2012@126.com

[†] *These authors have contributed equally to this work and share first authorship*

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *23 March 2021*
Accepted: *29 April 2021*
Published: *26 May 2021*

Citation:
Xia L, Yan Y and Wu D (2021) Protective Predictors Associated With Posttraumatic Stress and Psychological Distress in Chinese Nurses During the Outbreak of COVID-19. Front. Psychol. 12:684222. doi: 10.3389/fpsyg.2021.684222

Background: The novel coronavirus disease 2019 (COVID-19) posed an unprecedented threat to Chinese healthcare professionals. Nevertheless, few studies notably focused on the mental health conditions of nurses and explored protective factors to prevent posttraumatic stress and psychological distress. This study aimed to explore the prevalence and the predictive factors especially defensive predictors associated with posttraumatic stress and psychological distress in nurses during the COVID-19 pandemic.

Methods: In this online study, 1,728 nurses (∼77.5% came from the COVID-19 pandemic frontline) were included in the final analysis. Posttraumatic stress disorder checklist for Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (PCL-5) and Self-Reporting Questionnaire (SRQ) was used to assess posttraumatic stress and psychological distress.

Results: The results demonstrated that the prevalence of posttraumatic stress and psychological distress in nurses throughout China between February 1, 2020 and February 13, 2020 was 39.12 and 24.36%, respectively. Multivariate logistic regression indicated that insomnia, high panic intensity, and high impact of the COVID-19 pandemic were risk predictors of posttraumatic stress and psychological distress in nurses. Married participants had a 1.58 times increased risk of having posttraumatic stress when compared with the single participants. Frontline medical staff were more likely to suffer from psychological distress. The adequate exercise was a protective predictor of psychological distress [adjusted odds ratio (AOR) = 0.655, 95% CI = 0.486–0.883], but not with posttraumatic stress. High-quality diet was a protective predictor of posttraumatic stress (AOR = 0.112, 95% CI = 0.037–0.336) and psychological distress (AOR = 0.083, 95% CI = 0.028–0.247).

Conclusions: Our study revealed the prevalence and factors associated with posttraumatic stress and psychological distress in nurses during the COVID-19 pandemic. Low panic intensity, low level of impact, satisfactory sleep, adequate exercise,

and better diet were protective factors of posttraumatic stress and psychological distress. It indicated that the psychological status of nurses (particularly those from the COVID-19 pandemic frontline) should be monitored, and protective factors associated with posttraumatic stress and psychological distress should be increased.

Keywords: COVID-19, posttraumatic stress, psychological distress, prevalence, protective predictor

INTRODUCTION

In December 2019, the novel coronavirus disease 2019 (COVID-19) outbreak which spread globally and resulted in a worldwide pandemic emerged in Wuhan, Hubei province, China (Li Q. et al., 2020). It had never been found before in humans or animals and had subsequently garnered attention around the world following the rapid increase of new cases (Wang et al., 2020). The virus belongs to the coronavirus family, which could cause respiratory infections in humans that resembled the common cold, as well as a lethal illness similar to that associated with the Middle East respiratory syndrome and severe acute respiratory syndrome (Carver and Phillips, 2020). Because of its high infectivity and uncertainty, as well as its high mortality rate, no adequate treatment was available in the short term.

During the 2nd week in March 2021, new cases continued to rise globally, increasing by 10% to over 3 million new reported cases. The Americas and Europe continued to account for over 80% of new cases and new deaths (World Health Organization, 2021). According to data released by the National Health Commission of China, the number of confirmed cases in mainland China had decreased to 164 as of March 18, 2021, but overseas imported cases had been increasing (The National Health Commission of China, 2021). As the source region of the COVID-19 pandemic, Chinese medical work still faced heavy burdens and great challenges.

This pandemic posed a huge challenge to healthcare workers (HCWs) because of successive waves of infections with short recovery phases. The COVID-19 outbreak brought a negative psychological impact on the medical staff, such as stress, depression, anxiety, and worse sleep quality (Huang and Zhao, 2020; Zhu et al., 2020). Nurses were associated with a high incidence of secondary traumatic stress even in medical routine work (Beck, 2011; Duffy et al., 2015). A recent study showed that nurses had a higher level of burnout, insomnia, and anxiety in comparison with physicians. The fear of infecting others and the fear of being infected were the only direct factors related to the COVID-19 and associated with the positive variation in nurses' symptoms of depression, anxiety, and stress (Sampaio et al., 2021). Frontline medical workers of preventing the COVID-19 had been facing more enormous pressure, including a high risk of infection and inadequate protection from contamination, overwork, frustration, discrimination, isolation, patients with negative emotions, a lack of contact with their families, and exhaustion (Kang et al., 2020).

Posttraumatic stress disorder (PTSD) is a mental health condition that could follow exposure to stressful life events. Per the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5), symptoms of PTSD included intrusive recollections of the adverse event, avoidance behavior, a sense of ongoing threat and hypervigilance, and negative alterations in cognition and mood (American Psychiatric Association, 2013). Efficacious treatments for PTSD exist (Foa et al., 2008). Understanding on risk factors that temporally preceded posttraumatic stress (PTS) symptomatology is crucially vital to develop preventative interventions; this is important in providing effective interventions for PTSD prevention (Qi et al., 2016). Psychological distress (PD) is a heterogeneous range of symptoms, which include anxiety, anguish, depression, and demoralization (Massé, 2000; Ridner, 2004). It might meet the diagnostic criteria for major depression or an anxiety disorder when such symptoms are severe.

Previous studies provided evidence that frontline HCWs experienced PD and PTS during the severe acute respiratory syndrome (SARS) outbreak (Tam et al., 2004; Wu et al., 2009). Chen revealed that gender, education level, salary, work stress, job risk, depression, anxiety, insomnia, and PTS syndrome during the epidemic period were predictors of PTS and PD (Chen et al., 2020). A meta-analysis also showed that PTSD was associated with diet, exercise, and healthier habits including sleeping (van den Berk-Clark et al., 2018).

Based on the above research evidence, we assumed that the mental health of nurses might also be egregiously affected and predicted that the prevalence of PTS and PD in nurses was high during the COVID-19 pandemic, also that diet, exercise, and sleep condition were predictors associated with PTS and PD. We evaluated the prevalence of PTS and PD in nurses during the COVID-19 pandemic and mental health among nurses by quantifying the symptoms of insomnia, panic intensity, and other aspects and by analyzing influencing factors of these symptoms. The researchers hoped that the results of this study could provide support for the targeted interventions of the mental health of nurses during the outbreak.

MATERIALS AND METHODS

Procedure and Participants

To prevent the spread of COVID-19 through contact, we used a survey based on the large Internet marketing research company in China (https://www.wjx.cn/) following the research methodology guideline (Andrews et al., 2003) to collect data. This web-based survey of COVID-19 was conducted on the Internet through the WeChat public platform. All participants using WeChat could see this survey and answered the questionnaire by scanning the two-dimensional barcodes of the questionnaire address or clicking the relevant link. The (deleted for blind

review) institutional review board approved the ethical and scientific validity of this study. Electronic informed consent was obtained from each participant before starting the investigation. This web-based questionnaire was completely voluntary and non-commercial. Participants could withdraw from the survey at any moment without providing any justification.

From February 1 to February 13, 2020, 1,970 online questionnaires were collected from nurses nationwide. A total of 1,728 nurses were included in the final analysis after excluding the 242 questionnaires with wrong information (87.71% response rate). Approximately 77.5% of the samples were frontline nurses in the COVID-19 pandemic.

Measures

Sociodemographic Variables

The questionnaire set included a brief survey to collect sociodemographic and context characteristics with the work of preventing COVID-19. According to the Italy model (Carlucci et al., 2020), sociodemographic variables included age, gender (male or female), marital status (single, married, divorced, or widowed), and the role in pandemic prevention. The role in pandemic prevention included the following three types: (1) Frontline (those who directly provided services to confirmed or suspected patients with COVID-19); (2) Medical Reserve Corps (those who probably contacted confirmed or suspected patients with COVID-19); and (3) Medical Routine Work (those who were less likely directly servicing confirmed or suspected patients with COVID-19).

We provided four items to assess the subjective influence of the COVID-19 pandemic: (1) How long are you exposed to the COVID-19 pandemic (the time in contact with the outbreak scene): always staying in the epidemic scene, most of the time at the scene of the epidemic, a small part of the time at the scene of the epidemic, not at the epidemic scene; (2) How long do you spend browsing COVID-19-related information per day: 0–2 h, 3–5 h, 6–10 h, 11–15 h, 16–24 h; (3) Do you experience panic during the COVID-19 pandemic: never, occasionally, sometimes, often, always; (4) To what extent has the current outbreak affected you: no impact, mild impact, moderate impact, severe impact, and extreme impact.

We used three items to evaluate the self-report physical conditions: (1) sleep: Insomnia was a common disorder after stress and was evaluated by the Insomnia Severity Index (ISI); (2) exercise: Exercise habits are defined as meeting the WHO physical activity recommendations for adults aged 18–64 years old; (3) diet: Diet was measured according to self-reports using the healthy eating index.

Self-Reporting Questionnaire

The SRQ was designed by the WHO as a cost-effective screening instrument for common mental disorders (Beusenberg and Orley, 1994). It consisted of 20 short questions that required a "yes" or "no" response, depending on the presence or absence of symptoms in the past month. The Chinese version of SRQ-20 comprised of three subscales: depressive symptoms (10 items), anxiety and somatic symptoms (five items), and somatic and anxiety symptoms (five items). It exhibited satisfactory psychometric properties as a screening tool for PD (Chen et al., 2009). A cutoff of seven was recommended according to WHO for evaluation of PD (Beusenberg and Orley, 1994). The measurement model of the SRQ-20 was evaluated using confirmatory factor analysis (CFA). The criteria for assessing adequate model-fit included: the normed fit index (NFI) = 0.857, the comparative fit index (CFI) = 0.873, the incremental fit index (IFI) = 0.873, and the relative fit index (RFI) = 0.837. The SRQ-20 model was acceptable. SRQ-20 had good internal consistency with Cronbach's α coefficients of more than 0.87 in our sample.

Posttraumatic Stress Disorder Checklist for DSM-5

The PTSD checklist for DSM-5 (PCL-5) was a 20-item self-report measure designed to mirror each DSM-5 PTSD symptom (Blevins et al., 2015). A total-symptom score of 0–80 could be obtained by summing up the items. The PCL-5 comprised of four subscales: intrusion symptoms (five items), avoidance symptoms (two items), cognition and mood symptoms (seven items), and arousal and reactivity symptoms (six items). It scored on a five-point Likert scale from 0 (*not at all*) to 4 (*extremely*) during the previous month. Recent reports suggested that a cut score of 33 could be used to determine probable PTSD (Blevins et al., 2015). The Chinese version of PCL-5 was amenable to adaptation to Chinese culture by the back-translation method (Wang et al., 2017). The measurement model of the PCL-5 was evaluated using CFA. The criteria for assessing adequate model-fit included: the NFI = 0.930, the CFI = 0.936, the IFI = 0.936, and the RFI = 0.919. The PCL-5 model was acceptable. Of note, reliability statistics for the PCL-5 in this study indicated excellent internal consistency for the PCL-5 total score in our sample ($\alpha = 0.96$).

Statistical Analysis

Data were analyzed with SPSS version 22.0. Main continuous variables were divided as categorical variables first and categorical variables were analyzed as frequency and percentage. Categorical variables were analyzed by adopting Fisher's exact test or Pearson's Chi-squared test. Univariate and multivariate logistic regression models were performed to explore potential protective factors of sociodemographic and context characteristics regarding work of preventing the COVID-19 for PTS and PD. Odds ratio (OR), adjusted OR (AOR), and 95% CI were calculated. *P*-values of <0.05 were considered statistically significant (two-sided tests).

RESULTS

Sociodemographic Characteristics

The sociodemographic characteristics are shown in **Table 1**. Of the 1,728 samples analyzed, the females accounted for 94.4% of the total respondents. Among these samples, 1,339 (77.5%) of participants were from the frontline, most participants were in the age intervals of 20–29 (49.3%) and 30–49 years (48.4%). Most participants came from Hunan and Hubei provinces (∼93.1%).

TABLE 1 | Demographic characteristics of the sample ($N = 1,728$).

Variable	Total ($N = 1,728$)	Non-PTS ($N = 1,052$)	PTS ($N = 676$)	Z/X^2	*p*-value	Non-PD ($N = 1,307$)	PD ($N = 421$)	Z/X^2	*p*-value
Gender				**4.229**	**0.040**			**7.763**	**0.005**
Female	1,632 (94.4%)	984 (60.3%)	648 (39.7%)			1,223 (74.9%)	409 (25.1%)		
Male	96 (5.6%)	68(70.8%)	28(29.2%)			84(87.5%)	12 (12.5%)		
Marital status				**12.310**	**0.004**			3.601	0.280
Single	556 (32.2%)	367 (66.0%)	189 (34.0%)			430 (77.3%)	126 (22.7%)		
Married	1,117 (64.6%)	650 (58.2%)	467 (41.8%)			834 (74.7%)	283 (25.3%)		
Divorced	51 (3.0%)	34 (66.7%)	17 (33.3%)			41 (80.4%)	10 (19.6%)		
Widowed	4 (0.2%)	1 (25.0%)	3 (75.0%)			2 (50.0%)	2 (50.0%)		
Age (years)				**12.159**	**0.013**			4.872	0.281
20–29	852 (49.3%)	535 (62.8%)	317 (37.2%)			649 (76.2%)	203 (23.8%)		
30–39	597 (34.5%)	347 (58.1%)	250 (41.9%)			442 (74.0%)	155 (26.0%)		
40–49	240 (13.9%)	138 (57.5%)	102 (42.5%)			181 (75.4%)	59 (24.6%)		
50–59	35 (2.0%)	29 (82.9%)	6 (17.1%)			31 (88.6%)	4 (11.4%)		
60–69	4 (0.2%)	3 (75.0%)	1 (25.0%)			4 (100.0%)	0 (0.0%)		
Role in pandemic prevention				5.125	0.077			**15.282**	**<0.001**
Frontline	1339 (77.5%)	798 (59.6%)	541 (40.4%)			989 (73.9%)	350 (26.1%)		
Medical reserve corps	162 (9.4%)	101 (62.3%)	61 (37.7%)			123 (75.9%)	39 (24.1%)		
Medical routine work	227 (13.1%)	153 (67.4%)	74 (32.6%)			195 (85.9%)	32 (14.1%)		
Exposed duration in the pandemic				**14.331**	**0.002**			**13.297**	**0.004**
Always	241 (13.9%)	132 (54.8%)	109 (45.2%)			169 (70.1%)	72 (29.9%)		
Mostly	517 (29.9%)	299 (57.8%)	218 (42.2%)			375 (72.5%)	142 (27.5%)		
Sometimes	303 (17.5%)	179 (59.1%)	124 (40.9%)			230 (75.9%)	73 (24.1%)		
Absent	667 (38.6%)	442 (66.3%)	225 (33.7%)			533 (79.9%)	134 (20.1%)		
Panic intensity during the COVID-19 pandemic				**155.118**	**<0.001**			**140.771**	**<0.001**
Never	345 (20.0%)	278 (80.6%)	67 (19.4%)			307 (89.0%)	38 (11.0%)		
Occasionally	705 (40.8%)	466 (66.1%)	239 (33.9%)			570 (80.9%)	135 (19.1%)		
Sometimes	456 (26.4%)	234 (51.3%)	222 (48.7%)			319 (70.0%)	137 (30.0%)		
Often	178 (10.3%)	64 (36.0%)	114 (64.0%)			97 (54.5%)	81 (45.5%)		
Always	44 (2.5%)	10 (22.7%)	34 (77.3%)			14 (31.8%)	30 (68.2%)		
Impact of the COVID-19 pandemic				**152.280**	**<0.001**			**143.337**	**<0.001**
Never	253 (14.6%)	207 (81.8%)	46 (18.2%)			232 (91.7%)	21 (8.3%)		
Mild	809 (46.8%)	542 (67.0%)	267 (33.0%)			659 (81.5%)	150 (18.5%)		
Moderate	516 (29.9%)	262 (50.8%)	254 (49.2%)			347 (67.2%)	169 (32.8%)		
Severe	106 (6.1%)	29 (27.4%)	77 (72.6%)			52 (49.1%)	54 (50.9%)		
Extreme	44 (2.5%)	12 (27.3%)	32 (72.7%)			17 (38.6%)	27 (61.4%)		

(Continued)

TABLE 1 | Continued

Variable	Total (*N* = 1,728)	Non-PTS (*N* = 1,052)	PTS (*N* = 676)	Z/X^2	*p*-value	Non-PD (*N* = 1,307)	PD (*N* = 421)	Z/X^2	*p*-value
Time of browsing COVID-19-related information per day				**19.073**	**0.001**			**17.797**	**0.001**
0–2 h	1032 (59.7%)	669 (64.8%)	363 (35.2%)			812 (78.7%)	220 (21.3%)		
3–5 h	607 (35.1%)	333 (54.9%)	274 (45.1%)			440 (72.5%)	167 (27.5%)		
6–10 h	68 (3.9%)	41 (60.3%)	27 (39.7%)			42 (61.8%)	26 38.2%)		
11–15 h	15 (0.9%)	6 (40.0%)	9 (60.0%)			9 (60.0%)	6 (40.0%)		
16–24 h	6 (0.3%)	3 (50.0%)	3 (50.0%)			4 (66.7%)	2 (33.3%)		
Sleep				**261.467**	**<0.001**			**296.609**	**<0.001**
Satisfactorily	925 (53.5%)	710(76.8%)	215 (23.2%)			829 (89.6%)	96 (10.4%)		
Insomnia occasionally	543 (31.4%)	264(48.6%)	279 (51.4%)			364 (67.0%)	179 (33.0%)		
Insomnia sometimes	182 (10.5%)	70(38.5%)	112 (61.5%)			102 (56.0%)	80 (44.0%)		
Insomnia frequently	66 (3.8%)	7(10.6%)	59 (89.4%)			11 (16.7%)	55 (83.3%)		
Insomnia always	12 (0.7%)	1(8.3%)	11 (91.7%)			1 (8.3%)	11 (91.7%)		
Exercise				**9.874**	**0.043**			**26.804**	**<0.001**
Never	732 (42.4%)	423 (57.8%)	309 (42.2%)			509 (69.5%)	223 (30.5%)		
Occasionally	606 (35.1%)	393 (64.9%)	213 (35.1%)			489 (80.7%)	117 (19.3%)		
Sometimes	228 (13.2%)	130 (57.0%)	98 (43.0%)			183 (80.3%)	45 (19.7%)		
Frequently	146 (8.4%)	95 (65.1%)	51 (34.9%)			115 (78.8%)	31 (21.2%)		
Always	16 (0.9%)	11 (68.8%)	5 (31.3%)			11 (68.8%)	5 (31.3%)		
Diet				**148.435**	**<0.001**			**224.467**	**<0.001**
Very poor	34 (2.0%)	5 (14.7%)	29 (85.3%)			8 (23.5%)	26 (76.5%)		
Worse	105 (6.1%)	38 (36.2%)	67 (63.8%)			38 (36.2%)	67 (63.8%)		
Average	961 (55.6%)	524 (54.5%)	437 (45.5%)			692 (72.0%)	269 (28.0%)		
Better	403 (23.3%)	299 (74.2%)	104 (25.8%)			357 (88.6%)	46 (11.4%)		
Well	225 (13.0%)	186 (82.7%)	39 (17.3%)			212 (94.2%)	13 (5.8%)		

PTS, posttraumatic stress; PD, psychological distress. Posttraumatic stress was defined as individuals who scored 33 points in PCL-5. Psychological distress was defined as individuals who scored seven points in SRQ-20. The meaning of the bold values indicates that the results are statistically significant (P-value < 0.05).

Prevalence of PTS and PD Stratified by Sociodemographic Characteristics, the Influence of COVID-19, and Physical Conditions

A total of 39.12% of the participants scored above the threshold on PCL-5 (33 or more). The overall prevalence of PD (SRQ total scores > 7) was 24.36%. The prevalence of PTS and PD stratified by sociodemographic characteristics, the influence of COVID-19, and physical conditions are presented in **Table 1**. There was a statistically significant difference in the incidence of PTS and PD by exposed duration in the pandemic ($p = 0.002$, $p = 0.004$), the time of browsing COVID-19-related information per day ($p = 0.001$), the impact ($p < 0.001$), and panic intensity ($p < 0.001$) of COVID-19 pandemic. The incidence of PTS and PD in females was significantly higher than in males ($p = 0.04$, $p = 0.005$). The prevalence of PTS and PD was significant statistically in the diet ($p < 0.001$), exercise ($p = 0.043$, $p < 0.001$), and sleep ($p < 0.001$). There was no difference in the prevalence of PTS by the role in pandemic prevention ($p > 0.05$), and there was no statistical difference in the prevalence of PD by age ($p > 0.05$) and marital status ($p > 0.05$). Cases of PCL-5 and SRQ were more likely to have a higher level of panic, stronger subjective COVID-19 impact, frequent insomnia, and poor diet quality.

Predictive Factors Associated With PTS and PD During the COVID-19 Outbreak

The associations of potential influence factors with PTS and PD during the COVID-19 pandemic were reported in **Table 2**.

In the univariate logistic regression models, marital status was significantly associated with the prevalence of PTS ($p = 0.007$) in Chinese nurses, but not with PD ($p > 0.05$). The role in pandemic prevention was linked to the prevalence of PD ($p = 0.001$) in Chinese nurses, but not with PTS ($p > 0.05$). Occasional exercise was a protective factor of PTS (OR = 0.742, 95% CI = 0.594–0.926) and PD (OR = 0.546, 95% CI = 0.423–0.705) in comparison with never exercise.

In the multivariate logistic regression models, the high (often or always) panic intensity of the COVID-19 pandemic was a risk predictor of PTS (AOR = 3.185, 95% CI = 1.976–5.134) and PD (AOR = 2.489, 95% CI = 1.433–4.324) compared with low (never) panic intensity. Compared with low (*never*) impact, high (*severe or extreme*) impact of the COVID-19 pandemic was a risk predictor of PTS (AOR=3.63, 95% CI = 1.963–6.711) and PD (AOR = 2.652, 95% CI = 1.303–5.399). Contrasting to satisfactory sleep, insomnia was a risk predictor of PTS (AOR = 12.170, 95% CI = 5.311–27.888), and PD (AOR = 18.925, 95% CI = 9.156–39.114). Besides, married participants could induce an increased risk of 1.58 times to have PTS when compared with the single (AOR = 3.63, 95% CI = 1.963–6.711), but not with PD. Compared with frontline medical staff, participants engaged in daily medical work were only.5 times more likely to suffer from PD (AOR = 0.503, 95% CI = 0.319–793). The adequate (occasionally) exercise was a protective predictor of PD compared with never exercise (AOR = 0.655, 95% CI = 0.486–883), but exercise was not a predictor for PTS in the multivariate logistic regression models. High-quality diet was a protective predictor of PTS (AOR = 0.112, 95% CI = 0.037–0.336) and PD (AOR = 0.083, 95% CI = 0.028–0.247) compared with low-quality diet.

DISCUSSION

Our cross-sectional investigation based on the web identified the high prevalence of PTS and PD of nurses during the COVID-19 pandemic in China. In our study, the prevalence of PTS was 39.12% in nurses, higher than the Wuhan residents' prevalence of PTS (7%) a month after the COVID-19 (Liu et al., 2020). The previous study (Huang and Zhao, 2020) also showed that medical staff had a high prevalence of psychological morbidity during the outbreak compared with other professionals. Females were more susceptible to traumatic exposure, which was in line with the review of Tolin and Foa (2006). Four hundred twenty-one (24.36%) medical staff reported PD, which was in line with other reports of psychological negative changes (Huang et al., 2020). We also found that frontline were likely insidious hazards of mental health. Similarly, a study revealed that frontline HCWs had a high risk of developing psychological problems (Chen et al., 2020). Also, participants who spent too much time browsing COVID-19-related information per day were more likely to be associated with PTS and PD. Evidence of event-related potential technique indicated that heightened neural reactivity and attention toward unpleasant information, predisposed children to psychiatric symptoms when exposed to higher levels of stress, which was related to natural disasters (Kujawa et al., 2016). It was further speculated that excessive attention to negative information on the pandemic might be associated with PTS and PD.

Subsequently, this study examined protective predictors of PTS and PD. In terms of the predictors, our outcomes indicated that insomnia had been linked to more severe PTS and PD similarly (Liu et al., 2020). Except that, our study found that the married experienced higher levels of PTS than the single during the outbreak. Our results were consistent with a study in Singapore (Sim et al., 2004) which found a positive association between posttraumatic morbidities and being married. Likewise, a recent study on HCWs facing the COVID-19 pandemic showed that married, divorced, or widowed operators reported higher scores in vicarious traumatization symptoms compared with unmarried HCWs (Li Z. et al., 2020). One explanation was that married participants had more burdens of taking care of family members, following with more vulnerabilities to the COVID-19. Our study also showed that the high impact and panic intensity of the COVID-19 pandemic were risk predictors of PTS and PD. It was understandable that adequate sleep and diet improved resistance to external risk. Two of the three studies indicated that PTSD was associated with a healthier diet in female health professionals (Roberts et al., 2015; Sumner et al., 2015). Similarly, having a healthy diet was also associated with less PD in the elderly when adjusting for other lifestyle behaviors (Grønning et al., 2018). Besides, our study concluded that adequate exercise was a protective predictor of PD. There was tremendous evidence of exercise benefits (Rethorst et al., 2009; Krogh et al., 2011), it

TABLE 2 | Logistic regression with variables predicting PTS and PD in medical staff (nurses).

	Nurses with and without PTS				Nurses with and without PD			
	Unadjusted		Adjusted		Unadjusted		Adjusted	
	OR (95% CI)	*p*-value	AOR (95% CI)	*p*-value	OR (95% CI)	*p*-value	AOR (95% CI)	*p*-value
Marital status		0.007		**0.002**				
Single	1 (Reference)	NA	1 (Reference)	NA				
Married	**1.395 (1.129–1.724)**	0.002	**1.582 (1.239–2.020)**	<0.001				
Divorced	0.971 (0.529–1.783)	0.924	1.137 (0.567–2.278)	0.717				
Widowed	5.825 (0.602–56.384)	0.128	6.175 (0.547–69.750)	0.141				
Role in pandemic prevention						0.001		**0.006**
Frontline					1 (Reference)	NA	1 (Reference)	NA
Medical reserve corps					0.896 (0.613–1.310)	0.571	1.247 (0.799–1.947)	0.330
Medical routine work					**0.464 (0.313–0.687)**	<0.001	**0.503 (0.319–0.793)**	0.003
Panic intensity during the COVID-19 pandemic		<0.001		**<0.001**		<0.001		**0.004**
Never	1 (Reference)	NA	1 (Reference)	NA	1 (Reference)	NA	1 (Reference)	NA
Occasionally	**2.128 (1.562–2.898)**	<0.001	**1.560 (1.097–2.217)**	0.013	**1.913 (1.301–2.814)**	0.001	1.275 (0.809–2.011)	0.295
Sometimes	**3.936 (2.848–5.442)**	<0.001	**2.175 (1.490–3.176)**	<0.001	**3.470 (2.344–5.135)**	<0.001	**1.687 (1.049–2.715)**	0.031
Often	**7.391 (4.924–11.093)**	<0.001	**3.185 (1.976–5.134)**	<0.001	**6.746 (4.311–10.558)**	<0.001	**2.489 (1.433–4.324)**	0.001
Always	**14.107 (6.638–29.981)**	<0.001	**2.648 (1.077–6.509)**	0.034	**17.312 (8.440–35.508)**	<0.001	**2.966 (1.189–7.403)**	0.020
Impact of the COVID-19 pandemic		<0.001		**<0.001**		<0.001		**0.013**
Never	1 (Reference)	NA	1 (Reference)	NA	1 (Reference)	NA	1 (Reference)	NA
Mild	**2.217 (1.560–3.150)**	<0.001	1.381 (0.930–2.052)	0.110	**2.515 (1.555–4.066)**	<0.001	1.431 (0.829–2.470)	0.198
Moderate	**4.363 (3.034–6.273)**	<0.001	**1.786 (1.169–2.729)**	0.007	**5.381 (3.319–8.721)**	<0.001	**1.996 (1.137–3.507)**	0.016
Severe	**11.948 (7.010–20.367)**	<0.001	**3.630 (1.963–6.711)**	<0.001	**11.473 (6.379–20.633)**	<0.001	**2.652 (1.303–5.399)**	0.007
Extreme	**12.000 (5.746–25.060)**	<0.001	**3.000 (1.262–7.130)**	0.013	**17.546 (8.259–37.275)**	<0.001	**3.115 (1.217–7.972)**	0.018
Sleep		<0.001		**<0.001**		<0.001		**<0.001**
Satisfactorily	1 (Reference)	NA	1 (Reference)	NA	1 (Reference)	NA	1 (Reference)	NA
Insomnia occasionally	**3.490 (2.781–4.380)**	<0.001	**2.402 (1.878–3.073)**	<0.001	**4.247 (3.219–5.601)**	<0.001	**3.033 (2.241–4.104)**	<0.001
Insomnia sometimes	**5.284 (3.778–7.389)**	<0.001	**2.786 (1.933–4.015)**	<0.001	**6.773 (4.721–9.718)**	<0.001	**3.601 (2.416–5.368)**	<0.001
Insomnia frequently	**27.834 (12.529–61.836)**	<0.001	**12.170 (5.311–27.888)**	<0.001	**43.177 (21.853–85.309)**	<0.001	**18.925 (9.156–39.114)**	<0.001
Insomnia always	**36.326 (4.663–282.963)**	0.001	**10.391 (1.169–92.391)**	0.036	**94.990 (12.131–743.790)**	<0.001	**28.725 (3.159–261.189)**	0.003
Exercise		0.043				<0.001		**0.047**
Never	1 (Reference)	NA			1 (Reference)	NA	1 (Reference)	NA
Occasionally	**0.742 (0.594–0.926)**	0.008			**0.546 (0.423–0.705)**	<0.001	**0.655 (0.486–0.883)**	0.005
Sometimes	1.032 (0.764–1.394)	0.837			**0.561 (0.391–0.806)**	0.002	**0.644 (0.418–0.991)**	0.045
Frequently	0.735 (0.507–1.064)	0.103			**0.615 (0.402–0.943)**	0.026	0.903 (0.545–1.494)	0.690
Always	0.622 (0.214–1.809)	0.384			1.038 (0.356–3.021)	0.946	0.678 (0.183–2.512)	0.561
Diet		<0.001		**<0.001**		<0.001		**<0.001**
Very poor	1 (Reference)	NA	1 (Reference)	NA	1 (Reference)	NA	1 (Reference)	NA
Worse	**0.304 (0.109–0.851)**	0.023	0.399 (0.130–1.224)	0.108	0.543 (0.224–1.317)	0.176	1.020 (0.370–2.809)	0.970
Average	**0.144 (0.055–0.375)**	<0.001	**0.242 (0.085–0.685)**	0.008	**0.120 (0.053–0.267)**	<0.001	**0.256 (0.102–0.644)**	0.004
Better	**0.060 (0.023–0.159)**	<0.001	**0.136 (0.047–0.392)**	<0.001	**0.040 (0.017–0.093)**	<0.001	**0.125 (0.047–0.332)**	<0.001
Well	**0.036 (0.013–0.099)**	<0.001	**0.112 (0.037–0.336)**	<0.001	**0.019 (0.007–0.050)**	<0.001	**0.083 (0.028–0.247)**	<0.001

OR, odds ratio; AOR, adjusted odds ratio; PTS, posttraumatic stress; PD, psychological distress; NA, not applicable.
The meaning of the bold values indicates that the results are statistically significant (P-value < 0.05).

was plausible that keeping exercise improves the physical and psychological health.

Considering the present pandemic situation that COVID-19 cases are still increasing rapidly throughout the world, the quarantine in China and even in other countries would not be abolished soon. Additionally, delayed onset of traumatic symptoms might follow the stress state (Schnyder and Cloitre, 2015). Therefore, there was a concern that the prevalence of PTS among the nurses after public pandemic catastrophes would be more severe than the results of this study. Given that the survey was conducted 3 weeks following the COVID-19 pandemic, the negative changes reported likely reflected short-term and developing aspects of PTS and PD. Continuous surveillance of the psychological consequences and customized intervention for HCWs in the COVID-19 contagion should become routine as part of preparedness efforts worldwide.

This study had several limitations. Firstly, the varying gender ratios could have probably introduced gender biases into the results. Secondly, we used a web-based survey method to avoid possible infections during the outbreak of COVID-19. Future work should take account of sample gender-balancing and collection of longitudinal empirical data. Thirdly, due to our design limitations, it might be difficult to verify the veracity of the information from participants.

CONCLUSION

In summary, we found that nurses suffered from significant PTS and PD during the COVID-19 pandemic. The psychological morbidity of the nurses was best understood by their physical condition, sociodemographic characteristics, and the impact and panic intensity of the COVID-19 pandemic. Low panic intensity, low level of impact, satisfactory sleep, adequate exercise, and better diet were protective factors of PTS and PD. Our results can provide directions on preventing PTS and PD in nurses. Further, it can also provide data to support clinical and psychological assistance for healthcare professionals and contribute to epidemic prevention and control work to other countries.

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 an ethics committee of the Second Xiangya Hospital of Central South University. The patients/participants provided their written informed consent to participate in this study. 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

DW conceived and designed the study. LX, YY, and DW performed the analysis and prepared the manuscript. All authors were involved in the study conduction and contributed substantially to its revision and approved the final manuscript.

FUNDING

This study was supported by the National Key R&D Program of China (2017YFC0820104-03), the 225 High-level Health Talents Training Project of Hunan Province of China (Grant No:), and the Natural Science Foundation of Hunan Province (Grant No: 2016JJ4101).

ACKNOWLEDGMENTS

We are grateful to the people who participated in the study, and the professionals who helped us contact the participants.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.684222/full#supplementary-material

REFERENCES

American Psychiatric Association (2013). *Diagnostic and Statistical Manual of Mental Disorders, 5th edn.* Washington, DC: Author. doi: 10.1176/appi.books.9780890425596

Andrews, D., Nonnecke, B., and Preece, J. (2003). Electronic survey methodology: a case study in reaching hard-to-involve internet users. *Int. J. Hum. Comput. Interact.* 16, 185–210. doi: 10.1207/S15327590IJHC1602_04

Beck, C. T. (2011). Secondary traumatic stress in nurses: a systematic review. *Archiv. Psychiatric Nurs.* 25, 1–10. doi: 10.1016/j.apnu.2010.05.005

Beusenberg, M., and Orley, J. (1994). *A User's Guide to the Self Reporting Questionnaire (SRQ)*. Geneva: World Health Organization.

Blevins, C. A., Weathers, F. W., Davis, M. T., Witte, T. K., and Domino, J. L. (2015). The posttraumatic stress disorder checklist for DSM-5 (PCL-5): development and initial psychometric evaluation. *J. Traumatic Stress* 28, 489–498. doi: 10.1002/jts.22059

Carlucci, L., D'Ambrosio, I., and Balsamo, M. (2020). Demographic and attitudinal factors of adherence to quarantine guidelines during COVID-19: the Italian model. *Front. Psychol.* 11:559288. doi: 10.3389/fpsyg.2020.559288

Carver, P. E., and Phillips, J. (2020). Novel coronavirus (COVID-19): what you need to know. *Workplace Health Saf.* 68, 250–250. doi: 10.1177/2165079920914947

Chen, H., Wang, B., Cheng, Y., Muhammad, B., Li, S., Miao, Z., et al. (2020). Prevalence of posttraumatic stress symptoms in health care workers after exposure to patients with COVID-19. *Neurobiol. Stress* 13:100261. doi: 10.1016/j.ynstr.2020.100261

Chen, S., Zhao, G., Li, L., Wang, Y., Chiu, H., and Caine, E. (2009). Psychometric properties of the Chinese version of the self-reporting questionnaire 20 (srq-20) in community settings. *Int. J. Soc. Psychiatry* 55, 538–547. doi: 10.1177/0020764008095116

Duffy, E., Avalos, G., and Dowling, M. (2015). Secondary traumatic stress among emergency nurses: a cross-sectional study. *Int. Emerge. Nurs.* 23, 53–58. doi: 10.1016/j.ienj.2014.05.001

Foa, E. B., Keane, T. M., Friedman, M. J., and Cohen, J. A. (2008). *Effective Treatments for PTSD: Practice Guidelines From the International Society for Traumatic Stress Studies*. New York, NY: Guilford Press.

Grønning, K., Espnes, G. A., Nguyen, C., Rodrigues, A., Gregorio, M. J., Sousa, R., et al. (2018). Psychological distress in elderly people is associated with diet, wellbeing, health status, social support, and physical functioning- a HUNT3 study. *BMC Geriatr*. 18:205. doi: 10.1186/s12877-018-0891-3

Huang, J. Z., Han, M. F., Luo, T. D., and Zhou, X. P. (2020). Mental health survey of 230 medical staff in a tertiary infectious disease hospital for COVID-19. *Chin. J. Indus. Hygiene Occup. Dis.* 2020:38. doi: 10.3760/cma.j.cn121094-20200219-00063

Huang, Y., and Zhao, N. (2020). Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 epidemic in China: a web-based cross-sectional survey. *Psychiatry Res.* 288:112954. doi: 10.1016/j.psychres.2020.112954

Kang, L., Li, Y., Hu, S., Chen, M., Yang, C., and Yang, B. X. (2020). The mental health of medical workers in Wuhan, China dealing with the 2019 novel coronavirus. *Lancet Psychiatry*. 7:e14. doi: 10.1016/S2215-0366(20)30047-X

Krogh, J., Nordentoft, M., Sterne, J. A., and Lawlor, D. A. (2011). The effect of exercise in clinically depressed adults: systematic review and meta-analysis of randomized controlled trials. *J. Clin. Psychiatry* 72, 529–538.doi: 10.4088/JCP.08r04913blu

Kujawa, A., Hajcak, G., Danzig, A. P., Black, S. R., Bromet, E. J., Carlson, G. A. (2016). Neural reactivity to emotional stimuli prospectively predicts the impact of a natural disaster on psychiatric symptoms in children. *Biol. Psychiatry* 80, 381–389. doi: 10.1016/j.biopsych.2015.09.008

Li, Q., Guan, X., Wu, P., Wang, X., Zhou, L., Tong, Y. (2020). Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *N. Engl. J. Med*. 382, 1199–1207. doi: 10.1056/NEJMoa2001316

Li, Z., Ge, J., Yang, M., Feng, J., Qiao, M., Jiang, R., et al. (2020). Vicarious traumatization in the general public, members, and non-members of medical teams aiding in COVID-19 control. *Brain Behav. Immun.* 2020:S0889–1591. doi: 10.1016/j.bbi.2020.03.007

Liu, N. Q., Zhang, F., Wei, C., Jia, Y. P., Shang, Z. L., Sun, L. N. (2020). Prevalence and predictors of PTSS during COVID-19 Outbreak in China Hardest-hit Areas: gender differences matter. *Psychiatry Res.* 2020:112921. doi: 10.1016/j.psychres.2020.112921

Massé, R. (2000). Qualitative and quantitative analyses of psychological distress: methodological complementarity and ontological incommensurability. *Qualitative Health Res.* 10, 411–423. doi: 10.1177/104973200129118426

Qi, W., Gevonden, M., and Shalev, A. (2016). Prevention of post-traumatic stress disorder after trauma: current evidence and future directions. *Curr. Psychiatry Rep.* 18:20. doi: 10.1007/s11920-015-0655-0

Rethorst, C. D., Wipfli, B. M., and Landers, D. M. (2009). The antidepressive effects of exercise. *Sports Med.* 39, 491–511. doi: 10.2165/00007256-200939060-00004

Ridner, S. H. (2004). Psychological distress: concept analysis. *J. Adv. Nurs.* 45, 536–545. doi: 10.1046/j.1365-2648.2003.02938.x

Roberts, A. L., Agnew-Blais, J. C., Spiegelman, D., Kubzansky, L. D., Mason, S. M., Galea, S., et al. (2015). Posttraumatic stress disorder and incidence of type 2 diabetes mellitus in a sample of women: a 22-year longitudinal study. *J. Am. Med. Assoc. Psychiatry* 72, 203–210. doi: 10.1001/jamapsychiatry.2014.2632

Sampaio, F., Sequeira, C., and Teixeira, L. (2021). Impact of COVID-19 outbreak on nurses' mental health: a prospective cohort study. *Environ. Res.* 194:110620. doi: 10.1016/j.envres.2020.110620

Schnyder, U., and Cloitre, M. (2015). *Evidence Based Treatments for Trauma-Related Psychological Disorders: A Practical Guide for Clinicians*. Cham: Springer, 1–15. doi: 10.1007/978-3-319-07109-1_1

Sim, K., Chong, P. N., Chan, Y. H., and Soon, W. S. (2004). Severe acute respiratory syndrome-related psychiatric and posttraumatic morbidities and coping responses in medical staff within a primary health care setting in Singapore. *J. Clin. Psychiatry* 65, 1120–1127. doi: 10.4088/JCP.v65n0815

Sumner, J. A., Kubzansky, L. D., Elkind, M. S., Roberts, A. L., Agnew-Blais, J., Chen, Q., et al. (2015). Trauma exposure and posttraumatic stress disorder symptoms predict onset of cardiovascular events in women. *Circulation* 132, 251–259. doi: 10.1161/CIRCULATIONAHA.114.014492

Tam, C. W. C., Pang, E. P. F., Lam, L. C. W., and Chiu, H. F. K. (2004). Severe acute respiratory syndrome (SARS) in Hong Kong in 2003: stress and psychological impact among frontline healthcare workers. *Psychol. Med.* 34, 1197–1204. doi: 10.1017/S0033291704002247

The National Health Commission of China (2021). *Updates on the Novel Coronavirus Outbreak Up to March 19, 2021*. Available online at: http://www.nhc.gov.cn/xcs/yqtb/202003/c588ee20113b4136b27f2a07faa7075b.shtml (accessed March 19, 2021).

Tolin, D. F., and Foa, E. B. (2006). Sex differences in trauma and posttraumatic stress disorder: a quantitative review of 25 years of research. *Psychol. Bullet.* 132, 959–992. doi: 10.1037/0033-2909.132.6.959

van den Berk-Clark, C., Secrest, S., Walls, J., Hallberg, E., Lustman, P. J., Schneider, F. D., et al. (2018). Association between posttraumatic stress disorder and lack of exercise, poor diet, obesity, and co-occurring smoking: a systematic review and meta-analysis. *Health Psychol.* 37, 407–416. doi: 10.1037/hea0000593

Wang, C., Horby, P. W., Hayden, F. G., and Gao, G. F. (2020). A novel coronavirus outbreak of global health concern. *Lancet*. 395, 470–473. doi: 10.1016/S0140-6736(20)30185-9

Wang, L., Cao, X., Cao, C., Fang, R., Yang, H., and Elhai, J. D. (2017). Factor structure of DSM-5 PTSD symptoms in trauma-exposed adolescents: examining stability across time. *J. Anxiety Disord.* 52, 88–94. doi: 10.1016/j.janxdis.2017.07.001

World Health Organization (2021). *Weekly Epidemiological Update on COVID-19*. Available online at: https://www.who.int/publications/m/item/weekly-epidemiological-update---16-march-2021 (accessed 16 March 16, 2021).

Wu, P., Fang, Y., Guan, Z., Fan, B., Kong, J., Yao, Z. (2009). The psychological impact of the SARS epidemic on hospital employees in china: exposure, risk perception, and altruistic acceptance of risk. *Can. J. Psychiatry* 54:302. doi: 10.1177/070674370905400504

Zhu, Z., Xu, S., Wang, H., Liu, Z., Wu, J., Li, G., et al. (2020). COVID-19 in Wuhan: Sociodemographic characteristics and hospital support measures associated with the immediate psychological impact on healthcare workers. *EClinicalMedicine* 24:100443. doi: 10.1016/j.eclinm.2020.100443

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 26 May 2021
doi: 10.3389/fpsyg.2021.635099

Acupuncture Combined With Emotional Therapy of Chinese Medicine Treatment for Improving Depressive Symptoms in Elderly Patients With Alcohol Dependence During the COVID-19 Epidemic

Fazheng Zhao[1,2†], *Xin Tong*[2*†] *and Changqing Wang*[1*]

[1] Nanjing Medical University, Nanjing, China, [2] Heilongjiang University of Chinese Medicine, Harbin, China

OPEN ACCESS

Edited by:
Fushun Wang,
Nanjing University of Chinese Medicine, China

Reviewed by:
Wu Qunhong,
Harbin Medical University, China
Biao Zuo,
University of Pennsylvania, United States

***Correspondence:**
Xin Tong
vvfriend80@163.com
Changqing Wang
110932359@qq.com

[†] These authors share first authorship

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: 29 November 2020
Accepted: 22 February 2021
Published: 26 May 2021

Citation:
Zhao F, Tong X and Wang C (2021) Acupuncture Combined With Emotional Therapy of Chinese Medicine Treatment for Improving Depressive Symptoms in Elderly Patients With Alcohol Dependence During the COVID-19 Epidemic. Front. Psychol. 12:635099. doi: 10.3389/fpsyg.2021.635099

Objective: We aimed to analyze the characteristics and psychological mechanism of depressive symptoms in elderly patients with alcohol dependence under the COVID-19 epidemic and to observe the effect of acupuncture combined with emotional therapy of Chinese medicine treatment on depressive symptoms in elderly patients with alcohol dependence.

Methods: Sixty patients were randomly divided into two groups. One group was treated by a set of emotional therapy of Chinese medicine treatment for 12 weeks (control group). One group was treated by a set of acupuncture combined with emotional therapy of Chinese medicine treatment for 12 weeks (treatment group). We compared the curative effect between the control group and the treatment group, the mean alcohol consumption, the SF-36 scores before and after treatment, and the scores of Hamilton Depression Scale before and after treatment of 3, 6, and 9 weeks.

Results: Based on the cognitive behavior model, the characteristics and psychological mechanism of depression in elderly patients with alcohol dependence under the COVID-19 epidemic situation were summarized. The total effective rate of the control group was 60%, and that of the treatment group was 100% ($p < 0.05$). The alcohol consumption of the patients in each group decreased significantly after treatment ($p < 0.05$), and there was no significant difference in alcohol consumption between the treatment group and the control group ($p > 0.05$). After 12 weeks of treatment, there were significant differences in PF, RF, physical pain, general health status, energy, and mental health between the treatment group and the control group ($p < 0.05$). Before and after treatment, there were significant differences in PF, RF, physical pain, general health, energy, emotional function, and mental health ($p < 0.05$) of the treatment group. The PF, energy, and mental health of the control group were significantly different before and after treatment ($p < 0.05$). There was no significant difference between the treatment

group and the control group in the scores of Hamilton Depression Scale before treatment. There was significant difference between the treatment group and the control group in the scores of Hamilton Depression Scale at 3, 6, and 9 weeks after treatment.

Conclusion: Attention, cognition, emotion, behavior, and physical response reinforce each other, creating a vicious cycle that reinforces and sustains the depressive symptoms of elderly alcohol dependence under the COVID-19 epidemic, and acupuncture combined with emotional therapy of Chinese medicine treatment for improving the depressive symptoms of elderly alcohol dependence during the epidemic period of COVID-19 has a brilliant therapeutic effect.

Keywords: acupuncture, emotional therapy, elderly alcohol dependence, depressive symptoms, COVID-19

INTRODUCTION

Recently, the United Nations issued a policy brief on "the epidemic situation of COVID-19 and mental health," which pointed out that the epidemic situation not only damages people's lives and physical health but also has a serious impact on people's psychology and spirit, and causes the associated physical and mental illness (National Board of Health, 2020). The continuation of the epidemic has had an enormous impact on the physical and mental health of the elderly in particular. Old people usually live alone, they have a lack of communication with others, and the rate of serious disease and death rate is higher, which may cause a series of negative emotions and even psychological problems (Zhang et al., 2020). During the epidemic period of COVID-19, old people tend to interpret both ordinary and unusual physical sensations in a negative way, thereby giving rise to excessive concern and concern for their physical well-being, resulting in individual suffering and substance abuse; persistent health concerns may increase the risk of alcohol dependence (Salkovskis and Warwick, 1986; Fink et al., 2010; Sunderland et al., 2013). Alcohol dependence is a series of special physiological and psychological reactions caused by excessive and repeated drinking. During the epidemic period of COVID-19, the elderly patients with alcohol dependence showed cravings for alcohol due to their bad physical and mental condition and the forced experience of drinking alcohol frequently, which ran through the whole dependence process; it is characterized by withdrawal syndrome, relapse, and tolerance. The patients show severe depressive symptoms in the process of alcoholism and abstention. The important psychological cause of the disease is anxiety about their health under emergency conditions (Zheng et al., 2005; Tyrer et al., 2020). The depression symptom perplexity causes the patient's psychological burden to aggravate, which, in turn, causes the failure to stop drinking. In the treatment of alcohol dependence, drug therapy is often used. Long-term use leads to the injury of liver, kidney, and other organs. The patients suffer great economic and economic burden and, at the same time, bring serious injury to the body. Acupuncture therapy under the guidance of the basic theory of traditional Chinese medicine takes human physiology and psychology as an organic whole and has the advantage of treating body and mind together. In the course of clinical treatment, acupuncture therapy not only fully considers the influence of biological factors on the disease but also pays more attention to the role of various psychological factors on the outcome of the disease. Acupuncture therapy is a safe and effective method for clinical treatment of physical and mental diseases by distinguishing the physical and mental characteristics of patients and treating patients individually. Emotional therapy of Chinese medicine treatment and modern cognitive behavior therapy (CBT) have the same idea; the intervention on health care is very effective and the curative effect is lasting (Olatunji et al., 2014; Tyrer et al., 2014; Cooper et al., 2017; Axelsson and Hedman-Lagerlöf, 2019), and it is helpful to alleviate health care and improve the overall health condition and reduce the economic costs associated with health concerns (Morriss et al., 2019). This study is based on the holistic view of mind and body of traditional Chinese medicine (TCM) and, on the basis of dialectical analysis of psychosomatic characteristics of elderly alcohol dependence and depressive symptoms under the COVID-19 epidemic, carries out acupuncture treatment and integrates TCM emotional therapy into it to improve the treatment of elderly patients with alcohol dependence.

CHARACTERISTICS AND MECHANISM

The characteristics of depressive symptoms in elderly patients with alcohol dependence under the COVID-19 epidemic are as follows: (1) Cognitive characteristics: (i) Disease Belief: that they have developed COVID-19; (ii) Disease Preemption Concept: the idea and picture of COVID-19 appeared repeatedly; (iii) A heightened awareness of bodily sensations and changes. (2) Somatic characteristics: (i) Anxiety-related somatic reactions: increased heart rate; (ii) A slight bodily change or sensation that is distorted (as a slight fluctuation in body temperature or a dry tickle in the throat). (3) Emotional characteristics: (i) Fear of having developed COVID-19; (ii) Fear of future infection with COVID-19; (iii) Fear or anxiety about exposure to stimuli associated with neocoronary pneumonia. (4) Behavioral characteristics: (i) Checking and confirming: such as checking the body again and again, asking for a nucleic acid test, spending a lot of time searching, and looking up information about COVID-19; (ii) Fear of catching COVID-19 in the future:

stocking up on protective materials and food, washing repeatedly, sterilizing, overprotecting, and avoiding the stimuli associated with COVID-19 (such as staying indoors, working, or taking time off from school).

The cognitive behavior model of health anxiety was first proposed by Salkovskis et al. (Salkovskis and Warwick, 1986), on the basis of which the following researchers proposed a CBT-based integrated model of health anxiety. The alcohol-dependent elderly patients with depressive symptoms during the epidemic period of COVID-19 have potentially poor health perceptions (beliefs) that can be activated by different events, such as disease-related news reports or slight changes in somatic sensation. When triggered, these poor health perceptions can lead to an individual's heightened awareness of any bodily sensations or changes that could indicate illness, and a disastrous interpretation of perceived bodily sensations or changes, triggering health anxiety; these health anxiety triggers can lead to behavioral and physical changes, further reinforcing poor health perceptions and increasing attention to changes in body perception, leading to more pronounced health anxiety and creating a vicious cycle.

In the case of COVID-19, the elderly may be filled with tension in their daily lives when they see information about the epidemic in the media, whether there are confirmed cases in their city or near their place of residence. In this context, the individual's own underlying distorted beliefs about health are activated, becoming particularly alert to information and cues related to COVID-19, and paying close attention to their own physical responses and a disastrous explanation of the slight physical sensations and changes and distorted perceptions such as "I have a little tickle in my throat that I have been infected by COVID-19 virus" and "It is a worldwide pandemic and I must be infected," causing health concerns that lead to a range of non-adaptive behaviors and physical responses (Warwick and Salkovskis, 1990). While non-adaptive behaviors, such as repeated hand washing and hand sanitizing, alleviate anxiety in the short term, in the long term, they confirm and reinforce an individual's perception of poor health (Marcus et al., 2007). In anxious situations, the presence of somatic responses such as a scratchy throat or small fluctuations in body temperature increases the individual's focus on somatic responses and can lead to an increase in health anxiety, thereby reinforcing alcohol-dependent behavior. Thus, attention, cognition, emotion, behavior, and physical response reinforce each other, creating a vicious cycle that reinforces and sustains the depressive symptoms of alcohol dependence in elderly patients under the COVID-19 epidemic.

INFORMATION AND METHOD

In the following study, 60 elderly alcohol-dependent patients with depressive symptoms hospitalized in a class A tertiary hospital in Heilongjiang province from May 2020 to October 2020 were selected for therapy. Patients were randomly divided into two groups. One group was treated by a set of emotional therapy of Chinese medicine treatment for 12 weeks (control group). One group was treated by a set of acupuncture combined with emotional therapy of Chinese medicine treatment for 12 weeks (treatment group). There were 60 elderly patients with alcohol dependence and depressive symptoms, including 38 males and 22 females, aged 60–75 years. History of drinking ranged from 12 to 38 years (average, 23.5 years). The mean body weight was 63 $\pm$ 6.1 kg, and average daily pure alcohol consumption was 38.69 $\pm$ 15.31 g, drinking four to seven times per day. Patients who had signed an informed consent form were randomly divided into two groups, regardless of age or alcohol consumption, and the groups were comparable. All the selected patients underwent physical examination without family and personal history of physical and mental diseases. The depression symptoms occurred after drinking. Patients met the World Health Organization's DIAGNOSTIC CRITERIA FOR ALCOHOL DEPENDENCE: (1) uncontrollable urge to drink; (2) a daily regular drinking pattern; (3) the need to drink more than any other activity; (4) an increase in alcohol tolerance; (5) recurrent withdrawal symptoms; (6) only continued drinking may eliminate withdrawal symptoms; and (7) withdrawal often leads to relapse (Zhang, 1993). All patients met CCMD-3 criteria for the diagnosis of alcohol-induced depression, with the following two (or more) symptoms: insomnia, heart palpitations, gastrointestinal symptoms, chronic pain, memory loss, depression, anxiety, and other symptoms (Zhang, 1993). Symptoms appear for as short as 3 months and as long as 6 years. The scores of 60 patients were 16 and 27, respectively, with an average score of 22.34. The patients were treated with TCM emotional therapy (control group) and acupuncture combined with TCM emotional therapy (treatment group) for 12 weeks.

The Method of Treatment

The treatment group is subjected to acupuncture combined with Chinese medical emotional therapy. The control group is subjected to Chinese medical emotional therapy. The methods of acupuncture are taking Baihui and Neiguan points (alternating left and right, unilateral selection), flat reinforcing and reducing manipulation, and Zusanli moxibustion. The needle is kept for 30 min and is done once every 15 min, two times per week, and eight times for the course of treatment, with a total of three courses of treatment. There are four steps of Chinese medical emotional therapy based on the cognitive behavior therapy.

Chinese medical emotional therapy is based on the idea of helping elderly patients with alcohol dependence to express their emotions and guiding them with the idea of benefiting their mental and physical health. According to the "The Medical Classic of the Yellow Emperor," it is human's instinct to seek benefit and avoid harm. The key to treatment is to understand the causes of the disease, to be aware of the detrimental effects of unhealthy behaviors on health, and to develop individualized treatment plans for elderly patients with alcohol dependence, poor compliance behavior, non-cooperation, and a high recurrence rate. All-day drinking with no self-control is due to emotional disorders and depression for a long time (to drink away sorrow and abnormal pain). The first step of Chinese medical emotional therapy is to point out the harm of the disease according to the individual condition of the patient and stimulate the patient's psychology of seeking treatment. The second step is to make the patient feel understood on the basis of the first step, a sense of belonging, and help the patient to vent through talking. The third step is to guide the elderly patient's cognition

TABLE 1 | Comparison of curative effect between the control group and the treatment group examples (%).

Groups	*n*	Full recovery	Effective	Null and void	Total efficiency
CG	30	9	9	12	60.0
TG	30	16	14	0	100.0*

*$p < 0.05$, the treatment group was compared with the control group.

TABLE 2 | Comparison of daily average alcohol consumption before and after treatment.

Groups	Average daily alcohol consumption (g) 1 week prior to treatment	Average daily alcohol consumption (g) 1 week after treatment
CG	32.16 ± 8.80	26.21 ± 7.46*
TG	33.12 ± 7.21	27.25 ± 8.11*▲

*$p < 0.05$, comparison between pre-treatment and post-treatment. ▲$p > 0.05$, the treatment group was compared with the control group.

in the direction beneficial to the treatment of the disease. The fourth step is in-depth treatment, to further help the patient to remove emotional, behavioral, and physical disorders and obtain good results. The treatment plan is treatment once a month and continuous treatment for 3 months.

Criteria for Evaluation of Efficacy

The SF-36 scale, which is widely used to assess alcohol dependence, was used to assess the score (Daeppen et al., 1998; Zhang, 2005; Luquiens et al., 2012). The final SF-36 score formula was: Final SF-36 Score = 100% (actual initial score – theoretical minimum initial score)/(theoretical maximum initial score – theoretical minimum initial score). Before treatment and 3, 6, and 9 weeks after treatment, patients were scored for depression using the Hamilton Depression Scale, and then the efficacy was evaluated according to the description of symptoms in the Chinese Medicine Syndrome Questionnaire for alcohol dependence, clinical recovery (Tong, 2012; Wang, 2014): symptoms and signs disappeared or basically disappeared; Effective: symptoms and signs are improved; Invalid: symptoms and signs are not significantly improved, or even worse.

The Method of Statistics

The measurement data were expressed by mean ± standard deviation and were statistically processed by SPSS22.0 software.

RESULTS

Evaluation of the Curative Effect Between the Control Group and the Treatment Group

The total effective rate of the control group was 60%, and that of the treatment group was 100% ($p < 0.05$). The results showed that the curative effect of acupuncture combined with TCM emotional therapy was obviously better than that of emotional therapy of the Chinese medicine treatment group. Acupuncture can adjust the circulation and metabolic function of human body. This body-mind approach works better than that of emotional therapy of the Chinese medicine treatment alone. Clinically, patients with elderly alcohol dependence may experience impaired glucose metabolism and energy supply. Acupuncture may improve the physiological and psychological state of elderly patients with alcohol-related syndrome from the perspective of regulating human glucose metabolism. However, the mechanisms of the treatment are still needed to be studied in the future (**Table 1**).

Comparison of Daily Average Alcohol Consumption Between the Control Group and the Treatment Group Before and After Treatment

The average daily alcohol consumption before and after treatment was converted into grams of pure alcohol. The results showed that the alcohol consumption of the patients in each group decreased significantly after treatment ($p < 0.05$), and there was no significant difference in alcohol consumption between the treatment group and the control group ($p > 0.05$). The results showed that both groups could reduce the average daily alcohol consumption, indicating that the treatment achieved the desired effect, but how to make TCM emotional therapy play a greater role in the course of treatment should be further discussed in future research (**Table 2**).

Comparison of SF-36 Scores Between the Control Group and the Treatment Group Before and After Treatment

After 12 weeks of treatment, there were significant differences in PF, RF, physical pain, general health status, energy, and mental health between the treatment group and the control group ($p < 0.05$). Before and after treatment, there were significant differences in PF, RF, physical pain, general health, energy, emotional function, and mental health ($p < 0.05$) of the treatment group. The PF, energy, and mental health of the control group were significantly different before and after treatment ($p < 0.05$). The results showed that acupuncture combined with TCM emotional therapy can increase the therapeutic effect (**Table 3**).

Comparison of Hamilton Depression Scale Scores Between Control Group and Treatment Group Before and After Treatment

There was no significant difference between the treatment group and the control group in the scores of Hamilton Depression Scale before treatment. There was significant difference between the treatment group and the control group in the scores of Hamilton Depression Scale at 3, 6, and 9 weeks after treatment. Under the huge epidemic disaster and stress, the elderly alcohol-dependent patients need more personalized psychological counseling in order to effectively alleviate the depression (**Table 4**).

TABLE 3 | Comparison of SF-36 scores between two groups before and after treatment.

Groups		PF	RF	Somatic pain	General health condition
TG	Pre-treatment	65.0 ± 4.0	51.3 ± 3.2	80.5 ± 4.1	64.2 ± 4.1
	Post-treatment	73.0 ± 3.2*▲	67.2 ± 4.2*▲	90.3 ± 3.2*▲	76.7 ± 5.4*▲
CG	Pre-treatment	64.1 ± 3.3	50.7 ± 2.5	81.1 ± 3.8	63.1 ± 4.0
	Post-treatment	66.8 ± 4.6*	52.8 ± 3.0	81.8 ± 4.6	65.4 ± 3.2
Groups		**Energy**	**Social function**	**Emotional function**	**Mental health**
TG	Pre-treatment	61.3 ± 5.3	67.0 ± 6.2	75.2 ± 5.3	57.1 ± 3.5
	Post-treatment	74.1 ± 4.0*▲	69.3 ± 4.1	79.7 ± 5.2*	68.0 ± 4.5*▲
CG	Pre-treatment	60.6 ± 3.9	66.1 ± 4.7	75.6 ± 5.0	57.6 ± 5.8
	Post-treatment	63.8 ± 4.6*	67.8 ± 2.4	78.0 ± 3.1	60.8 ± 3.1*▲

*$p < 0.05$, comparison between pre-treatment and post-treatment. ▲$p < 0.05$, the treatment group was compared with the control group.

TABLE 4 | Comparison of Hamilton Depression Scale scores.

Groups	*n*	Pre-treatment	3 weeks later	6 weeks later	9 weeks later
CG	30	31.43 ± 3.24	27.33 ± 3.40	19.21 ± 2.24	16.43 ± 3.51
TG	30	29.30 ± 3.11	23.54 ± 3.17*	14.43 ± 2.30*	11.48 ± 3.01*

*$p < 0.01$, the treatment group was compared with the control group.

DISCUSSION

Through clinical observation, it was found that the depression of the elderly patients with alcohol dependence during the epidemic period of COVID-19 was caused by not only emotional stimulation but also the loss of confidence and determination after the failure of abstention, a violent mood change. Because of the long-term effects of alcohol, metabolic disorders and abnormal secretion of neurotransmitters in the body cause a series of chronic pain, dizziness, and other physical discomfort and depression. Elderly patients with alcohol dependence and depression are often depressed due to emotional injury. Acupuncture can adjust the patients' emotional disorder by regulating the circulation of the body. Human's psychological activity and physiological activity are a pair of main contradictory movements in normal life. They interact and condition each other. Psychological activity is a kind of life phenomenon that is produced on the basis of normal physiological activity of human body. Meanwhile, the production of psychological activity, in turn, affects various physiological activities of human body. It is on the basis of this dialectical relationship that acupuncture can affect people's various pathological and psychological processes by regulating people's physiological activities.

This study applied acupuncture combined with emotional therapy of Chinese medicine treatment during the epidemic period of COVID-19, which not only effectively lightened the mood of the elderly patients but also played a positive role in psychological suggestion, such that patients enhance the acupuncture manipulation and acupoint treatment of the psychological trust and benefit. This method can reduce the psychological craving caused by physical discomfort and emotional disorder (abnormal) in the elderly patients with alcohol dependence. During the epidemic period of COVID-19, acupuncture combined with emotional therapy of Chinese medicine treatment can improve the depressive symptoms of the elderly patients with alcohol dependence. After the outbreak of the COVID-19 epidemic, people's psychological state has also changed because of the influence of the epidemic situation and the change of lifestyle. The COVID-19 virus has the characteristics of long latent period, atypical clinical symptoms, easily missed diagnosis and misdiagnosis, and long isolation period. Due to the rapid spread of information, it is difficult for the public to distinguish true from the false information. In particular, it has caused significant short- and long-term physical and mental health damage to the elderly (Li et al., 2003; Zhu et al., 2004; Lee et al., 2006). The anxiety and depression experienced by the elderly due to the epidemic cannot be effectively addressed, resulting in an increase in the number of elderly people suffering from alcohol dependence, which requires additional attention. Therefore, it is of great significance to find an effective treatment method.

CONCLUSION

By clinical observation, it was found that the depression of the elderly patients with alcohol dependence during the epidemic period of COVID-19 was not only caused by emotional stimulation but also caused by the loss of confidence and determination after the failure of abstention, a violent mood change. Because of the long-term effects of alcohol, metabolic disorders and abnormal secretion of neurotransmitters in the body cause a series of chronic pain, dizziness, and other

physical discomfort and depression. Elderly patients with alcohol dependence and depression are often depressed due to emotional injury. Acupuncture can adjust the patients' emotional disorder by regulating the circulation of the body. Human's psychological activity and physiological activity are a pair of main contradictory movements in normal life. They interact and condition each other. Psychological activity is a kind of life phenomenon that is produced on the basis of normal physiological activity of human body. Meanwhile, the production of psychological activity, in turn, affects various physiological activities of human body. It is on the basis of this dialectical relationship that acupuncture can affect people's various pathological and psychological processes by regulating people's physiological activities. This study applied acupuncture combined with emotional therapy of Chinese medicine treatment during the epidemic period of COVID-19, which not only effectively lightened the mood of the elderly patients but also played a positive role in psychological suggestion, such that patients enhance the acupuncture manipulation and acupoint treatment of the psychological trust and benefit. This method can reduce the psychological craving caused by physical discomfort and emotional disorder (abnormal) in the elderly patients with alcohol dependence. During the epidemic period of COVID-19, acupuncture combined with emotional therapy of Chinese medicine treatment can improve the depressive symptoms of the elderly patients with alcohol dependence.

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 Heilongjiang University of Chinese medicine Ethical Commission. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

CW, FZ, and XT contributed to the conception and design of the study, contributed to the acquisition of data, contributed to the analysis and interpretation of data, contributed to the drafting of the manuscript, and contributed to the critical revision of the manuscript. All authors read and approved the final manuscript for publication.

ACKNOWLEDGMENTS

The authors acknowledge the National Natural Science Foundation of China Program (81503495), the Heilongjiang Foundation Program for Natural Science (H2017060), the Heilongjiang Foundation Program for Philosophy and Social Sciences (20SHB076), the Research Project of Sichuan Hospital Management and Development Research Center (SCYG2020-13), Key Issues of Education Science Planning in Heilongjiang Province (GJB1421320), and Special Topics on COVID-19 Epidemic Key Issues of Heilongjiang Province (GJE1320156) for financial support.

REFERENCES

Axelsson, E., and Hedman-Lagerlöf, E. (2019). Cognitive behavior therapy for health anxiety: systematic review and meta-analysis of clinical efficacy and health economic outcomes. *Expert Rev. Pharmacoecon. Outcomes Res.* 19, 663–676. doi: 10.1080/14737167.2019.1703182

Cooper, K., Gregory, J. D., Walker, I., Lambe, S., and Salkovskis, P. M. (2017). Cognitive behaviour therapy for health anxiety:a systematic review and meta-analysis. *Behav. Cogn. Psychother* 45, 110–123. doi: 10.1017/S1352465816000527

Daeppen, J. B., Krieg, M. A., Burnand, B., and Yersin, B. (1998). MOS-SF-36 in evaluating health-related quality of life in alcohol-dependent patients. *Am. J. Drug Alcohol Abuse* 24, 685–694. doi: 10.3109/00952999809019617

Fink, P., Ørnbøl, E., and Sparle, C. K. (2010). The outcome of health anxiety in primary care. A two-year follow-up study on healthcare costs and self-rated health. *PLoS ONE* 5:e9873. doi: 10.1371/journal.pone.0009873

Lee, T. C., Chi, I., Chung, L. W. M., and Chou, K.-L. (2006). Ageing and psychological response during the post-SARS period. *Aging Mental Health* 10, 303–311. doi: 10.1080/13607860600638545

Li, Y. H., Wang, S. W., Fang, A. J., et al. (2003). The influence of SARS on the mental health of different old people. *Chin. J. Behav. Med. Sci.* 12, 566–567.

Luquiens, A., Reynand, M., Falissard, B., and Aubin, H. J. (2012). Quality of life among alcohol-dependent patients: how satisfactory are the available instruments? A systematic review. *Drug Alcohol Depend.* 125, 192–202. doi: 10.1016/j.drugalcdep.2012.08.012

Marcus, D. K., Gurley, J. R., Marchi, M. M., and Bauer, C. (2007). Cognitive and perceptual variables in hypochondriasis and health anxiety: a systematic review. *Clin. Psychol. Rev.* 27, 127–139. doi: 10.1016/j.cpr.2006.09.003

Morriss, R., Patel, S., Malins, S., Guo, B., Higton, F., James, M., et al. (2019). Clinical and economic outcomes of remotely delivered cognitive behaviour therapy versus treatment as usual for repeat unscheduled care users with severe health anxiety: amulti-centre randomised controlled trial. *BMC Med.* 17:16. doi: 10.1186/s12916-019-1253-5

National Board of Health (2020). *Circular on the Issuance of Guidelines for Emergency Psychological Crisis Intervention in Cases of Pneumonia With Novel Coronavirus Infection.* Available online at: http://www.nhc.gov.cn/xcs/zhengcwj/202001/6adc08b966594253b2b791be5c3b9467.shtml,2020-01-27 (accessed March 16, 2021).

Olatunji, B. O., Kauffman, B. Y., Meltzer, S., Davis, M. L., Smits, J. A., and Powers, M. B. (2014). Cognitive behavioral therapy for hypochondriasis/health anxiety: a meta-analysis of treatment outcome and moderators. *Behav. Res. Ther.* 58, 65–74. doi: 10.1016/j.brat.2014.05.002

Salkovskis, P. M., and Warwick, H. M. (1986). Morbid preoccupations, health anxiety and reassurance:a cognitive-behavioural approach to hypochondriasis. *Behav. Res. Ther.* 24, 597–602. doi: 10.1016/0005-7967(86)90041-0

Sunderland, M., Newby, J. M., and Andrews, G. (2013). Health anxiety in Australia: prevalence, comorbidity, disability and service use. *Br. J. Psychiatry* 202, 56–61. doi: 10.1192/bjp.bp.111.103960

Tong, X. (2012). Effect of Xingqi Jieyu capsule combined with amitriptyline on latent depression in college students. *Chin. Med. Inform.* 29, 68–69.

Tyrer, P., Cooper, S., Salkovskis, P., Tyrer, H., Crawford, M., Byford, S., et al. (2014). Clinical and cost effectiveness of cognitive behaviour therapy for health

anxiety in medical patients: randomized controlled trial. *Lancet* 383, 219–225. doi: 10.1016/S0140-6736(13)61905-4

Tyrer, P., Wang, D., Crawford, M., Dupont, S., Cooper, S., Nourmand, S., et al. (2020). Sustained benefit of cognitive behaviour therapy for health anxiety in medical patients (CHAMP) over 8 years: a randomised-controlled trial. *Psychol. Med.* 16, 1–9. doi: 10.1017/S003329172000046X

Wang, Z. (2014). *Clinical and Experimental Study on TCM Syndrome Characteristics of Alcohol Dependence and the Method of Relieving Heat and Tranquilizing the Mind to Treat Alcohol and Alcohol Dependence*. Beijing: Beijing University of Chinese Medicine.

Warwick, H. M. C., and Salkovskis, P. M. (1990). Hypochondriasis. *Behav. Res. Ther*. 28, 105–117. doi: 10.1016/0005-7967(90)90023-C

Zhang, J., Sun, R., and Yang, J. (2020). Anxiety and depression in elderly patients during epidemic period of COVID-19 and its influencing factors. *Chin. J. Mult. Organ Dis. Elderly* 19:8.

Zhang, M. (1993). *Handbook of Psychometric Rating Scale*. Changsha: Hunan Science and Technology Publishing House.

Zhang, Z. (2005). *Handbook of Behavioral Medicine Scales*. Beijing: China Medical Electronic Audio & Video Publishing House.

Zheng, G., Jimba, M., and Wakai, S. (2005). Exploratory study on psychosocial impact of the Severe Acute Respiratory Syndrome (SARS) outbreak on Chinese students living in Japan. *Asia Pac. J. Public Health* 17, 124–129. doi: 10.1177/1010539505017 00211

Zhu, N., Yuan, Y., Kong, Q., et al. (2004). The effect of anxiety on the condition of elderly soldiers during SARS. *Chin. J. Behav. Med. Sci.* 13:453.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 28 May 2021
doi: 10.3389/fpsyg.2021.664964

Using Mindfulness to Reduce Anxiety and Depression of Patients With Fever Undergoing Screening in an Isolation Ward During the COVID-19 Outbreak

Yuping Liu[1†], Sizhu Huyang[2,3†], Haihong Tan[1], Yubiao He[1], Jin Zhou[1], Xue Li[1], Man Ye[4], Jin Huang[4] and Daxing Wu[2,3,5*]*

[1]Department of Infectious Diseases, The Second Xiangya Hospital, Central South University, Changsha, China, [2]Medical Psychological Center, The Second Xiangya Hospital of Central South University, Changsha, China, [3]Medical Psychological Institute of Central South University, Changsha, China, [4]Clinical Nursing Teaching and Research Section, The Second Xiangya Hospital, Central South University, Changsha, China, [5]National Clinical Research Center for Mental Disorders, Changsha, China

OPEN ACCESS

Edited by:
Fushun Wang,
Nanjing University of Chinese Medicine, China

Reviewed by:
Paolo Roma,
Sapienza University of Rome, Italy
Feng Jiang,
Shanghai Jiao Tong University, China

***Correspondence:**
Jin Huang
Huangjin71@csu.edu.cn
Daxing Wu
wudaxing2017@csu.edu.cn;
wudaxing2012@126.com

[†]These authors have contributed equally to this work and share first authorship

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: 06 February 2021
Accepted: 27 April 2021
Published: 28 May 2021

Citation:
Liu Y, Huyang S, Tan H, He Y, Zhou J, Li X, Ye M, Huang J and Wu D (2021) Using Mindfulness to Reduce Anxiety and Depression of Patients With Fever Undergoing Screening in an Isolation Ward During the COVID-19 Outbreak. Front. Psychol. 12:664964. doi: 10.3389/fpsyg.2021.664964

The coronavirus disease 2019 (COVID-19) continues to spread globally. This infectious disease affects people not only physically but also psychologically. Therefore, an effective psychological intervention program needs to be developed to improve the psychological condition of patients screened for fever during this period. This study aimed to investigate the effect of a brief mindfulness intervention on patients with suspected fever in a screening isolation ward awaiting results of the COVID-19 test. The Faces Scale and the Emotional Thermometer Tool were used to investigate 51 patients who were randomly divided into an intervention group and a control group. All patients completed self-rating questionnaires online at the time they entered the isolation ward and before they were informed of the results. The intervention group listened to the mindfulness audios through hospital broadcasts in the isolation ward before their lunch break and while they slept. Compared with the control group, the intervention group's life satisfaction score increased ($F = 4.02$, $p = 0.051$) and the emotional thermometer score decreased ($F = 8.89$, $p = 0.005$). The anxiety scores ($F = 9.63$, $p = 0.003$) and the needing help scores decreased significantly ($F = 4.95$, $p = 0.031$). Distress ($F = 1.41$, $p = 0.241$), depression ($F = 1.93$, $p = 0.171$), and anger ($F = 3.14$, $p = 0.083$) also decreased, but did not reach significance. Brief mindfulness interventions can alleviate negative emotions and improve the life satisfaction of patients in the isolation ward who were screened for COVID-19 during the waiting period.

Keywords: coronavirus disease 2019, brief mindfulness intervention, isolation ward, anxiety, depression

INTRODUCTION

From December 2019, the outbreak of the coronavirus disease 2019 (COVID-19) has had a massive impact on both physical and psychological well-being. Fever, tiredness, and dry cough are the most common symptoms of COVID-19. Most people can recover without special treatment, but they are highly contagious and can be infectious during the incubation period.

Thus, the transmission speed of COVID-19 was not fully understood during the initial stage. The National Health Commission of China (NHC) responded swiftly and included COVID-19 in Category B of notifiable diseases, defined by the *Law of the People's Republic of China on the Prevention and Treatment of Infectious Diseases* (*Revised*; CDC, 2020) on January 20th, 2020. The NHC announced that the country would implement preventive and control measures for Category A of infectious diseases to effectively fight against pneumonia caused by the novel coronavirus. The government has taken several efficient measures to curb the spread of the epidemic, such as halting most businesses and social activities, quarantining measures, assigning designated hospitals for COVID-19 treatment, and building cabin hospitals.

An online survey found that over half of the respondents were psychologically affected and one-third of the respondents showed moderate-to-severe anxiety (Wang et al., 2020c). Several longitude researches in different countries have reported that, during the lockdown, people showed a significant increase in depression, anxiety, and psychological distress, some people even experienced PTSD-related symptoms (Pierce et al., 2020; Planchuelo-Gómez et al., 2020; Roma et al., 2020; Wang et al., 2020b). Moreover, the results of the Di Giuseppe et al. (2020) and Planchuelo-Gómez et al. (2020) suggest that contact with positive cases, lockdown time, the young age, female gender, and consumption of information about COVID-19 were risk factors for psychological symptoms. When people are confined to their homes or some designated places, they spend most of their day watching the news or browsing websites for information about COVID-19 and worrying about their family members who may or may not contract the disease. Contrary to the outbreak of severe acute respiratory syndrome in 2002, online information has replaced newspapers and TV coverage and has become the main source for people to obtain information. However, the information contains not only official reports but also rumors (The Lancet, 2020; Wang et al., 2020c). Meanwhile, self-quarantining can result in people spending too much time on the internet, which leads to social isolation and causes emotional discomfort and psychological stress (Barbisch et al., 2015).

Since the outbreak of COVID-19 in Wuhan, a fever screening system in the isolation ward of a 3A grade hospital has begun to treat and test symptomatic COVID-19 patients. Doctors evaluate the clinical status, survey past, and epidemiology history of outpatients, and then transfer these patients to a fever screening in an isolation ward. Patients stayed in the ward until the test results were obtained. During quarantine, patients suffered from physical discomfort and psychological distress such as feelings of fear, loneliness, terror, and anger (Xiao, 2020). On January 1st, 2020, the NHC issued guiding principles for emergency psychological crisis interventions for the outbreak of COVID-19. They suggested that we do our best to prevent the further spread of COVID-19 and simultaneously pay attention to psychological crisis interventions to reduce the negative impact on people's psychological well-being and provide specific instructions of psychological intervention to different patients, medical staff, and non-clinical people.

Based on a study of people living in Italy during COVID-19 Pandemic (Conversano et al., 2020b), research indicated that besides social relationship and older age, mindfulness is also an important protective factor against psychological distress. To be specific, mindfulness can help us deal with the stress situation what we are going through, which is based on two primary elements in clinical psychology: (1) people are aware of their present experience and (2) do not judge the present experience and accept the present experience (Keng et al., 2011). In recent years, mindfulness-based interventions have been widely used in clinical patients such as those with cancer, psychological disorders, psychiatric illnesses, and non-clinical patients. Researchers suggest that mindfulness can have a positive influence on psychology, including improving well-being, reducing psychological syndromes, and even modulating behaviors. After mindfulness interventions, people showed a reduction in anxiety levels (Hoge et al., 2013; Würtzen et al., 2013), depression (Deyo et al., 2009; Würtzen et al., 2013), anger, and an increase in forgiving tendencies, life satisfaction, and life equality (Brown and Ryan, 2003). Regardless of short or long-term mindfulness interventions (Shapiro et al., 2006; Lorca et al., 2019), people in the experimental groups showed promising changes during the interventions compared to the control group.

In our research, we aimed to observe the psychological states of patients who were isolated in a ward, promote awareness of COVID-19, and compare the effects of the psychological intervention. We instructed these inpatients to apply mindfulness through standard intervention recording *via* hospital broadcasts instead of face-to-face interactions to minimize the possibility of infection.

MATERIALS AND METHODS

Participants

In this study, we recruited participants from February 1, 2020 to April 30, 2020. The participants were patients with fever who underwent screening in an isolation ward of a 3A grade hospital. The inclusion criteria were patients who (1) had a clear consciousness, (2) were over 18 years of age, (3) had suspected fever or needed to be further diagnosed, (4) were willing to cooperate with the investigation and psychological intervention, and (5) were able to use WeChat and complete questionnaires online. A total of 51 patients were recruited for the study by convenience sampling and were divided into the intervention group (odd day of admission date) and the control group (even day of admission date) according to their admission time. Participation was voluntary and informed consent was obtained. The experimental protocols were approved by the Ethical Committee of the Second Xiangya Hospital of Central South University.

Table 1 presents the demographic information of the intervention group (n = 25) and control group (n = 26), which included gender, age, education level, marital status, and living situation (with or without family). We also used the Generalized Anxiety Disorder Scale (GAD-7; Spitzer et al., 2006) and the

Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001) to evaluate anxiety level and patients' mental status between the two groups.

Materials

The Frequently Asked Questions about COVID-19 (FAQ-C) was compiled by specialists and professors based on *Public protection and psychological counseling about COVID-19*, published by the Second Xiangya Hospital of Central South University. All the questions were multiple-choice and alternative questions, and were graded out of 100 points.

The Faces Scale (FS; Andrews and Crandall, 1976; Andrews and Stephen, 1976) was utilized. The scale contained eight different cartoon faces, which varied from a very happy face to a very sad face, and aimed to assess satisfaction with recent life (positive and negative feelings).

The Emotional Thermometer Tool (ET; Mitchell et al., 2010a,b) is a visual analog screening tool used to detect emotional disorders in a clinical situation. We adopted the Chinese version of ET (Cheng et al., 2021), which consisted of five items: distress, anxiety, depression, anger, and help (*e.g., In the first four columns, please circle the number that best describes how much emotional upset you have been experiencing in the past week, including today since outbreak of the coronavirus disease 2019. In the last column, please indicate how much you need help for these concerns*). Cronbach's alpha reliability in this research was 0.78.

The seven-item GAD-7 (Spitzer et al., 2006) is designed to screen for generalized anxiety disorder and evaluate its severity (*e.g., Feeling nervous, anxious or on edge?*). The questionnaire was widely used in clinical practice and the situation of patients was assessed for the past 2 weeks. In this study, Cronbach's alpha was 0.894.

The PHQ-9 (Kroenke et al., 2001) has diagnostic validity and is efficient in clinical situations. This questionnaire had nine items and only took patients a few minutes to complete to screen for depression in the past 2 weeks (*e.g., Thoughts that you would be better off dead or of hurting yourself in some way?*). Researchers should be aware of people with a score of over five in the case of depression. Cronbach's alpha reliability of this study was 0.850.

Procedure

Routine Procedure

All participants received routine care. In the isolation ward, we followed the standard operating procedure to allow patients to be hospitalized for treatment. We taught them about sterilization and quarantine measures. In addition, patients took medicines prescribed by their doctors and remained on proper treatment according to their state of illness.

We educated patients about COVID-19 to prevent further spread and promoted awareness of COVID-19, which was referred to as *Public protection and psychological counseling about COVID-19*, published by the Second Xiangya Hospital of Central South University. The control group received routine care and scientific information about COVID-19. Compared to the control group, the intervention group received the same along with psychological intervention.

The patients filled out the questionnaire twice, each time taking about 5 min. First, at the time of admission, and then again before the results from the COVID-19 testing laboratory. The interval between the two questionnaires varies from about

TABLE 1 | Characteristics of intervention and control patients: mean ± SD.

	Intervention group (*N* = 25)	Control group (*N* = 26)	χ^2/t	*p*
Demographics				
Gender (*n*, %)			4.45	0.048*
Female	11 (44%)	7 (27%)		
Male	14 (56%)	19 (73%)		
Age (years)	33.74 ± 13.04	35.85 ± 11.91	−0.59	0.557
Highest educational level (*n*, %)			7.87	0.089
Primary school	1 (4%)	3 (12%)		
Junior middle school	3 (12%)	3 (12%)		
Senior middle school	3 (12%)	8 (31%)		
University	16 (64%)	7 (27%)		
Post-graduate degree	2 (8%)	5 (19%)		
Marriage status (*n*, %)			2.69	0.227
Single	12 (48%)	7 (27%)		
Married	12 (48%)	18 (70%)		
Divorced/widowed	1 (4%)	1 (4%)		
Living situation (*n*, %)			0.60	0.499
Alone	6 (24%)	4 (15%)		
With family member	19 (76%)	22 (85%)		
Nervousness about COVID-19	2.56 ± 1.39	2.88 ± 1.11	−0.93	0.359
Panic regarding COVID-19	2.56 ± 1.19	2.85 ± 1.23	−0.85	0.402
GAD-7	4.04 ± 4.01	5.35 ± 3.93	−1.17	0.250
PHQ-9	4.00 ± 3.71	5.35 ± 4.35	−1.19	0.241

SD, standard deviation; χ^2, chi-square test for categorical variables; GAD-7, Generalized Anxiety Disorder Scale; PHQ-9, Patient Health Questionnaire.
*$p < 0.05$.

10 to 24 h depending on the time of admission. The COVID-19 test results for all patients were negative.

Brief Mindfulness Intervention

The intervention group also received psychological intervention. We built a professional psychological service team that consisted of professors of clinical psychology, head nurses, and experienced core members of our department. During the waiting time, our members monitored patients' feelings and used an online psychological service platform for one-on-one communication. Meanwhile, we encouraged patients to share about their experience and encouraged them to relieve their psychological burdens with positive speech and behaviors.

We sent light music to participants *via* WeChat; moreover, the ward's broadcast would play music for 30–60 min during the lunch break and before sleep. The selected music was composed of BANDARI light music and a mindfulness instruction audio. In the 25-min mindfulness instruction audio, the speaker helped the patients pay attention to themselves by using guiding words to focus repeatedly on the breath or other objects, and consciously relaxing all parts of the body in order to concentrate, increase the feeling of the self-body, and focus on the present moment.

Statistical Analysis

All data were analyzed using SPSS25 and GraphPad Prism8 (GraphPad Software, San Diego, CA, United States). We performed a chi-square test or an independent-samples *t*-test to compare the characteristics of patients in the two groups. The results of GAD-7 and PHQ-9 between groups were compared using independent-sample *t*-tests. First, the results of the FAQ-C, FS, and ET questionnaires before and after the intervention were separately conducted using the independent-samples *t*-test. Second, we performed a two-way repeated measures ANOVA to further compare the effect of a mindfulness intervention on the two groups, with gender as a covariate. Statistical significance was set at $p < 0.05$.

RESULTS

There were no significant differences between the intervention and control groups in terms of age, education level, marriage, and living situation (**Table 1**). However, there was a significant difference in gender ($\chi^2 = -0.59$, $p = 0.048$). The scores of the GAD-7 ($t = -1.17$, $p = 0.250$) and PHQ-9 ($t = -1.19$, $p = 0.241$) did not differ significantly between the two groups.

We recorded the baseline and post-intervention scores of FAQ-C, FS, the total score of ET, and five sub-tests scores of ET. The baseline scores between the two groups were not significantly different (**Table 2**). After the intervention, compared to the control groups, the ET ($t = 13.08$, $p = 0.001$), ET-distress ($t = 12.71$, $p = 0.001$), ET-anxiety ($t = 8.67$, $p = 0.005$), ET-depression ($t = 5.78$, $p = 0.020$), ET-anger ($t = 9.41$, $p = 0.004$), and ET-help ($t = 5.86$, $p = 0.019$) were significantly lower in the intervention group, and FS scores were much higher ($t = 9.71$, $p = 0.003$).

TABLE 2 | Independent-samples *t*-test results of pre- and post-intervention between two groups†.

	Inter. (SD)	Con. (SD)	*t*	*p*
Pre-intervention				
FAQ	85.20 (12.95)	80.77 (15.98)	0.81	0.374
FS	4.92 (1.04)	4.65 (1.50)	1.34	0.253
ET	13.08 (9.40)	16.42 (11.61)	1.08	0.303
Distress	2.80 (2.42)	4.46 (3.24)	3.90	0.054
Anxiety	3.52 (3.08)	4.12 (3.02)	0.14	0.710
Depression	1.40 (1.68)	2.12 (2.74)	0.93	0.340
Anger	1.60 (2.45)	1.73 (2.51)	0.09	0.765
Help	3.76 (3.49)	4.00 (3.81)	0.12	0.728
Post-intervention				
FAQ	86.04 (23.12)	86.54 (13.84)	0.13	0.716
FS	5.56 (0.96)	4.50 (1.42)	9.71	0.003**
ET	9.04 (7.63)	18.15 (10.71)	13.08	<0.001***
Distress	2.08 (2.18)	4.58 (2.76)	12.71	<0.001***
Anxiety	2.32 (2.53)	4.42 (2.64)	8.67	0.005**
Depression	1.08 (1.44)	2.50 (2.37)	5.78	0.020*
Anger	0.56 (0.92)	2.00 (2.48)	9.41	0.004**
Help	3.00 (2.87)	4.96 (3.25)	5.86	0.019*

SD, standard deviation. †Covariance: gender. FAQ, The Frequently Asked Questions about COVID-19 scores; FS, The Faces Scale scores; ET, The Emotional Thermometer Tool scores.
**p < 0.05; **p < 0.01; ***p < 0.001.*

TABLE 3 | Results of the FAQ, FS, and ET in the control and intervention group before and after mindfulness intervention with two-way repeated measures ANOVA†.

	Effect	*F* ratio	*p*	Partial η^2
FAQ	Group	0.04	0.836	0.001
	Time	1.21	0.277	0.010
	Group × Time	1.60	0.212	0.032
FS	Group	5.74	0.021*	0.107
	Time	2.04	0.160	0.041
	Group × Time	4.02	0.051	0.077
ET	Group	5.83	0.020*	0.108
	Time	0.90	0.347	0.018
	Group × Time	8.89	0.005**	0.156
ET-Distress	Group	9.78	0.003**	0.169
	Time	0.05	0.824	0.001
	Group × Time	1.41	0.241	0.029
ET-Anxiety	Group	2.79	0.101	0.055
	Time	2.87	0.097	0.056
	Group × Time	9.63	0.003**	0.167
ET-Depression	Group	3.24	0.078	0.063
	Time	0.10	0.756	0.002
	Group × Time	1.93	0.171	0.039
ET-Anger	Group	3.61	0.063	0.070
	Time	0.09	0.766	0.002
	Group × Time	3.14	0.083	0.061
ET-Help	Group	2.13	0.151	0.043
	Time	0.33	0.567	0.007
	Group × Time	4.95	0.031*	0.095

FAQ, The Frequently Asked Questions about COVID-19 scores; FS, The Faces Scale scores; ET, The Emotional Thermometer Tool scores. †Covariance: gender.
**p < 0.05; **p < 0.01.*

Although the score of the first test was not significantly different, further analysis is needed to rule out its effect. A two-way repeated measures ANOVA was used to compare the difference in the second-test score between the intervention

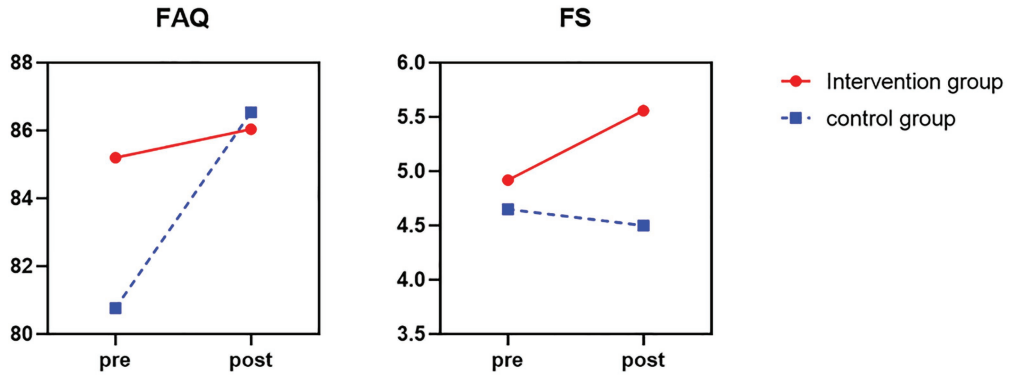


FIGURE 1 | The score of FAQ and FS before and after mindfulness intervention between control group (blue line) and intervention group (red line).

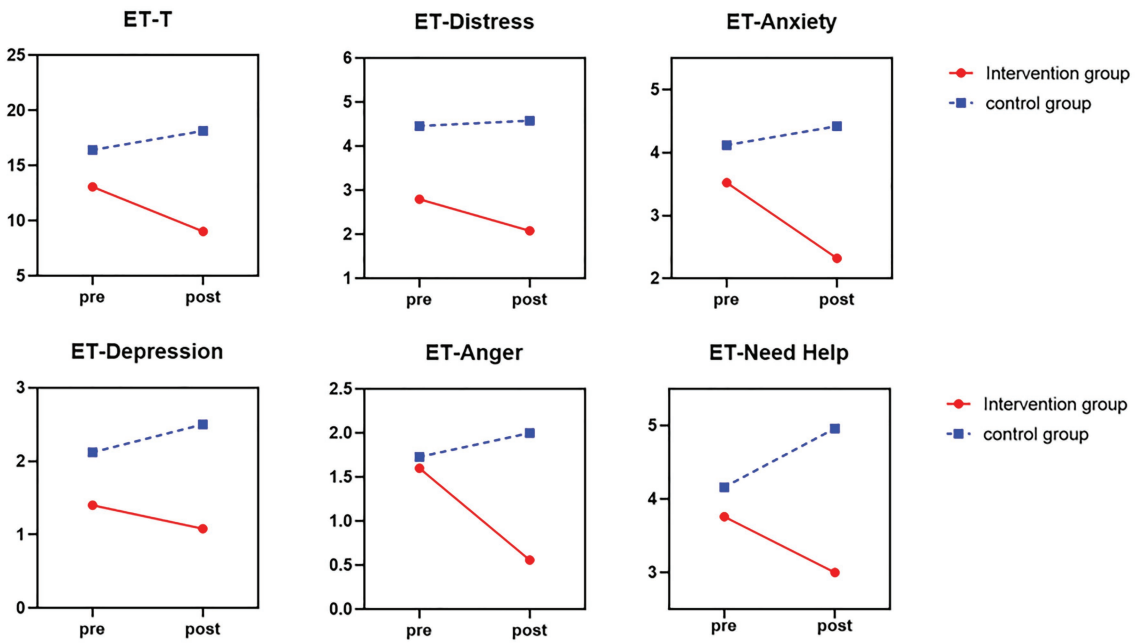


FIGURE 2 | The score of total mean ET and five subscales of ET before and after mindfulness intervention between control group (blue line) and intervention group (red line).

and control groups controlling for baseline, and gender was also used as a covariate. The results of the analysis, controlling for pre-test scores, are shown in **Table 3**.

There was a marginally significant Group × Time interaction of total FS score, $F = 4.02$, $p = 0.051$, partial $\eta^2 = 0.032$. As can be seen in **Figure 1**, after brief mindfulness intervention, the score of FS in the intervention group was much lower than the control group. As shown in **Figures 1, 2**, the scores of the individual ET items, all subtests, including "Distress," "Anxiety," "Depression," "Anger," and "Need Help," were reduced in the intervention group, while the scores of the control group were increased. The mean total ET score was much lower ($F = 8.89$, $p = 0.005$, partial $\eta^2 = 0.156$) compared to the control group. Meanwhile, the anxiety subscale ($F = 9.63$, $p = 0.003$, partial $\eta^2 = 0.167$) and help subscale ($F = 4.95$, $p = 0.031$, partial $\eta^2 = 0.095$) were significantly lower in the intervention group than in the control group. However, the distress subscale ($F = 1.41$, $p = 0.241$, partial $\eta^2 = 0.029$), depression subscale ($F = 1.93$, $p = 0.171$, partial $\eta^2 = 0.039$), and anger subscale scores ($F = 3.14$, $p = 0.083$, partial $\eta^2 = 0.061$) were not statistically significant.

DISCUSSION

Our study focused on whether the psychological states of patients entering the isolation ward were improved after a brief mindfulness intervention. The primary findings suggested

that patients in the intervention group showed mood modification after the brief mindfulness-based intervention. This may be related to the increased attention brought about by mindfulness interventions, which enable patients in the intervention group to find ways to cope with and manage stressful emotions, while reducing the perception of negative emotions such as depression and anxiety (Conversano et al., 2020a). Compared to the control group, they felt more satisfied with life in the second test, and the levels of distress, anxiety, depression, anger, and needing help decreased. In contrast, the score of patients in the control group increased during the waiting period. Specifically, there was an increase in FS, and the decrease in mean total ET, anxiety, and ET-anger was significant. Interestingly, the ET-distress scores showed significant main effect of group but no significant interaction, which may be due to the margin significant difference between two groups at baseline. The later studies could add scales measuring psychological distress to control for differences between the two groups to better observe the effect of brief mindfulness interventions on psychological distress. Although some subscale scores were not statistically significant, this result still indicated that brief mindfulness intervention can help patients in an isolation ward to improve their psychological condition and make them feel more positive in the face of uncertain outcomes.

In the last few decades, mindfulness-related interventions have been applied extensively both in China and abroad, especially in clinical settings (Hoge et al., 2013; Würtzen et al., 2013; Liu et al., 2019; Buckner et al., 2020); however, they also affect the non-clinical population (Arch and Craske, 2006; Zhu et al., 2019). Recently, Lorca et al. (2019) suggested that a single-session mindfulness practice using a meditation recording reduced both subjective and objective anxiety in patients undergoing a PET/CT study. With the support of a previous study, mindfulness interventions can significantly improve participants' positive emotions (Keng et al., 2011), reduce the self-reported level of anxiety and depression (Hoge et al., 2013; Würtzen et al., 2013; Liu et al., 2019; Zhu et al., 2019; Buckner et al., 2020), and even adjust heart rate (Lorca et al., 2019). Our results are consistent with the conclusion that mindfulness interventions can adjust a patient's mood and may have clinical implications for people in quarantine to reduce psychological stress.

However, some deficiencies in our research could be avoided in further studies. The sample of the present study was small and the gender ration of patients was not equal. The sample can be expanded in future research and the ratio of gender could be balanced as much as possible to exclude the effect of gender on the results. In addition, the current mindfulness-based intervention was conducted during a short period, and only compares the condition of isolated patients when they were admitted in the ward for 24 h before they heard of their results from the laboratory. In the future, researchers should record the periodic changes in psychological conditions and add mindfulness questionnaires to monitor how patients accept mindfulness interventions during the entire quarantine period. In addition, because of the high infectiousness, all interventions and questionnaires were online or through broadcast without face-to-face communication. Our research is primary, but importantly, it may provide some suggestions for improvement in mood and 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 Second Xiangya Hospital of Central South University Ethics Committee. The patients/participants provided their written informed consent to participate in this study. Informed consent was obtained from all participants.

AUTHOR CONTRIBUTIONS

DW and JH conceived and designed the study. All the authors were involved in the study. YL, SH, and DW performed the analysis and prepared the manuscript. All co-authors contributed substantially to the revision and have approved the final manuscript.

FUNDING

This work was supported by Special Funds of Hunan Innovative Province Construction (grant no. 2020SK3003).

ACKNOWLEDGMENTS

We would like to thank the people who participated in the study.

REFERENCES

Andrews, F. M., and Crandall, R. (1976). The validity of measures of self-reported well-being. *Soc. Indic. Res.* 3, 1–19. doi: 10.1007/BF00286161

Andrews, F. M. W., and Stephen, B. (1976). *Social Indicators of Well-Being: Americans' Perceptions of Life Quality*. Boston, MA: Springer.

Arch, J. J., and Craske, M. G. (2006). Mechanisms of mindfulness: emotion regulation following a focused breathing induction. *Behav. Res. Ther.* 44, 1849–1858. doi: 10.1016/j.brat.2005.12.007

Barbisch, D., Koenig, K. L., and Shih, F. Y. (2015). Is there a case for quarantine? Perspectives from SARS to Ebola. *Disaster Med. Public Health Prep.* 9, 547–553. doi: 10.1017/dmp.2015.38

Brown, K. W., and Ryan, R. M. (2003). The benefits of being present: mindfulness and its role in psychological well-being. *J. Pers. Soc. Psychol.* 84, 822–848. doi: 10.1037/0022-3514.84.4.822

Buckner, J. D., Lewis, E. M., Abarno, C. N., and Heimberg, R. G. (2020). Mindfulness training for clinically elevated social anxiety: the impact on peak drinking. *Addict. Behav.* 104:106282. doi: 10.1016/j.addbeh.2019.106282

CDC (2020). Law of the People's Republic of China on the Prevention and Treatment of Infectious Diseases (Revised). Available at: http://www.nhc.gov.cn/jkj/s7916/202001/44a3b8245e8049d2837a4f27529cd386.shtml (Accessed January 20, 2020).

Cheng, C., Jing, Z., Li, Z., and Jie, B. (2021). The Chinese Version of Emotion Temperature. Available at: http://www.psycho-oncology.info/ET_chinese.pdf (Accessed April 12, 2021).

Conversano, C., Ciacchini, R., Orrù, G., Di Giuseppe, M., Gemignani, A., and Poli, A. (2020a). Mindfulness, compassion, and self-compassion among health care professionals: what's new? A systematic review. *Front. Psychol.* 11:1683. doi: 10.3389/fpsyg.2020.01683

Conversano, C., Di Giuseppe, M., Miccoli, M., Ciacchini, R., Gemignani, A., and Orrù, G. (2020b). Mindfulness, age and gender as protective factors against psychological distress during COVID-19 pandemic. *Front. Psychol.* 11:1900. doi: 10.3389/fpsyg.2020.01900

Deyo, M., Wilson, K. A., Ong, J., and Koopman, C. (2009). Mindfulness and rumination: does mindfulness training lead to reductions in the ruminative thinking associated with depression? *Explore* 5, 265–271. doi: 10.1016/j.explore.2009.06.005

Di Giuseppe, M., Perry, J. C., Conversano, C., Gelo, O. C. G., and Gennaro, A. (2020). Defense mechanisms, gender and adaptiveness in emerging personality disorders in adolescent outpatients. *J. Nerv. Ment. Dis.* 208, 933–941. doi: 10.1097/NMD.0000000000001230

Hoge, E. A., Bui, E., Marques, L., Metcalf, C. A., Morris, L. K., Robinaugh, D. J., et al. (2013). Randomized controlled trial of mindfulness meditation for generalized anxiety disorder: effects on anxiety and stress reactivity. *J. Clin. Psychiatry* 74, 786–792. doi: 10.4088/JCP.12m08083

Keng, S. L., Smoski, M. J., and Robins, C. J. (2011). Effects of mindfulness on psychological health: a review of empirical studies. *Clin. Psychol. Rev.* 31, 1041–1056. doi: 10.1016/j.cpr.2011.04.006

Kroenke, K., Spitzer, R. L., and Williams, J. B. (2001). The PHQ-9: validity of a brief depression severity measure. *J. Gen. Intern. Med.* 16, 606–613. doi: 10.1046/j.1525-1497.2001.016009606.x

Liu, H., Gao, X., and Hou, Y. (2019). Effects of mindfulness-based stress reduction combined with music therapy on pain, anxiety, and sleep quality in patients with osteosarcoma. *Braz. J. Psychiatry* 41, 540–545. doi: 10.1590/1516-4446-2018-0346

Lorca, A. M., Lorca, M. M., Criado, J. J., Aguado, R., Baños, M. C. Z., and Armesilla, M. D. C. (2019). Using mindfulness to reduce anxiety during PET/CT studies. *Mindfulness* 10, 1163–1168. doi: 10.1007/s12671-018-1065-2

Mitchell, A. J., Baker-Glenn, E. A., Granger, L., and Symonds, P. (2010a). Can the distress thermometer be improved by additional mood domains? Part I. initial validation of the emotion thermometers tool. *Psychooncology* 19, 125–133. doi: 10.1002/pon.1523

Mitchell, A. J., Baker-Glenn, E. A., Park, B., Granger, L., and Symonds, P. (2010b). Can the distress thermometer be improved by additional mood domains? Part II. What is the optimal combination of emotion thermometers? *Psychooncology* 19, 134–140. doi: 10.1002/pon.1557

Pierce, M., Hope, H., Ford, T., Hatch, S., Hotopf, M., John, A., et al. (2020). Mental health before and during the COVID-19 pandemic: a longitudinal probability sample survey of the UK population. *Lancet Psychiatry* 7, 883–892. doi: 10.1016/S2215-0366(20)30308-4

Planchuelo-Gómez, Á., Odriozola-González, P., Irurtia, M. J., and de Luis-García, R. (2020). Longitudinal evaluation of the psychological impact of the COVID-19 crisis in Spain. *J. Affect. Disord.* 277, 842–849. doi: 10.1016/j.jad.2020.09.018

Roma, P., Monaro, M., Colasanti, M., Ricci, E., Biondi, S., Di Domenico, A., et al. (2020). A 2-month follow-up study of psychological distress among Italian people during the COVID-19 lockdown. *Int. J. Environ. Res. Public Health* 17:8180. doi: 10.3390/ijerph17218180

Shapiro, S. L., Carlson, L. E., Astin, J. A., and Freedman, B. (2006). Mechanisms of mindfulness. *J. Clin. Psychol.* 62, 373–386. doi: 10.1002/jclp.20237

Spitzer, R. L., Kroenke, K., Williams, J. B., and Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch. Intern. Med.* 166, 1092–1097. doi: 10.1001/archinte.166.10.1092

The Lancet (2020). COVID-19: fighting panic with information. *Lancet* 395:537. doi: 10.1016/S0140-6736(20)30379-2

Wang, C., Horby, P. W., Hayden, F. G., and Gao, G. F. (2020c). A novel coronavirus outbreak of global health concern. *Lancet* 395, 470–473. doi: 10.1016/S0140-6736(20)30185-9

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., et al. (2020a). Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *Int. J. Environ. Res. Public Health* 17:1729. doi: 10.3390/ijerph17051729

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., McIntyre, R. S., et al. (2020b). A longitudinal study on the mental health of general population during the COVID-19 epidemic in China. *Brain Behav. Immun.* 87, 40–48. doi: 10.1016/j.bbi.2020.04.028

Würtzen, H., Dalton, S. O., Elsass, P., Sumbundu, A. D., Steding-Jensen, M., Karlsen, R. V., et al. (2013). Mindfulness significantly reduces self-reported levels of anxiety and depression: results of a randomised controlled trial among 336 Danish women treated for stage I–III breast cancer. *Eur. J. Cancer* 49, 1365–1373. doi: 10.1016/j.ejca.2012.10.030

Xiao, C. (2020). A novel approach of consultation on 2019 novel coronavirus (COVID-19)-related psychological and mental problems: structured letter therapy. *Psychiatry Investig.* 17, 175–176. doi: 10.30773/pi.2020.0047

Zhu, T., Xue, J., Montuclard, A., Jiang, Y., Weng, W., and Chen, S. (2019). Can mindfulness-based training improve positive emotion and cognitive ability in Chinese non-clinical population? A pilot study. *Front. Psychol.* 10:1549. doi: 10.3389/fpsyg.2019.01549

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

BRIEF RESEARCH REPORT
published: 04 June 2021
doi: 10.3389/fpsyg.2021.669606

The Stress and Anxiety to Viral Epidemics-6 Items (SAVE-6) Scale: A New Instrument for Assessing the Anxiety Response of General Population to the Viral Epidemic During the COVID-19 Pandemic

Seockhoon Chung[1], Myung Hee Ahn[2], Sangha Lee[3], Solbi Kang[4], Sooyeon Suh[4]* and Yong-Wook Shin[1]*

[1]Department of Psychiatry, ASAN Medical Center, University of Ulsan College of Medicine, Seoul, South Korea, [2]Division of Psychiatry, Health Screening and Promotion Center, ASAN Medical Center, Seoul, South Korea, [3]Department of Psychiatry, Ajou University School of Medicine, Suwon, South Korea, [4]Department of Psychology, Sungshin Women's University, Seoul, South Korea

OPEN ACCESS

Edited by:
Fang Pan, Shandong University, China

Reviewed by:
Maria Auxiliadora Robles-Bello, University of Jaén, spain
Cristina Senín-Calderón, University of Cádiz, Spain

***Correspondence:**
Seockhoon Chung
schung@amc.seoul.kr
Sooyeon Suh
alysuh@sungshin.ac.kr

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *19 February 2021*
Accepted: *19 April 2021*
Published: *04 June 2021*

Citation:
Chung S, Ahn MH, Lee S, Kang S, Suh S and Shin Y-W (2021) The Stress and Anxiety to Viral Epidemics-6 Items (SAVE-6) Scale: A New Instrument for Assessing the Anxiety Response of General Population to the Viral Epidemic During the COVID-19 Pandemic. Front. Psychol. 12:669606. doi: 10.3389/fpsyg.2021.669606

The general population has reported experiencing anxiety due to the COVID-19 pandemic. This study explored the validity and utility of the Stress and Anxiety to Viral Epidemics-6 items (SAVE-6) scale for measuring the anxiety response of the general population to the viral epidemic. About 1,009 respondents participated in an online survey. Of these, 501 (49.7%) participants were rated as having at least a mild degree of anxiety response to the viral epidemic (SAVE-6 score ≥ 15), while 90 (8.9%) and 69 (6.8%) participants were rated as having moderate degree of depression and anxiety, respectively. The SAVE-6 scale showed a good internal consistency (Cronbach's alpha = 0.815). Parallel analysis suggested a one-factor structure for the measure. The SAVE-6 scale was found to be a reliable, valid, and useful brief measure that can be applied to the general population.

Keywords: stress, anxiety, mental health, general population, COVID-19

INTRODUCTION

The COVID-19 pandemic has disrupted the daily lives of many individuals, with them experiencing various psychiatric issues, including depression, anxiety, insomnia, and post-traumatic stress. Particularly, people experience the fear of infection, both for themselves and their loved ones, or of spreading the infection to others. The prevalence of anxiety symptoms in the pandemic era reported ranging from 6.33 to 50.9% (Xiong et al., 2020). Studies have assessed the anxiety levels of individuals using various rating scales, such as the Generalized Anxiety Disorder-seven items (GAD-7; Hou et al., 2021), Zung's Self-rating Anxiety Scale (SAS; Ran et al., 2020), and the Depression Anxiety and Stress Scale (Wang et al., 2020). However, these scales do not specifically assess anxiety dealing with the COVID-19 pandemic. Therefore, a rating scale specific to the viral epidemic needs to be developed to determine the actual effects of the COVID-19 pandemic on the anxiety of an individual.

Several rating scales were developed and applied in 2020 in response to the pandemic: the five-item Coronavirus Anxiety Scale developed by Lee (2020a), the COVID-19-Anxiety Questionnaire modified by Petzold et al. (2020) based on the DSM-5 Severity Measure for Specific Phobia-Adult Scale, the seven-item Fear of COVID-19 Scale developed by Ahorsu et al. (2020), the four-item Obsession with COVID-19 Scale developed by Lee (2020b), the 11-item Coronavirus Pandemic Anxiety Scale developed by Bernardo et al. (2020), the two-factor nine-item COVID-19 Anxiety Syndrome Scale (six items for perseverance and three items for avoidance) developed by Nikcevic and Spada (2020), and the seven-item COVID-19 Anxiety Scale developed by Silva et al. (2020). These scales inquired about the anxiety of, repetitive thoughts of, or anxiety-related physiological arousal symptoms in an individual. Originally, we developed the Stress and Anxiety to Viral Epidemics-9 (SAVE-9) items scale specifically for healthcare workers. It consisted of items inquiring about apprehension or thoughts of an individual about the risk of infection, about the consequent influence on their physical health, or about avoidance of others (Chung et al., 2020). The SAVE-9 scale was designed to have two factors: first, anxiety about the viral epidemic factor, including six items (SAVE-6) and second, work-related stress associated with the viral epidemic, including three items (SAVE-3). We previously validated the SAVE-9 questionnaire and verified its utility among healthcare workers. In this study, we hypothesized that the SAVE-6 scale can be used for measuring anxiety in response to the viral epidemic among the general population. We also explored the psychometric properties of the SAVE-6 scale and determined the appropriate cut-off point of the scale with respect to the general anxiety symptoms.

MATERIALS AND METHODS

Participants and Procedure

This study was conducted *via* an anonymous online survey system through EMBRAIN, a professional research company.[1] The survey collected 1,009 responses from January 14 to 20, 2021. The participants voluntarily responded to the survey. The mean age of the participants was 44.3 (±13.5) years, with 51% (n = 515) male population. The study protocol was approved by the Institutional Review Board of Sungshin Women's University, Seoul, South Korea (SSWUIRB-2020-040). Written informed consent was waived.

Assessment of Symptoms

SAVE-6

The SAVE-6 scale is a subcategory of the SAVE-9 scale[2] developed originally for measuring stress and anxiety due to the viral epidemic among healthcare workers (Chung et al., 2020). Each of the six items is rated on a five-point Likert scale ranging from 0 (never) to 4 (always). The cut-off score of the SAVE-6 scale has been reported to be 15, equivalent to at least a mild degree or ≥ 5 on the GAD-7 scale. The total score on the SAVE-6 scale ranges from 0 to 24, with higher scores reflecting higher levels of anxiety response to the viral epidemic.

GAD-7

The GAD-7 scale is a self-report questionnaire for measuring general anxiety (Spitzer et al., 2006). Each item is scored on a four-point Likert scale (0 = not at all to 3 = nearly every day). Scores range from 0 to 21, with higher scores reflecting higher levels of anxiety. The cut-off points for anxiety are 0–4 (minimal), 5–9 (mild anxiety), 10–14 (moderate), and 15–21 (severe).

Patient Health Questionnaire-9

The PHQ-9 scale is a self-report questionnaire for measuring depression (Kroenke et al., 2001). Each item is rated on a four-point Likert scale (0 = not at all to 3 = nearly every day). Scores range from 0 to 27, with higher scores reflecting severe depression. The cut-off points for depression are 0–4 (minimal), 5–9 (mild), 10–14 (moderate), 15–19 (moderately severe), and 20–27 (severe).

Statistical Analyses

We conducted an independent t-test and the chi-square test to examine the gender differences in clinical variables or rating scale scores using the IBM SPSS Statistics for Windows, version 21.0. We also performed Spearman's correlation to examine the association of scores from the SAVE-6 scale with demographic variables and rating scale scores since the distribution of PHQ-9 and GAD-7 scores were not within the normal limit. We hypothesized a one-factor model for the SAVE-6 scale based on the previous analysis on healthcare workers (Chung et al., 2020). The normality assumption was checked by using skewness and kurtosis for an acceptable limit of range ±2 (Gravetter and Wallnau, 2014). After examining the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity to explore the data suitability, exploratory factor analysis (EFA) was conducted to evaluate the construct validity. In EFA, we used the principal axis factor (PAF) extraction method with a Pearson's correlation matrix and promax rotation. To determine the number of factors to be retained, the scree test and the parallel analysis test (Horn, 1965; Glorfeld, 1995; Timmerman and Lorenzo-Seva, 2011), based on minimum rank factor analysis (MRFA; Lorenzo-Seva and Ferrando, 2006), with a 95-percentile threshold, based on the polychoric correlation matrix, were conducted using FACTOR, version 10.10.03 (Lorenzo-Seva and Ferrando, 2006) program. The reliability and internal consistency of the factor were examined using Cronbach's alpha and McDonald's omega coefficient to verify the dimensionality of the SAVE-6 scale. Finally, the receiver operating characteristic (ROC) analysis was performed to explore the appropriate cut-off score of the SAVE-6 scale in accordance with generalized anxiety symptoms.

[1]www.embrain.com
[2]www.save-viralepidemic.net

TABLE 1 | Demographic characteristics of participants (*N* = 1,009).

Variables	Male (*N* = 515)	Female (*N* = 494)	*p*-value
	Mean ± *SD*, *N* (%)		
Age (Years)	44.0 ± 13.5	44.7 ± 13.5	0.59
19~29 years old	99 (19.2%)	89 (18.0%)	
30~39 years old	98 (19.0%)	89 (18.0%)	
40~49 years old	114 (22.1%)	109 (22.1%)	0.94
50~59 years old	118 (22.9%)	116 (23.5%)	
60~69 years old	86 (16.7%)	91 (18.4%)	
Marital status (Single)	173 (33.6%)	142 (28.7%)	0.10
Education			
High school and under	121 (23.5%)	134 (27.1%)	
University or college	331 (64.3%)	311 (63.0%)	0.27
Postgraduate	63 (12.2%)	49 (9.9%)	
Region			
Metropolitan Cities (Seoul, Busan, Daegu, Incheon, Gwangju, Daejeon, Ulsan)	222 (43.1%)	293 (56.9%)	0.38
Suburban Provinces (Gyeonggi, Gangwon, Chungcheong, Jeolla, Gyeongsang, Jeju)	227 (46.0%)	267 (54.0%)	
COVID-19 questions			
Is there anyone you know who has been infected with COVID-19? (Yes)	123 (23.9%)	99 (20.0%)	0.15
Did you experience being quarantined for having been infected with COVID-19? (Yes)	45 (8.7%)	35 (7.1%)	0.35
Did you experience being infected with COVID-19? (Yes)	4 (0.8%)	2 (0.4%)	0.69
Do you have any serious medical problems, such as cardiovascular or pulmonary disease? (Yes)	91 (17.7%)	95 (19.2%)	0.57
Rating scales			
Stress and Anxiety to Viral Epidemics-6 (SAVE-6)	14.0 ± 4.7	14.7 ± 4.6	0.02
Patient Health Questionnaire-9 (PHQ-9)	6.0 ± 5.0	6.4 ± 4.9	0.28
Depression (PHQ-9 ≥ 10)	44 (8.5%)	46 (9.3%)	0.74
Generalized Anxiety Disorder-7 (GAD-7)	3.2 ± 3.9	3.4 ± 3.7	0.53
Generalized anxiety (GAD-7 ≥ 10)	36 (7.0%)	33 (6.7%)	0.90

RESULTS

Demographic Characteristics

Table 1 presents the demographic characteristics of the patients. There is no significant gender difference in clinical variables and rating scale scores except in the SAVE-9 scale score. Among the sample, 90 (8.9%) and 69 (6.8%) participants scored above the cut-off for clinical depression symptoms (PHQ-9 ≥ 10) and generalized anxiety (GAD-7 ≥ 10), respectively. Among the respondents, 222 (20.0%) reported knowing a person that had been infected, 80 (7.9%) reported having the experience of being quarantined, 6 (0.6%) reported the experience of being infected themselves, and 186 (18.4%) reported having a serious medical illness.

The SAVE-6 scores were significantly higher among respondents who were rated as having depression [PHQ-9 ≥ 10, t (1,007) = 9.29, and $p < 0.001$] and generalized anxiety [GAD-7 ≥ 10, t (1,007) = 8.34, and $p < 0.001$]. Moreover, the SAVE-6 scale scores were significantly higher among women [t (1,007) = 2.38 and $p = 0.018$] when compared with men, among people with a serious disease [t (1,007) = 2.11 and $p = 0.035$], and among people who knew a person infected with COVID-19 (t (1,007) = 2.07 and $p = 0.038$). However, no significant differences were observed with respect to the area of residence ($p = 0.19$), to the experience of being infected ($p = 0.55$), and to the experience of being quarantined ($p = 0.09$).

Factor Structure of the SAVE-6 Scale

The normality assumption was checked. It revealed that the distribution of each of the six items was within the normal limit (**Table 2**). The KMO measure (0.82) and the Bartlett's test of sphericity ($p < 0.001$) showed adequacy for running EFA. The EFA with PAF extraction, the polychoric correlation, and the promax rotation suggested a one-factor model of the SAVE-6 scale based on the Kaiser Criterion method with an eigenvalue above 1.00 (eigenvalue = 2.635, 42.3% of the variance).

The scree test and parallel analysis using the MRFA extraction and polychoric correlation were used to identify the adequate number of factors for the scale. We compared the explained real-data eigenvalues with the 95th percentile of random eigenvalues and made a decision where the real-data eigenvalues exceeded the 95th percentile of random eigenvalues. The results suggested that the single-factor structure (real-data eigenvalue = 69.99, 95th percentile of random eigenvalue = 45.40) of the SAVE-6 scale similar to that of the previous study (Chung et al., 2020).

Reliability of the Scores and Evidence Based on Relations to Other Variables

The SAVE-6 scale showed a good internal consistency reliability (McDonald's $\varpi = 0.818$ and Cronbach's $\alpha = 0.815$). In this sample, the Cronbach's α of PHQ-9 and GAD-7 were 0.869 and 0.929, respectively. The high scores of SAVE-6 scale scores were significantly correlated with PHQ-9 scores ($\rho = 0.37$, $p < 0.001$) and GAD-7 scores ($\rho = 0.37$, $p < 0.001$). In this

TABLE 2 | Frequencies of answers of participants to each of the SAVE-6 item.

Items	Response scale, *N* (%)					Descriptive	Skewness	Kurtosis	Factor loading
	Never	Rarely	Sometimes	Often	Always	Mean ± *SD*			
1. Are you afraid the virus outbreak will continue indefinitely?	12 (1.2%)	51 (5.1%)	132 (13.1%)	473 (46.9%)	341 (33.8%)	3.07 ± 0.88	−1.008	1.047	0.666
2. Are you afraid your health will worsen because of the virus?	30 (3.0%)	101 (10.0%)	216 (21.4%)	427 (42.3%)	235 (23.3%)	2.73 ± 1.02	−0.679	−0.033	0.844
3. Are you worried that you might get infected?	55 (5.5%)	132 (13.1%)	262 (26.0%)	397 (39.3%)	163 (16.2%)	2.48 ± 1.08	−0.523	−0.332	0.807
4. Are you more sensitive toward minor physical symptoms than usual?	72 (7.1%)	180 (17.8%)	259 (25.7%)	367 (36.4%)	131 (13.0%)	2.30 ± 1.12	−0.366	−0.662	0.679
5. Are you worried that others might avoid you even after the infection risk has been minimized?	281 (27.8%)	368 (36.5%)	156 (15.5%)	133 (13.2%)	71 (7.0%)	1.35 ± 1.21	0.695	−0.501	0.593
6. Do you worry your family or friends may become infected because of you?	79 (7.8%)	142 (14.1%)	236 (23.4%)	373 (37.0%)	179 (17.7%)	2.43 ± 1.168	−0.505	−0.562	0.749

Cronbach's Alpha is 0.815 for total SAVE-6 measure, SD = Standard Deviation.

study, the ROC analysis revealed that the 15 point of the SAVE-6 scale is appropriate (area under the curve, AUC = 0.706, sensitivity = 70.7%, and specificity = 60.0%) for at least a mild degree of GAD-7 score (≥5), and almost half of the 1,009 respondents (n = 501, 49.7%) scored ≥ 15 on the SAVE-6 scale. We also observed that the 17 point of the SAVE-6 scale is in accordance with the moderate degree of GAD-7 (≥10, AUC = 0.768, sensitivity = 72.5%, and specificity = 71.3) and 320 (31.7%) respondents were scored ≥ 17 on the SAVE-6 scale.

DISCUSSION

We originally developed the SAVE-9 scale for healthcare workers during the pandemic (Chung et al., 2020). We previously found that the SAVE-9 scale could be clustered into two factors: anxiety about the viral epidemic (six items, SAVE-6) and work-related stress associated with the viral epidemic (three items, SAVE-3). In the present study, we investigated the utility of the six-item factor when applied to the general population, labeled as the SAVE-6 scale. We observed that EFA supported a one-factor model of the SAVE-6 scale, consistent with the result of the parallel analysis. The SAVE-6 scale showed good internal consistency reliability. In addition, the ROC analysis revealed that the 15 point of the SAVE-6 scale is appropriate for at least a mild degree of GAD-7 score (≥5).

The SAVE-6 scale was extracted from the original SAVE-9 scale for measuring the behavior or thoughts of healthcare workers during the COVID-19 pandemic. Previous rating scales were developed to inquire about physiological arousal symptoms of individuals associated with clinically elevated fear and anxiety (the Coronavirus Anxiety Scale, Lee, 2020a); feelings of anxiety, nervousness, muscle tension, and behaviors of avoidance (the COVID-19-Anxiety Questionnaire, Petzold et al., 2020); worry, increased heartbeat, or repetitive thoughts (the Fear of COVID-19 scale, Ahorsu et al., 2020; the Coronavirus Pandemic Anxiety Scale, Bernardo et al., 2020; the COVID-19 Anxiety Scale, Silva et al., 2020); or behaviors of avoidance, checking, and worrying (the COVID-19 Anxiety Syndrome Scale, Nikcevic and Spada, 2020). The SAVE-9 scale consists of items inquiring about the apprehension of an individual during the current pandemic situation, work-related stress of healthcare workers, worry about avoidance behavior of others, and concern about their own health and the health of their family members.

Though the results of this study showed a good single model of the SAVE-6 scale with good reliability, we observed a gender difference in the scores of SAVE-6 scale. In this pandemic era, the level of stress or anxiety due to the viral epidemic was reported to be higher among women compared to men in the general population (Hou et al., 2020; Mohammadpour et al., 2020), and even in the special population, such as healthcare workers (Huang et al., 2021; Lee et al., 2021). Silva et al. (2020) also observed the higher level of anxiety among female participants while developing their new rating scale, the COVID-19 anxiety scale. Female preponderance in the anxiety level needs to be considered while developing an anxiety scale targeting the viral epidemic may be expected. Moreover, female preponderance in the anxiety level needs to be considered while developing an anxiety scale targeting the viral epidemic.

The SAVE-9 scale for healthcare workers was originally developed to be brief and practical and to identify individuals who need psychological support. The appropriate cut-off score of the SAVE-9 scale was defined in accordance with at least a mild degree of GAD-7 score to screen healthcare workers who may be vulnerable to COVID-19 infection and consequent work-related stress (Chung et al., 2020). In the previous study, the appropriate cut-off score of factor I of the SAVE-9 scale was defined as point 15 (AUC = 0.728, sensitivity = 0.72, and specificity = 0.61) among healthcare workers. In parallel with the current study, we also observed point 15 of the SAVE-6 scale as a cut-off among the general population (AUC = 0.706,

sensitivity = 70.7%, and specificity = 60.0%). In the current study, 49.7% of the participants were rated as having at least a mild degree of anxiety to the viral epidemic using the SAVE-6 scale, while 31.4% of participants were rated as having a mild degree of anxiety with a GAD-7 score ≥ 5. Although the data were not shown in the results, an additional 27.5% of the participants were screened using the SAVE-6 scale among those who were not rated as having anxiety (GAD-7 < 5).

This study had several limitations. First, we did not measure test-retest reliability. Therefore, it was difficult to state the stability of the measure. Second, we could not gather information concerning the employment of the participants. Given that people from certain professions, such as healthcare workers, government officials, and school teachers, are at a higher risk of infection in this pandemic era, the analysis could have benefited from considering the jobs or workplaces of the participants. Last, the results of this study should be interpreted with caution as it is a cross-sectional study. Further studies are needed to generate more information about the general population.

In conclusion, we observed that the SAVE-6 scale is a reliable, valid, and useful brief measure. Future studies should explore the utility of the SAVE-6 scale among the general population using a more representative sample.

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 Board of Sungshin Women's University, No. SSWUIRB-2020-040. Written informed consent was waived.

AUTHOR CONTRIBUTIONS

SC, MA, Y-WS, and SS conceived the study. SS obtained ethics approval. SK, SS, and SL recruited participants and obtained data. SC organized the database and performed statistical analyses. All authors contributed to the article and approved the submitted version.

FUNDING

This work was supported by the Framework of International Cooperation Program managed by the National Research Foundation of Korea (FY2020K2A9A1A01094956).

ACKNOWLEDGMENTS

We would like to appreciate all the people who voluntarily participated in the survey.

REFERENCES

Ahorsu, D. K., Lin, C. Y., Imani, V., Saffari, M., Griffiths, M. D., and Pakpour, A. H. (2020). The fear of COVID-19 scale: development and initial validation. *Int. J. Ment. Heal. Addict.* 1–9. doi: 10.1007/s11469-020-00270-8 [Epub ahead of print]

Bernardo, A. B. I., Mendoza, N. B., Simon, P. D., Cunanan, A. L. P., Dizon, J., Tarroja, M. C. H., et al. (2020). Coronavirus pandemic anxiety scale (CPAS-11): development and initial validation. *Curr. Psychol.* 1–9. doi: 10.1007/s12144-020-01193-2 [Epub ahead of print]

Chung, S., Kim, H. J., Ahn, M. H., Yeo, S., Lee, J., Kim, K., et al. (2020). Development of the stress and anxiety to viral Epidemics-9 (SAVE-9) scale for assessing work-related stress and anxiety in healthcare workers in response to COVID-19. PsyArXiv [Preprint]. doi:10.31234/osf.io/a52b4

Glorfeld, L. W. (1995). An improvement on horn's parallel analysis methodology for selecting the correct number of factors to retain. *Educ. Psychol. Meas.* 1995, 377–393.

Gravetter, F., and Wallnau, L. (2014). *Essentials of Statistics for the Behavioral Sciences*. *8th Edn*. Belmont, CA: Wadsworth.

Horn, J. (1965). A rationale and test for the number of factors in factor analysis. *Psychom. Theory* 30, 179–185.

Hou, F., Bi, F., Jiao, R., Luo, D., and Song, K. (2020). Gender differences of depression and anxiety among social media users during the COVID-19 outbreak in China: a cross-sectional study. *BMC Public Health* 20:1648. doi: 10.1186/s12889-020-09738-7

Hou, W. K., Tong, H., Liang, L., Li, T. W., Liu, H., Ben-Ezra, M., et al. (2021). Probable anxiety and components of psychological resilience amid COVID-19: a population-based study. *J. Affect. Disord.* 282, 594–601. doi: 10.1016/j.jad.2020.12.127

Huang, Q., Luo, L. S., Wang, Y. Y., Jin, Y. H., and Zeng, X. T. (2021). Gender differences in psychological and behavioral responses of infected and uninfected health-care workers during the early COVID-19 outbreak. *Front. Public Health* 9:638975. doi: 10.3389/fpubh.2021.638975

Kroenke, K., Spitzer, R. L., and Williams, J. B. (2001). The PHQ-9: validity of a brief depression severity measure. *J. Gen. Intern. Med.* 16, 606–613. doi: 10.1046/j.1525-1497.2001.016009606.x

Lee, J., Lee, H. J., Hong, Y., Shin, Y. W., Chung, S., and Park, J. (2021). Risk perception, unhealthy behavior, and anxiety due to viral epidemic among healthcare workers: the relationships with depressive and insomnia symptoms during COVID-19. *Front. Psych.* 12:615387. doi: 10.3389/fpsyt.2021.615387

Lee, S. A. (2020a). Coronavirus anxiety scale: a brief mental health screender for COVID-19 related anxiety. *Death Stud.* 44, 393–401. doi: 10.1080/07481187.2020.1748481

Lee, S. A. (2020b). How much "thinking" about COVID-19 is clinically dysfunctional? *Brain Behav. Immun.* 87, 97–98. doi: 10.1016/j.bbi.2020.04.067

Lorenzo-Seva, U., and Ferrando, P. J. (2006). FACTOR: A computer program to fit the exploratory factor analysis model. *Behav. Res. Methods* 38, 88–91. doi: 10.3758/BF03192753

Mohammadpour, M., Ghorbani, V., Khoramnia, S., Ahmadi, S. M., Ghvami, M., and Maleki, M. (2020). Anxiety, self-compassion, gender differences and COVID-19: predicting self-care behaviors and fear of COVID-19 based on anxiety and self-compassion with an emphasis on gender differences. *Iran. J. Psychiatry* 15, 213–219. doi: 10.18502/ijps.v15i3.3813

Nikcevic, A. V., and Spada, M. M. (2020). The COVID-19 anxiety syndrome scale: development and psychometric properties. *Psychiatry Res.* 292:113322. doi: 10.1016/j.psychres.2020.113322

Petzold, M. B., Bendau, A., Plag, J., Pyrkosch, L., Maricic, L. M., Rogoll, J., et al. (2020). Development of the COVID-19-anxiety questionnaire and first psychometric testing. *BJPsych Open* 6:e91. doi: 10.1192/bjo.2020.82

Ran, M. S., Gao, R., Lin, J. X., Zhang, T. M., Chan, S. K. W., Deng, X. P., et al. (2020). The impacts of COVID-19 outbreak on mental health in

general population in different areas in China. *Psychol. Med.* 1–10. doi: 10.1017/S0033291720004717 [Epub ahead of print]

Silva, W. A. D., de Sampaio Brito, T. R., and Pereira, C. R. (2020). COVID-19 anxiety scale (CAS): development and psychometric properties. *Curr. Psychol.* 1–10. doi: 10.1007/s12144-020-01195-0 [Epub ahead of print]

Spitzer, R. L., Kroenke, K., Williams, J. B., and Lowe, B. (2006). A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch. Intern. Med.* 166, 1092–1097. doi: 10.1001/archinte.166.10.1092

Timmerman, M. E., and Lorenzo-Seva, U. (2011). Dimensionality assessment of ordered polytomous items with parallel analysis. *Psychol. Methods* 16, 209–220. doi: 10.1037/a0023353

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., et al. (2020). Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *Int. J. Environ. Res. Public Health* 17:1729. doi: 10.3390/ijerph17051729

Xiong, J., Lipsitz, O., Nasri, F., Lui, L. M. W., Gill, H., Phan, L., et al. (2020). Impact of COVID-19 pandemic on mental health in the general population: a systematic review. *J. Affect. Disord.* 277, 55–64. doi: 10.1016/j.jad.2020.08.001

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 07 June 2021
doi: 10.3389/fpsyg.2021.689251

Effects of Wise Intervention on Perceived Discrimination Among College Students Returning Home From Wuhan During the COVID-19 Outbreak

Ting Lu[1], *Zihan Guo*[1], *Hao Li*[1], *Xinyu Zhang*[1], *Zhihong Ren*[2]*, *Weiping Yang*[1]*, *Liuqing Wei*[1] *and Ling Huang*[1]

[1] *Department of Psychology, Faculty of Education, Hubei University, Wuhan, China,* [2] *Key Laboratory of Adolescent Cyberpsychology and Behavior, Key Laboratory of Human Development and Mental Health of Hubei Province, Ministry of Education, School of Psychology at Central China Normal University, Wuhan, China*

OPEN ACCESS

Edited by:
Fushun Wang,
Nanjing University of Chinese Medicine, China

Reviewed by:
Wu Qiong,
Suzhou University of Science and Technology, China
Xiaoyu Tang,
Liaoning Normal University, China

***Correspondence:**
Zhihong Ren
ren@ccnu.edu.cn
Weiping Yang
swywp@163.com

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *31 March 2021*
Accepted: *10 May 2021*
Published: *07 June 2021*

Citation:
Lu T, Guo Z, Li H, Zhang X, Ren Z, Yang W, Wei L and Huang L (2021) Effects of Wise Intervention on Perceived Discrimination Among College Students Returning Home From Wuhan During the COVID-19 Outbreak. Front. Psychol. 12:689251. doi: 10.3389/fpsyg.2021.689251

At the beginning of the coronavirus disease 2019 (COVID-19) outbreak, college students returning home from Wuhan, Hubei Province, experienced various degrees of discrimination. This study first investigates perceived discrimination among college students returning home from Wuhan. Then, an experimental method is used to investigate the effectiveness of an intervention designed to reduce the perceived discrimination among those who returned to towns outside of Hubei Province. A total of 63 college students participated in the experiment. In the experimental group ($N = 31$), a wise intervention based on reading and writing was adopted to intervene in perceived discrimination among the participants. The results showed that the perceived discrimination among students returning from Wuhan to towns outside of Hubei Province was significantly higher than that among students returning to towns within Hubei Province. The wise intervention reduced the perceived discrimination in the experimental group but not in the control group. Further analysis found that perceived social support fully mediated the relationship between the intervention and perceived discrimination. These results provide insights on how the content of intervention (perceived social support) and the form of intervention (wise intervention) can prevent the occurrence of psychological problems in epidemic situations.

Keywords: COVID-19, perceived discrimination, perceived social support, wise intervention, mental health

INTRODUCTION

The coronavirus disease 2019 (COVID-19) was first reported in Wuhan in December 2019. After that, the disease spread throughout Hubei Province and other parts of China, and then to numerous other countries (Shaukat et al., 2020). This pandemic has had an immense adverse impact on the physical and mental health of the population in China (Ju et al., 2020). Although great efforts have been undertaken to curb the epidemic, the significant morbidity and mortality of this virus triggered an unprecedented level of panic and fear in the communities (Qiu et al., 2020; Salari et al., 2020), leading to adverse mental health outcomes such as anxiety, depression, and post-traumatic

stress symptoms (Ahmed et al., 2007). In addition, infectious disease outbreaks have also been associated with stigma (Otu et al., 2020), and anxiety and fear related to an infection can lead to acts of discrimination (Usher et al., 2020), which could further exacerbate existing health problems or trigger new ones (Lee et al., 2016; Lian and Kawachi, 2020).

Discrimination can be defined as the prejudicial and/or distinguishing treatment of an individual based on their actual or perceived membership or certain characteristics (Skosireva et al., 2014). Perceived discrimination is a kind of subjective experience relative to objective discrimination and involves the perception of the individual of being treated differently or unfairly due to belonging to a group (such as race or illness) (Major et al., 2002). Stress resulting from perceived discrimination can have a negative impact on physical and mental health and may increase the likelihood of health-threatening behaviors (Williams et al., 1997). For example, studies have shown that unfair treatment and perceived discrimination are risk factors for poor health (Pascoe and Smart Richman, 2009), and perceived discrimination can also lead to psychological disorders such as depression and eating disorders (Kim et al., 2019; Kelly et al., 2020).

In the context of COVID-19, psychological intervention for individuals who might be discriminated against (such as those in high-risk areas) is of great importance for both the prevention and treatment of psychological problems. Researchers have made many interventions against discrimination (Evans-Lacko et al., 2012; Li et al., 2019). However, most of these interventions targeted the removal of the drivers of stigma or the shifting of norms and policies that facilitate the stigmatization process (Stangl et al., 2013) by aiming to reduce stigma and discrimination against people with health conditions (Stangl et al., 2019), i.e., these interventions aimed to reduce discrimination against specific groups. However, in general, interventions that target the perceived discrimination of the discriminated groups are still lacking.

Among a variety of factors influencing perceived discrimination, perceived social support may be key. Perceived social support is the support subjectively perceived by individuals through the recognition and evaluation of support from family members, friends, and important others (Fan et al., 2012). Researchers theorize that social support is one of the most useful stress buffers (Krysia and Wei, 2014). Some researchers have proposed that the reduction of social support produces a negative schema in depressed individuals, leading to cognitive bias in information processing and thus producing discrimination perceptions (Zhang et al., 2019). According to the buffering model of social support states, perceived social support is a protection mechanism that can buffer the negative impact of negative stimuli on an individual, allowing the individual to avoid all kinds of negative emotions (Aneshensel and Stone, 1982; Etzion, 1984; Tiegs, 2010). Empirical studies have also found that social support can reduce the perceived discrimination of an individual (Wang and Zhang, 2020). Therefore, if a certain method can be used to improve the perceived social support of an individual, the perception of discrimination may be significantly reduced. One study conducted a social support skill-training group intervention to treat veterans with post-traumatic stress disorder and found a positive effect of this training (Sirati-Nir et al., 2018). Another study adopted a 13-week group treatment intervention focusing on social skills training and cognitive restructuring and found that the intervention increased the perceived social support of participants from family (Brand et al., 1995). However, although these interventions are effective, most of them require long-term treatment. Thus, in the context of COVID-19, these interventions may be difficult to implement. Therefore, it is necessary to find more concise and effective interventions.

Wise intervention is a new intervention method developed in recent years. Unlike previous interventions, it aims to change the way people feel and think in their lives and has a low resource and time investment but long-term effects (Walton and Wilson, 2018). These interventions are very much like an everyday experience, and their purpose is simply to change the specific way people think or feel in their normal lives to help individuals thrive (Walton, 2014). The wise intervention has prominent advantages over other intervention methods. First, wise intervention holds that the individual psychological process does not work in a vacuum but in a complex system. Therefore, it is more suitable for the specific situation facing individuals and can promote the self-reinforcement of individual thoughts and behaviors over time (Walton and Cohen, 2011). Second, wise intervention is characterized by simplicity, accuracy, and strong operability (Logel and Cohen, 2012). Third, wise intervention does not have additional negative effects and requires less time and resources. This intervention method has increasingly been applied to different areas of social life, such as education (Yeager et al., 2013), close relationships (Finkel et al., 2013), and mental health (Peng, 2019), and has achieved remarkable results.

The number of people affected by the COVID-19 epidemic is so large that researchers need to consider exploring interventions that are easy to implement in specific situations such as quarantining at home. Therefore, based on the idea of wise intervention, this study chooses perceived social support as the intervention point by referring to the influencing factors of perceived discrimination, the view of the buffer model, and the relevant theoretical and empirical research results. That is, through perceived social support, wise intervention is used to help college students who returned home from Wuhan think about their plight from multiple perspectives, understand their environment, improve perceived social support, and thus reduce perceived discrimination.

Wuhan, the capital city of Hubei Province, China, the initial epicenter of COVID-19, was put under an international spotlight, leading to the stigmatized label "Wuhan virus" (Yang et al., 2020). Such COVID-19-related discrimination was quite evident and omnipresent among individuals, especially those who manifested a potential linkage with Wuhan during the outbreak of COVID-19 since Wuhan was the first epicenter of this global health crisis (Li et al., 2020). On January 23, 2020, the Chinese government locked down Wuhan in an unprecedented effort to curb the spread of COVID-19 (Xinhua Net, 2020), and Hubei Province 2 days later. And after February 21, there was no explosive growth of daily confirmed infections in any Chinese province except Hubei Province (Ye and Lyu, 2020). Thus, people from

Wuhan or Hubei Province were targeted and blamed by other Chinese people (Ren et al., 2020). Therefore, this study will first use the questionnaire method to determine the perceived discrimination of college students returning home from Wuhan during the epidemic and then use the wise intervention program to intervene for the individuals who feel discriminated against because of the situation. We also investigate the potential mechanism of this intervention method.

STUDY 1. INVESTIGATION OF PERCEIVED DISCRIMINATION

In China, the rapid spread of COVID-19 in the early stages of the outbreak was mainly due to the large number of people returning home to meet their families during the Spring Festival (Liu et al., 2020), including thousands of college students studying in Wuhan. Wuhan, as one of the key higher education hubs of China, hosts a large number of university students, amounting to 1.3 million (One in 10 Wuhan residents is a university student) (Yang et al., 2020). Coming from every province of China, the majority of these students returned to their hometown in mid-January during the winter vacation. Some of the students who studied in Wuhan returned to their hometowns in other cities within Hubei Province, which were also severely affected by the epidemic. Some returned to their hometowns outside Hubei Province, where the epidemic situation was relatively mild. Soon after the students returned home, intensive anti-epidemic measures were put in place across the country, and the students who returned from Wuhan became the focus of quarantine and anti-epidemic efforts. Because they were treated differently, it is possible that they perceived discrimination (Major et al., 2002). And it is also possible that the perceived discrimination was different by hometown address (within Hubei Province *vs.* outside Hubei Province).

Methods

Participants

In March 2020, when the general public was ordered to quarantine at home, we enrolled college students returning home from Wuhan to complete the questionnaire. Data were collected using an online convenient questionnaire tool (https://www.wjx.cn/). In the context of COVID-19 quarantine, convenience and snowball sampling methods were used to recruit the participants, that is, five researchers (students in Hubei University) first distributed the questionnaire link through their social media communication group (QQ group), and then invited the participants to forward the questionnaire link to more college students returning from Wuhan. Only fully completed questionnaires could be successfully submitted online. It was made clear that the participation was voluntary. Participants could withdraw at any time for no reason by simply closing the questionnaire page. Ultimately, a total of 382 questionnaires were received, one invalid questionnaire with all items filled with the same answers was eliminated, and 381 valid questionnaires were obtained (questionnaire recovery efficiency, 99.7%). The participants were aged between 17 and 24 years old (mean age 20.17, SD = 1.55), including 120 male college students and 261 female college students. There were 168 college students returning home within Hubei Province and 213 students returning home outside Hubei Province. The study was approved by the Ethical Committee of the Institute of Education, Hubei University. Individuals who agreed to participate were given information about the study, and informed consent was obtained from the students or their parents, for individuals under the age of 18.

Measures

Perceived Personal Discrimination Scale

The questionnaire was developed by Shen et al. (2009), which is a 2-dimensional scale used to assess the perceived discrimination (Liu and Shen, 2010). The questionnaire included six items dividing into 2 dimensions (individual discrimination perception and group discrimination perception). Three items were used to measure individual discrimination perception, such as "I feel I have been treated differently"; and three other items measured group discrimination perception, such as "On the whole, people with similar background and experiences like me have been treated unfairly." The responses of the participants in each item were recorded on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The higher the total score, the more intense the perceived discrimination. This questionnaire is widely used in China and shows good validity and reliability (Shen et al., 2009; Liu and Shen, 2010; Zhang et al., 2019). We revised the questionnaire in this study to fit the context of the epidemic situation. The main change is to add background restrictions (i.e., as a person returning home from Wuhan after the outbreak of the epidemic). The Cronbach's alpha coefficient for this study is 0.88.

Data Analysis

For data analysis, we used the statistical package SPSS 22.0 for Windows. Data were described using the mean and SD for continuous data. A $p \leq 0.05$ was considered significant. During the outbreak of COVID-19, there were great differences in the severity of the epidemic and the acceptance of Wuhan returnees between Hubei Province and other provinces. Therefore, we further used an independent sample *t*-test to explore the differences in perceived discrimination by hometown address (within Hubei Province *vs.* outside Hubei Province).

Results

The results showed that the perceived discrimination score of college students returning home from Wuhan was 15.19 ± 5.24, with the highest score being 30 and the lowest score being 6. The comparison of perceived discrimination among students who returned home from Wuhan by hometown address is shown in **Figure 1**. For those with hometown addresses outside Hubei Province, the perceived discrimination score was 16.62 ± 5.23, which was significantly higher than the theoretical median value of 15, $t\ (212) = 4.55$, $p < 0.01$, *Cohen's d* = 0.62. For the students who returned to towns within Hubei Province, the perceived discrimination score was 13.37 ± 4.67, which was significantly lower than the theoretical median value of 15, $t\ (167) = -4.51$,

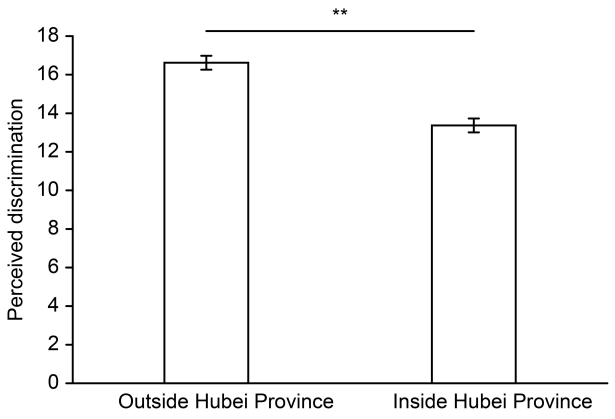


FIGURE 1 | Perceived discrimination by hometown address (error bars show ± 1 SEM, $^{**}p < 0.01$).

$p < 0.01$, *Cohen's* $d = -0.70$. Moreover, there was a significant difference in perceived discrimination between the two groups, $t\,(379) = 6.32$, $p < 0.01$, *Cohen's* $d = 0.65$.

Discussion

The results showed that college students returning from Wuhan to towns outside Hubei Province from Wuhan perceived significantly more discrimination. Considering the actual situation of the epidemic outbreak at that time and the cause of perceived discrimination, a possible reason for this greater perception of discrimination reports in the media that most infected patients in other regions had some connection to Wuhan, either by traveling to Wuhan or by contacting infected patients in Wuhan (Publicity Department of the Central Committee of the Chinese Communist Party Home Page, 2020). The Chinese government quarantined the city of Wuhan on January 23, 2020, and Hubei Province 2 days later. Therefore, in Hubei Province, people felt that "misery loves company." As a result, people who had been to Hubei were subject to more serious stigma and xenophobia (Moukaddam and Shah, 2020), resulting in greater perceived discrimination for college students who returned to towns outside Hubei Province. As the stress of perceived discrimination negatively affects mental and physical health (Williams et al., 1997), it is necessary to provide interventions to those who have perceived discrimination. Therefore, we will further intervene in the perceived discrimination of college students returning from Wuhan to towns outside Hubei Province.

STUDY 2. WISE INTERVENTION ON PERCEIVED DISCRIMINATION

The results of Study 1 showed that the level of perceived discrimination of college students returning from Wuhan to other provinces was relatively high. This study intervened with these people. To reduce perceived discrimination and prevent possible psychological problems, this study adopted the concept of wise intervention, created intervention materials for perceived social support, and intervened in the form of reading and writing.

The purpose of this study is to determine whether the intervention is effective and to identify its mechanism. Based on previous studies, we hypothesize that (1) wise intervention for perceived social support can significantly affect the perceived discrimination of college students returning home from Wuhan and that (2) perceived social support plays a mediating role in the influence of the intervention on perceived discrimination.

Methods

Participants

From March to April 2020, college students returning from Wuhan to provinces outside Hubei Province were recruited through the Internet to participate in the intervention experiment. A total of 79 participants participated, and 16 participants who did not complete the experiment as required were excluded. The high dropout percentage might be because the experiment was launched online. In the context of the epidemic, we could not conduct the experiment in the laboratory. We also made it clear that the participation was voluntary and they can withdraw from the study at any time without providing a reason. The participants might feel less pressure to withdraw from the experiment online. Furthermore, the total experiment took ∼40 min to complete, the time is relatively long, so some subjects quit before they have completed the experiment. Finally, 63 participants (15 males and 48 females) completed the experiment. There were 31 participants in the experimental group and 32 participants in the control group, all aged between 18 and 23, with an average age of 20.33. The age difference between the two groups was not significant, $t\,(61) = -0.52$, $p = 0.607$, and the sex difference was not significant, $\chi^2 = 0.13$, $p = 0.714$.

G*Power version 3.1 (Faul et al., 2007) was used to compute the required sample size of the experiment. With effect size f set at 0.25, alpha set at 0.05, two groups, and two repetitions, correlation among repetitions 0.5, non-sphericity correction = 1 yield a total sample size of 54 for testing the within-between interaction hypothesis, with 27 subjects in each group. In the present study, the final sample size was 31 participants in the intervention group and 32 in the control group. A bigger sample size than required would lead to a greater statistical power.

Measures

Perceived Personal Discrimination Scale

This scale is the same as that used in Study 1.

Perceived Social Support Scale

The PSSS was developed by Zimet et al. (1988). We used the Chinese version, revised by domestic scholar Jiang (1999), to measure the degree of perceived social support. There are 12 items on the scale, which are divided into three dimensions: family support, friend support, and other support. All items are rated on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). A lower score indicates poorer social support. The Chinese version of the PSSS has demonstrated good reliability in prior studies (Cronbach alpha = 0.88) (Huang et al., 1999). In this study, we changed "leader, relative, and colleague"

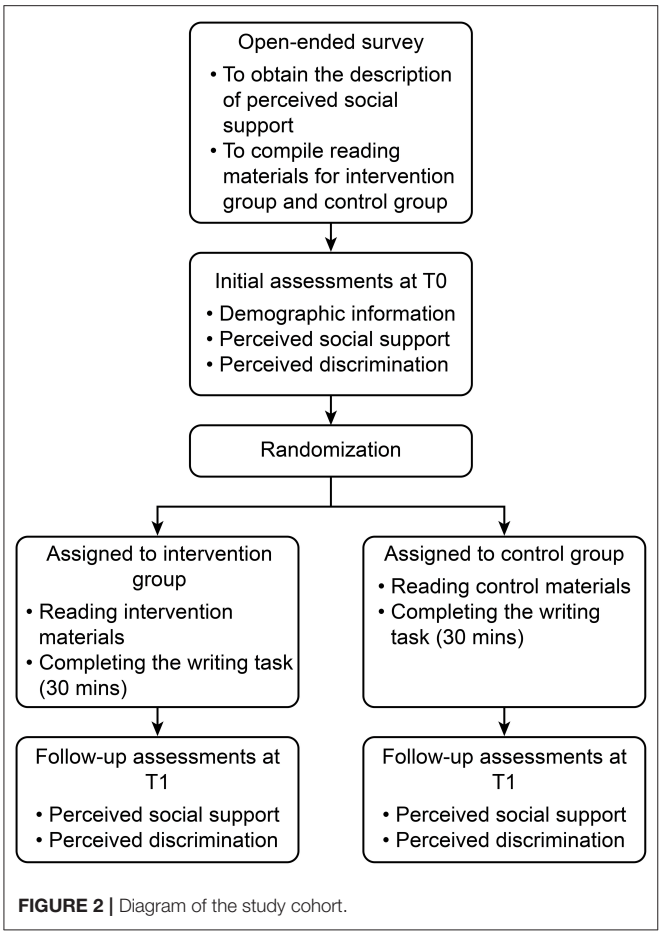


FIGURE 2 | Diagram of the study cohort.

to "community, neighbor, and volunteer." Combined with the special social situation during the epidemic period, we change the original "leaders, relatives, and colleagues" to "community, neighbors, and volunteers." The Cronbach's alpha coefficient for this study is 0.91.

Procedure

There are four stages in the present study: an open-ended survey, an initial assessment, intervention, and a follow-up test (**Figure 2**).

Open-Ended Survey

Before the intervention, we used an open-ended questionnaire to determine the actual situation of students returning home from Wuhan to prepare the reading materials for the experimental group. To prevent contamination, no participants who participated in the open-ended survey were allowed to participate in the formal experiment, and they were required not to inform others of the experimental contents.

First, five trained psychology undergraduates compiled the first draft of the perceived social support open-ended questionnaire by reading literature and having many rounds of discussion. Then, the questionnaire was sent to 23 psychology undergraduates who did not help compile the questionnaire, and they provided some modification suggestions. After amendments, the questionnaire was validated by three professional teachers of psychology. Finally, the questionnaire was sent to college students who did not major in psychology to ensure that the questionnaire was unambiguous.

The structure of the final open-ended questionnaire was as follows: (1) To understand the difficulties of the participants after returning home as a whole. For example, "What difficulties did you experience, and what did you worry about when you came back from Wuhan during the epidemic? How have these difficulties and concerns changed over time?" (2) They were asked to write about their experiences of perceived social support in terms of family support, friend support, and other support. For example, "How did you get on with your family after you came back from Wuhan during the epidemic? What did your family do to make you feel positive or negative about yourself or your hometown? Please provide enough details so that other students returning from Wuhan can understand your experience. Has your relationship with your family changed over time? If so, what has changed your relationship with your family?"

After the questionnaire was constructed, it was distributed to 18 college students returning home from Wuhan (9 male students and 9 female students, aged 20.33 $\pm$ 2.09 years). According to the answers of the participants, the researchers integrated them into a positive social support intervention material, which was used as the reading material for the experimental group in the intervention process. It should be noted that the positive meaning constructed in the intervention in this study is not a reversal of black and white because the researchers constructed the positive meaning against the ambiguous situation (rather than a situation with overt hostility), striving to help the individuals who returned home from Wuhan acquire adaptive meaning during a critical period.

The final reading materials of the experimental group included "the experience of other college students returning home from Wuhan" and "blessings and encouragement from other college students returning home from Wuhan." In the part of "the experience of other college students returning home from Wuhan," the positive social support examples were integrated into three parts: family support, friend support, and other support. For example:

"At first, I was worried that I was a potential carrier of the virus; when I came back, I was scared and worried that I was going to get infected because of my little cough and worried that I was going to infect my family, but my family was still very nice to me. They didn't think I was going to get sick and treated me just like normal. When my neighbors discussed with my family that I had come back from Wuhan, my family would explain, "She came back early, the incubation period has passed, and it doesn't matter." It makes me feel warm. When I have a fever, even though I have a common cold, my parents bring food and water to my bed to make me feel warm." (Other experiences of college students returning home from Wuhan).

"During the quarantine period, because we couldn't get out of the house, our materials were purchased by the community. In the beginning, they were not proficient, and sometimes they made some small mistakes, but they took our suggestions actively

and constantly improved. I can see the community workers were very busy and ate instant noodles for 3 days, and some got sick. Some students may be unhappy about tedious inspection reports, but it is their job duty, so we should cooperate with the community and together to overcome the outbreak. China refuels! Come on Wuhan!" (Other experiences of college students returning from Wuhan).

"Calm down and don't over blame ourselves. We didn't make mistakes. Quarantine is just to better control the epidemic. We are right to be isolated and contribute to the safety of the country, society, and others." (encouragement and blessings from other college students returning from Wuhan).

"In fact, I think there will be anxiety at the beginning, and I will settle down slowly and face it with a peaceful mind. There are truly many people who care about you, and we should be good at discovering that everyone has goodwill. Let us overcome the epidemic together. Come on Wuhan!" (encouragement and blessings from other college students returning from Wuhan).

The reading materials allowed the participants to look at the events in the social situation from multiple perspectives, to see the things they were facing more positively in the current social background, and to change the meaning construction process of the original events, that is, to change the process of how people understood themselves and the social situation.

Initial Assessment

The initial assessment was used to evaluate the social demographic information of the participants (including the returning place, gender, and age) and the core variables of the study (including perceived social support and perceived discrimination). The initial assessment was taken at T0, which was right before the intervention.

Intervention

A wise intervention starts with a specific and well-founded theory. The accuracy of the theory allows researchers to create a precise tool instantiating the theory in short training sessions and altering a particular mental process in real life. In this study, according to social cognition approaches, perceived support is primarily a cognitive phenomenon that represents a highly abstracted and impressionistic view of the social world (Wang and Zhang, 2020). Therefore, through reading and writing, this intervention helps students returning home from Wuhan understand their environments by thinking about their plights from multiple perspectives, improve their perceived social support, and thus reduce the discrimination they perceive.

The participants were randomly assigned to the experimental group and the control group. The intervention lasted for ∼30 min. Both groups were unaware of the difference in experimental conditions and did not know the specific experimental hypothesis.

The experimental group received perceived social support reading material, while the control group received non-intervention material. After reading the material, the participants were asked to complete the corresponding writing task (∼300 words).

After reading the intervention material, each participant was given an instruction: "Please write a short essay based on your own experience. Tell about the people and things around you and their support and encouragement. In addition, leave what you would like to say to other college students returning home from Wuhan. We will select a part of the content of the composition to show to the next group of students returning home from Wuhan. I'm sure they will appreciate your efforts and your heart to get us through this difficult time." In this task instruction, the participants were "supported and encouraged" to recall the process through further positive intervention, and the intervention information was internalized to play a better role. At the same time, the instruction emphasized "we will select a part of the content of the composition to show to the next group of college students returning home from Wuhan. I'm sure they will appreciate your efforts and your heart to help them to get through this difficult time." We encouraged the participants to "consider themselves as the benefactor rather than the beneficiary" (Peng, 2019), to give strong meaning to the participation of the participants in this experiment and ensure their effective participation.

There are two important meanings of "writing" in this study. First, writing helped participants express their feelings and thoughts during the epidemic and further clarify their thoughts and feelings. Second, expressing the combination of their own experience and those of others in writing helped the participants view their social situation more positively and objectively.

The only difference in intervention procedures between the control group and the experimental group was the reading material. The reading materials of the control group were simple popular science articles, and the task after reading was to finish a series of writing tasks. The length and reading time of the articles were similar to those of the experimental group. To avoid excessive cognitive resource consumption and fatigue, short answers were given at the beginning of obvious paragraphs or underlined. This operation effectively controlled the experimental independent variables.

After the completion of the writing task, the participants were asked to take photos of the writing content and then send the photos to the experimenter to ensure that the participants completed the writing task seriously.

Follow-Up Assessment

When the participants finished their intervention task (T1), the main variables of this study (including perceived social support and perceived discrimination) were measured again using the scale that was used in the initial assessment.

At the end of the experiment, we sent the reading materials of the intervention group to the participants in the control group. They could choose whether to read or not according to their own needs. In addition, we provided all participants with the contact information of a psychological service hotline that can provide psychological assistance services during the epidemic period.

Data Analysis

SPSS 22.0 was used for data processing. The effectiveness of the intervention was analyzed by using a 2 × 2 repeated-measures

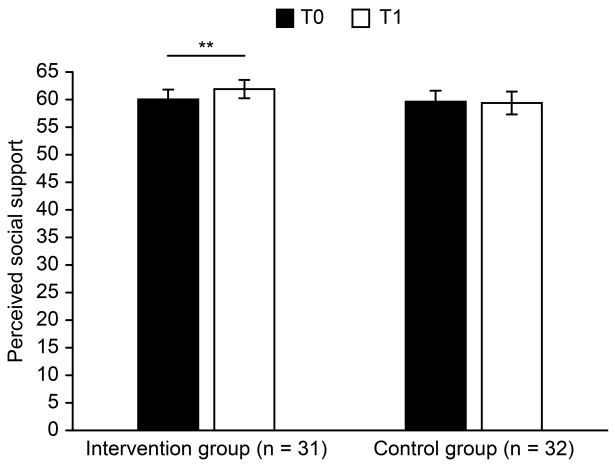


FIGURE 3 | Perceived social support before and after intervention (error bars show ±1 SEM, $^{**}p < 0.01$).

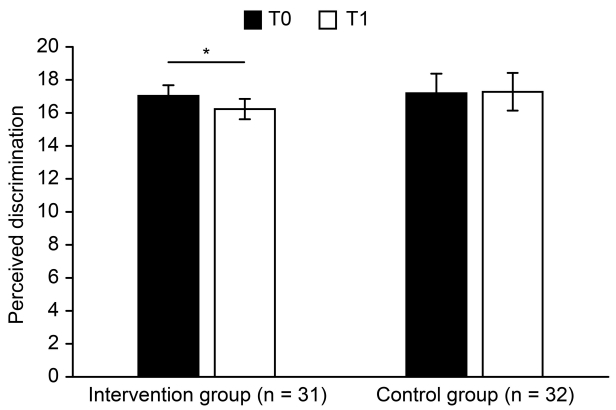


FIGURE 4 | Perceived discrimination before and after intervention (error bars show ± 1 SEM, $^{*}p < 0.05$).

(ANOVA, Greenhouse–Geisser corrections with corrected degrees of freedom), with time (T0 *vs.* T1) as a within-subject factor, and group (Intervention group *vs.* Control group) as a between-subjects factor. Then, independent *t*-tests and paired *t*-tests were performed, and perceived discrimination and perceived social support were compared with respect to group and time. The effect size estimates η_p^2 or *Cohen's d* were reported.

Results

Baseline Assessment

The independent *t*-test results show that there were no significant between-group differences on any baseline outcome measure at T0: perceived discrimination: $t\ (61) = -0.12$, $p = 0.909$; perceived social support: $t\ (61) = 0.15$, $p = 0.879$.

The lack of a significant difference in perceived social support and perceived discrimination between the experimental group and the control group before the intervention indicates that the experimental group and the control group had good homogeneity and met the requirements of randomization before the intervention.

Intervention Effects

To answer hypothesis 1, we performed a 2 × 2 ANOVA with time (T0 *vs.* T1) as a within-subjects factor and group (Intervention group *vs.* Control group) as a between-subjects factor. For perceived social support, the main effect of time [$F_{(1,61)} = 3.527$, $p = 0.065$, $\eta_p^2 = 0.055$] was marginally significant, perceived social support (T0) > perceived social support (T1). The main effect of group [$F_{(1,61)} = 0.311$, $p = 0.579$, $\eta_p^2 = 0.005$] was not significant. The interaction between time and group [$F_{(1,61)} = 6.039$, $p = 0.017$, $\eta_p^2 = 0.090$] was significant. For the experimental group, perceived social support increased significantly (**Figure 3**), T0 *vs.* T1: $t\ (30) = -2.92$, $p = 0.007$, *Cohen's d* $= -1.07$. For the control group, there was no significant change in perceived social support, $t\ (31) = 0.43$, $p = 0.670$, *Cohen's d* $= 0.15$. For perceived discrimination, the main effect of time [$F_{(1,61)} = 1.865$, $p = 0.177$, $\eta_p^2 = 0.030$] was not significant. No main effect of group [$F_{(1,61)} = 0.213$, $p = 0.646$, $\eta_p^2 = 0.003$] was revealed. The interaction between time and group [$F_{(1,61)} = 2.976$, $p = 0.090$, $\eta_p^2 = 0.047$] was marginally significant. For the intervention group, the perceived discrimination of the participants at T1 was lower than that of T0 (**Figure 4**), $t\ (30) = 2.73$, $p = 0.010$, *Cohen's* d $= 0.99$, while there were no differences for the control group, $t\ (31) = -0.22$, $p = 0.828$, *Cohen's* d $= -0.08$.

To investigate whether the intervention effectively decreased perceived discrimination, it is necessary to test whether there was a significant difference between the experimental group and the control group in the change in perceived social support or perceived discrimination after the implementation of the intervention (T1–T0). Independent sample *t*-tests were used to compare the changes in the experimental group and the control group, and the results showed that there was a significant difference in perceived social support between the two groups, $t\ (61) = 2.46$, $p = 0.017$, *Cohen's* d $= 0.63$, indicating that the intervention of the experimental group effectively increased perceivable social support level. The difference between the two groups was marginally significant on perceived discrimination, $t\ (61) = -1.73$, $p = 0.090$, *Cohen's* d $= -0.44$. This shows that compared with the control group, the experimental group experienced decreased perceivable discrimination.

The Mediating Effect of Perceived Social Support

To assess hypothesis 2, we tested the mediating role of perceived social support in the influence of the intervention on perceived discrimination. We used the Hayes (Hayes, 2013) PROCESS tool in SPSS. This widely used SPSS program is based on deviation correction of the percentile bootstrap method and can add intermediary regulation and adjustment to the variety of mediation model verifications.

The results are shown in **Table 1**. The intervention conditions had a marginally significant influence on perceived social support ($p = 0.090$, 95% $CI = -3.36 \sim -0.05$). After incorporating perceived social support as a mediating variable,

TABLE 1 | Regression analysis of the mediating role of perceived social support.

Dependent variable	Independent variable	R^2	*B*	*SE*	*β*	*t*	*p*
Perceived discrimination	Intervention condition	0.05	0.90	0.52	0.22	1.73	0.090
Perceived social support	Intervention condition	0.09	−2.12	0.86	−0.30	−2.46	0.017
Perceived discrimination	Intervention condition	0.10	0.59	0.53	0.14	1.09	0.279
	Perceived social support		−0.15	0.08	−0.25	−1.97	0.054

Perceived discrimination and perceived social support were the changes before and after the intervention (T1–T0).

TABLE 2 | The mediating effect of perceived social support.

	Indirect effect value	Bootstrap standard error	Boot CI lower limit	Boot CI upper limit	Relative mediation effect
Indirect effect	0.32	0.26	−0.03	0.95	35%

the results showed that the intervention conditions had a significant influence on perceived social support ($p = 0.017$, 95% CI $= -3.85 \sim -0.40$). On perceived social support, the direct effect of intervention on perceived discrimination was marginally significant ($p = 0.054$, 95% CI $= -0.30 \sim 0.00$), while on perceived discrimination, the direct effect of intervention was not significant ($p = 0.279$, 95% CI $= -0.48$–1.65). It can be seen that perceived social support plays a complete mediating role in terms of the intervention conditions and perceived discrimination. The percentile bootstrap mediating effect test for bias correction further showed that (as shown in **Table 2**) the mediating effect value was 0.32, the 95% confidence interval of bootstrap was [−0.03, 0.95], and the mediating effect accounted for 35% of the total effect.

The results of Study 2 showed that the wise intervention program had a significant effect on the perceived discrimination of college students returning home from Wuhan, which proved that the intervention method used in this experiment was effective. We also found that while the perception of discrimination decreased, the perceived social support of individuals increased. Therefore, Study 2 further verified the mediating effect of perceived social support between intervention conditions and perception of discrimination, and the results showed that perceived social support played a complete mediating effect. Hypothesis 2 was confirmed.

GENERAL DISCUSSION

In the context of the COVID-19 outbreak, the mental health of the individuals has attracted much attention. Some studies have investigated the mental health of college students in China and found that the mental health level of Chinese college students was affected by the epidemic (Chen et al., 2020; Wang et al., 2020). Based on this, we took college students returning home from Wuhan as the subjects and found that these college students returning home from Wuhan to other provinces experienced more perceived discrimination. Then, we proposed a wise intervention method to intervene in the perceived discrimination perception of these college students and found that the wise intervention effectively reduced the perceived discrimination of college students returning home from Wuhan.

In the investigation of the mental health status of college students returning home from Wuhan, we found that their perceived discrimination was higher than the norm and was significantly affected by hometown location (within Hubei Province *vs.* outside Hubei Province): the perceived discrimination of students returning to towns outside Hubei Province was significantly higher. Considering the detailed experience shared by the participants in Study 2, there are several possible reasons: (1) The epidemic was more severe in Hubei Province than in other provinces. COVID-19 is reported to spread mainly through respiratory droplets, direct contact, aerosol diffusion, and so forth, and these modes of transmission are closely related to population mobility (Center for Disease Control and Prevention Home Page, 2020; Jiang and Luo, 2020). On January 27, 2020, all cities within Hubei Province reported confirmed COVID-19 cases (Jiang and Luo, 2020). Since then, all the people from Hubei Province have become the targets of protection. Therefore, college students returning from Wuhan to their hometowns within Hubei Province may not have experienced being treated differently. However, in areas outside Hubei Province, where the epidemic was less severe, stricter measures were taken to monitor those who returned from Wuhan. Under these circumstances, college students who returned from Wuhan to other provinces became "disadvantaged groups." According to the theory of relative deprivation in social comparison theory (Mummendey et al., 1999), members of disadvantaged groups often experience the feeling of being deprived of their basic rights. This sense of deprivation would make college students returning from Wuhan more likely to perceive discrimination. (2) The perceived social support of college students returning from Wuhan to other provinces was low, which ultimately led to higher perceived discrimination. When college students returned from Wuhan to their hometowns outside Hubei Province, instead of being welcomed by relatives and friends, they were met with defensiveness and rejection, and their perceived social support was severely reduced, leading to more perceived discrimination. Studies have shown that poor received and perceived social

support negatively influences the mental health of people (Vaingankar et al., 2020). By contrast, perceived social support is generally beneficial to an adaptation of the individual. The more social support an individual receives, the better his/her adaptation will be (Chirkov et al., 2008). In conclusion, this suggests that when the COVID-19 outbreak occurred, people may have adopted a series of treatment with negative bias toward those who had been to the epidemic area, leading to strong perceived discrimination among those who returned from the epidemic area and possibly mental illness (Evans-Lacko et al., 2012). Therefore, adopting some methods to increase perceived social support of people may help them avoid some adverse consequences.

This study also found that perceived social support played a mediating role between intervention conditions and perceived discrimination; that is, by enhancing individual perceived social support, the perception of discrimination among college students returning from Wuhan was reduced. According to the stress-buffering model, social support protects mental health by buffering the effect of perceived discrimination (Cohen and Wills, 1985; Krysia and Wei, 2014).

In line with the primary hypothesis, wise intervention for perceived social support can significantly affect the perceived discrimination, which manifested as a large effect (*Cohen's* $d = -1.07$). This study asked the participants to read the detailed experience of other college students who returned home from Wuhan and to complete the corresponding writing tasks. Showing examples of the student of support from relatives, friends, and society from different angles changed their understanding of their current social situations, enhanced their understanding of their social support level, and changed their idea that "other people exclude me because of the bad situation and are unwilling to help me," which reduced the discrimination they perceived. This is consistent with previous research results; that is, social support can reduce the perception of discrimination of an individual (Podsakoff et al., 2012; Zhang et al., 2019), and perceived emotional support from family in response to a serious problem buffer the stress caused by high levels of everyday discrimination (Krysia and Wei, 2014). In addition, other researchers have proposed that the more social support an individual receives, the less lonely he or she feels, and the more positive emotions he or she experiences (He et al., 2015; Wood and Cook, 2019). Therefore, perceived social support may be an important protective resource in the context of epidemic situations and may effectively reduce the perceived pressure on individuals, thus protecting their psychological well-being.

In addition, we used a new concept of intervention and proposed a wise intervention for perceived social support. We used reading and writing to intervene in the perceived discrimination of an individual. Previous studies have confirmed that epidemic outbreaks have been historically accompanied by stigma, discrimination, and xenophobia, leading to psychological harm to individuals in the epicenter (Villa et al., 2020). Therefore, psychological interventions that reduce the perceived discrimination in the people exposed to the pandemic could be helpful in preventing the development of mental illnesses. In this study, the wise intervention method effectively reduced the perceived discrimination of college students returning home from Wuhan. This method is different from traditional long-term interventions, with the advantages of being short-term, low-cost, and more concise. Moreover, this method has lower requirements for the implementers of the intervention and can be completed over the Internet (Walton and Cohen, 2011; Logel and Cohen, 2012). Currently, the epidemic has spread to a pandemic, emphasizing the importance of managing psychological problems. We can consider promoting the use of this method to reduce perceived discrimination among infected people, suspected infected people, and other people who experience discrimination by others to reduce the possibility of psychological problems.

Finally, some limitations of the study deserve noting. (1) In the context of COVID-19 quarantine, convenience, and snowball sampling methods were used to recruit the sample. As the study did not limit the gender of the subjects, the final results showed that the majority of the sample in this study were female subjects (accounted for 68.5% of the total sample). This limits the generality and generalization of the conclusions, so future studies should balance gender ratios and verify the results of this study in a wider population. (2) The original plan of this study was to use multiple time points for the posttest to evaluate the effectiveness of this wise intervention method. However, this experiment is closely related to the epidemic environment. The Chinese government took strong anti-epidemic measures so that the epidemic situation could be better controlled. Therefore, the psychological states of the people changed greatly with changes in the social situation, so this study failed to conduct multiple posttests. However, the core idea of the intervention is to "change the meaning construction of the participants," which requires the participants to continuously internalize and thus produce long-term effects. Therefore, in the future, researchers can design multiple posttests in a standardized environment to test the long-term effects of this intervention.

CONCLUSIONS

In this study, we found that during the COVID-19 outbreak, college students returning from Wuhan to their hometowns outside Hubei Province (areas where the epidemic was not severe) perceived discrimination. Therefore, we used the wise intervention program for perceived social support to assist these college students. The results showed that this intervention program effectively reduced the perceived discrimination of college students. In addition, this study further explored the potential mechanism of the effect of the intervention. It was found that the intervention reduced the perceived discrimination of individuals by improving their levels of perceived social support.

The results of this study provide some insight into the prevention and intervention for mental health problems among individuals affected by the epidemic. Specifically, the content of intervention (perceived social support) and the form of intervention (wise intervention) can be designed to prevent the occurrence of psychological problems in epidemic situations. Moreover, the investigation of the mechanism of intervention is helpful for preventing or intervening in the discrimination

perceived by individuals and helps develop more effective intervention programs.

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 Hubei University. Written informed consent to participate in this study was provided by the participants or the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

TL, ZR, and WY: conceptualization. TL and LW: data curation and resources. ZG and XZ: formal analysis. HL, XZ, and LH: investigation. TL and ZR: methodology and validation. WY: project administration. ZR: supervision. ZG, HL, and XZ: writing—original draft. TL, ZG, ZR, and WY: writing—review and editing. All authors contributed to the article and approved the submitted version.

FUNDING

This study was supported by the Humanity and Social Science Youth Foundation of the Education Bureau of Hubei Province of China (19Q004), the National Social Science Foundation of China (19FJKY004).

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.689251/full#supplementary-material

REFERENCES

Ahmed, A. T., Mohammed, S. A., and Williams, D. R. (2007). Racial discrimination & health: pathways & evidence. *Ind. J. Med. Res.* 126, 318–327.

Aneshensel, C. S., and Stone, J. D. (1982). Stress and depression: a test of the buffering model of social support. *Arch. Gen. Psychiatry.* 39, 1392–1396. doi: 10.1001/archpsyc.1982.04290120028005

Brand, E. F., Lakey, B., and Berman, S. (1995). A preventive, psychoeducational approach to increase perceived social support. *Am. J. Commun. Psychol.* 23, 117–135. doi: 10.1007/BF02506925

Center for Disease Control and Prevention Home Page (2020). Available online at: https://www.cdc.gov/coronavirus/2019-ncov/about/transmission.html (accessed October 28, 2020).

Chen, B. J., Yuan, Y., Sun, X. X., Chen, Z. H., Xie, F., Shen, S. T., et al. (2020). Emotional status of college students, its trend, sources and outcome during the early stage of COVID-19. *China J. Health Psychol.* 28, 1646–1654. doi: 10.13342/j.cnki.cjhp.2020.11.010

Chirkov, V. I., Safdar, S., de Guzman, J., and Playford, K. (2008). Further examining the role motivation to study abroad plays in the adaptation of international students in Canada. *Int. J. Intercult. Relat.* 32, 427–440. doi: 10.1016/j.ijintrel.2007.12.001

Cohen, S., and Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychol. Bull.* 98, 310–357. doi: 10.1037/0033-2909.98.2.310

Etzion, D. (1984). Moderating effect of social support on the stress-burnout relationship. *J. Appl. Psychol.* 69, 615–622. doi: 10.1037/0021-9010.69.4.615

Evans-Lacko, S., London, J., Japhet, S., Rüsch, N., Flach, C., Corker, E., et al. (2012). Mass social contact interventions and their effect on mental health related stigma and intended discrimination. *BMC Public Health.* 12:489. doi: 10.1186/1471-2458-12-489

Fan, X. H., Fang, X. Y., Yang, L., Lin, X. Y., and Yuan, X. J. (2012). The effect of social support and social identity on the relationship between perceived discrimination and socio-cultural adjustment among chinese migrant children. *Acta Psychol. Sinica.* 44, 647–663. doi: 10.3724/SP.J.1041.2012.00647

Faul, F., Erdfelder, E., Lang, A. G., and Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behav. Res. Methods* 39, 175–191. doi: 10.3758/BF03193146

Finkel, E. J., Slotter, E. B., Luchies, L. B., Walton, G. M., and Gross, J. J. (2013). A brief intervention to promote conflict reappraisal preserves marital quality over time. *Psychol. Sci.* 24, 1595–1601. doi: 10.1177/0956797612474938

Hayes, A. (2013). Introduction to mediation, moderation, and conditional process analysis. *J. Educ. Measure.* 51, 335–337. doi: 10.1111/jedm.12050

He, A., Hui, Q., and Liu, H. (2015). The relationship between social support and loneliness among college students: mediating role of gratitude. *Chin. J. Clin. Psychol.* 23, 150–153. doi: 10.16128/j.cnki.1005-3611.2015.01.034

Huang, L., Jiang, Q. J., and Ren, W. H. (1999). The correlational study on coping modes, social support, and psychosomatic symptoms among cancer patients. *Chin. Ment. Health J.* 8, 199–201.

Jiang, J., and Luo, L. (2020). Influence of population mobility on the novel coronavirus disease (COVID-19) epidemic: based on panel data from Hubei, China. *Glob. Health Res. Policy.* 5:30. doi: 10.1186/s41256-020-00151-6

Jiang, Q. J. (1999). "Perceived social support scale (PSSS)," in *Handbook of the Mental Health Rating Scale*, eds X. D. Wang, X. L. Wang, and H. Ma (Beijing: Chinese Mental Health Journal), 131–133.

Ju, Y., Zhang, Y., Wang, X., Li, W., Ng, R. M. K., and Li, L. (2020). China's mental health support in response to COVID-19: progression, challenges and reflection. *Globaliz. Health.* 16:102. doi: 10.1186/s12992-020-00634-8

Kelly, N. R., Cotter, E. W., Guidinger, C., and Williamson, G. (2020). Perceived discrimination, emotion dysregulation and loss of control eating in young men. *Eat. Behav.* 37:101387. doi: 10.1016/j.eatbeh.2020.101387

Kim, K., Sun, J. J., Cho, S., Ji, H. P., and Kim, H. C. (2019). Perceived discrimination, depression, and the role of perceived social support as an effect modifier in korean young adults. *J. Prevent. Med. Public Health.* 52, 366–376. doi: 10.3961/jpmph.19.114

Krysia, N. M., and Wei, Z. (2014). Does social support buffer the stress of discrimination and reduce psychological distress among asian americans?. *Soc. Psychol. Q.* 77, 273–295. doi: 10.1177/0190272514534271

Lee, S. H., Lee, H. S., Kim, G. H., Lee, J.-H., Lee, K.-J., and Kim, J. J. (2016). The association between perceived discrimination and depression/anxiety disorders among Korean workers: analysis of the third Korean Working Conditions Survey. *Ann. Occupat. Environ. Med.* 28:32. doi: 10.1186/s40557-016-0121-4

Li, H., Zheng, L., Le, H., Zhuo, L., Wu, Q., Ma, G., et al. (2020). The Mediating role of internalized stigma and shame on the relationship between COVID-19 related discrimination and mental health outcomes among back-to-school students in Wuhan. *Int. J. Environ. Res. Public Health* 17:9237. doi: 10.3390/ijerph17249237

Li, J., Fan, Y., Zhong, H.-Q., Duan, X.-L., Chen, W., Evans-Lacko, S., et al. (2019). Effectiveness of an anti-stigma training on improving attitudes and decreasing discrimination towards people with mental disorders among care assistant workers in Guangzhou, China. *Int. J. Mental Health Syst.* 13:1. doi: 10.1186/s13033-018-0259-2

Lian, T., and Kawachi, I. (2020). Experiences of discrimination and self-reported health in chinese migrants: a structural equation model. *BMC Public Health* 20:1477. doi: 10.1186/s12889-020-09588-3

Liu, X., and Shen, J. L. (2010). Migrant children's perceived discrimination and its relationship with self-esteem. *J. Psychol. Sci.* 33, 695–697. doi: 10.16719/j.cnki.1671-6981.2010.03.044

Liu, Z. H., Zhao, Y. J., Feng, Y., Zhang, Q., Zhong, B. L., Cheung, T., et al. (2020). Migrant workers in China need emergency psychological interventions during the COVID-19 outbreak. *Global Health* 16:75. doi: 10.1186/s12992-020-00608-w

Logel, C., and Cohen, G. L. (2012). The role of the self in physical health: testing the effect of a values-affirmation intervention on weight loss. *Psychol. Sci.* 23, 53–55. doi: 10.1177/0956797611421936

Major, B., Quinton, W. J., and McCoy, S. K. (2002). Antecedents and consequences of attributions to discrimination: Theoretical and empirical advances. *Adv. Experi. Soc. Psychol.* 34, 251–330. doi: 10.1016/S0065-2601(02)80007-7

Moukaddam, N., and Shah, A. (2020). Psychiatrists beware! The impact of COVID-19 and pandemics on mental health. *Psychiatr. Times* 37, 11–12.

Mummendey, A., Kessler, T., Klink, A., and Mielke, R. (1999). Strategies to cope with negative social identity: predictions by social identity theory and relative deprivation theory. *J. Pers. Soc. Psychol.* 76, 229–245. doi: 10.1037/0022-3514.76.2.229

Otu, A., Charles, C. H., and Yaya, S. (2020). Mental health and psychosocial well-being during the COVID-19 pandemic: the invisible elephant in the room. *Int. J. Mental Health Syst.* 14:38. doi: 10.1186/s13033-020-00371-w

Pascoe, E. A., and Smart Richman, L. (2009). Perceived discrimination and health: a meta-analytic review. *Psychol. Bull.* 135, 531–554. doi: 10.1037/a0016059

Peng, W. Y. (2019). Perceived School Climate Intervention Improves Mental Health of High School Students: A Study of Wise Intervention. (Unpublished doctorial dissertation). Central China Normal University, Wuhan, China.

Podsakoff, P. M., MacKenzie, S. B., and Podsakoff, N. P. (2012). Sources of method bias in social science research and recommendations on how to control it. *Annu. Rev. Psychol.* 63, 539–569. doi: 10.1146/annurev-psych-120710-100452

Publicity Department of the Central Committee of the Chinese Communist Party Home Page (2020). Available online at: www.nhc.gov.cn/xcs/s7847/202001/8d735f0bb50b45af928d9944d16950c8.shtml (accessed January 21, 2020).

Qiu, J., Shen, B., Zhao, M., Wang, Z., Xie, B., and Xu, Y. (2020). A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: implications and policy recommendations. *Gene. Psychiatry* 33:e100213. doi: 10.1136/gpsych-2020-100213

Ren, S. Y., Gao, R. D., and Chen, Y. L. (2020). Fear can be more harmful than the severe acute respiratory syndrome coronavirus 2 in controlling the corona virus disease 2019 epidemic. *World J. Clin. Cases* 8, 652–657. doi: 10.12998/wjcc.v8.i4.652

Salari, M., Zali, A., Ashrafi, F., Etemadifar, M., Sharma, S., Hajizadeh, N., et al. (2020). Incidence of anxiety in parkinson's disease during the coronavirus disease (COVID-19) pandemic. *Mov. Disord.* 35, 1095–1096. doi: 10.1002/mds.28116

Shaukat, N., Ali, D. M., and Razzak, J. (2020). Physical and mental health impacts of COVID-19 on healthcare workers: a scoping review. *Int. J. Emerg. Med.* 13:40. doi: 10.1186/s12245-020-00299-5

Shen, J. L., Hu, X. Y., and Liu, X. (2009). Left-over children's perceived discrimination: its characteristics and relationship with personal well being. *J. Henan University*. 49, 116–121. doi: 10.15991/j.cnki.411028.2009.06.018

Sirati-Nir, M., Khaghanizade, M., Rahimi, A., Khazaei, M., and Ghadirian, F. (2018). The effect of social support skill-training group intervention on perceived social support in veterans with posttraumatic stress disorder. *Iran. J. Nursing Midwifery Res.* 23, 272–276. doi: 10.4103/ijnmr.IJNMR_165_16

Skosireva, A., O'Campo, P., Zerger, S., Chambers, C., Gapka, S., and Stergiopoulos, V. (2014). Different faces of discrimination: perceived discrimination among homeless adults with mental illness in healthcare settings. *BMC Health Serv. Res.* 14:376. doi: 10.1186/1472-6963-14-376

Stangl, A. L., Earnshaw, V. A., Logie, C. H., Brakel, W. V., Simbayi, L. C., Barré, I., et al. (2019). The health stigma and discrimination framework: a global, crosscutting framework to inform research, intervention development, and policy on health-related stigmas. *BMC Med.* 17:31. doi: 10.1186/s12916-019-1271-3

Stangl, A. L., Lloyd, J. K., Brady, L. M., Holland, C. E., and Baral, S. (2013). A systematic review of interventions to reduce HIV-related stigma and discrimination from 2002 to 2013: how far have we come? *J. Int. AIDS Soc.* 16:18734. doi: 10.7448/IAS.16.3.18734

Tiegs, F. (2010). The main effect model versus buffering model of shop steward social support: a study of rank-and-file auto workers in the U.S.A. *J. Organiz.Behav.* 14, 481–493. doi: 10.1002/job.4030140509

Usher, K., Durkin, J., and Bhullar, N. (2020). The COVID-19 pandemic and mental health impacts. *Int. J. Mental Health Nursing.* 29, 315–318. doi: 10.1111/inm.12726

Vaingankar, J. A., Abdin, E., Chong, S. A., Shafie, S., Sambasivam, R., Zhang, Y. J., et al. (2020). The association of mental disorders with perceived social support, and the role of marital status: results from a national cross-sectional survey. *Arch. Public Health.* 78:108. doi: 10.1186/s13690-020-00476-1

Villa, S., Jaramillo, E., Mangioni, D., Bandera, A., Gori, A., and Raviglione, M. C. (2020). Stigma at the time of the COVID-19 pandemic. *Clin. Microbiol. Infect.* 11, 1450–1452. doi: 10.1016/j.cmi.2020.08.001

Walton, G, M., and Wilson, T. D. (2018). Wise interventions: psychological remedies for social and personal problems. *Psychol. Rev.* 125, 617–655. doi: 10.1037/rev0000115

Walton, G. (2014). The new science of wise psychological interventions. *Curr. Dir. Psychol. Sci.* 23, 73–82. doi: 10.1177/0963721413512856

Walton, G. M., and Cohen, G. L. (2011). A brief social-belonging intervention improves academic and health outcomes of minority students. *Science.* 331, 1447–1451. doi: 10.1126/science.1198364

Wang, H., Ma, H. X., Luo, H. G., and Liu, Y. J. (2020). Investigation of university students' mental health status during outbreak of COVID-19. *J. North China University Sci. Technol.* 22, 478–481. doi: 10.19539/j.cnki.2095-2694.2020.06.012

Wang, S., and Zhang, D. (2020). The impact of perceived social support on students' pathological internet use: the mediating effect of perceived personal discrimination and moderating effect of emotional intelligence. *Comput. Hum. Behav.* 106:106247. doi: 10.1016/j.chb.2020.106247

Williams, D. R., Yan, Y.u., Jackson, J. S., and Anderson, N. B. (1997). Racial differences in physical and mental health. *J. Health Psychol.* 2, 335–351. doi: 10.1177/135910539700200305

Wood, E. P., and Cook, S. H. (2019). Father support is protective against the negative effects of perceived discrimination on CRP among sexual minorities but not heterosexuals. *Psychoneuroendocrinology* 110:104368. doi: 10.1016/j.psyneuen.2019.06.019

Xinhua Net (2020). *Xinhua Headlines: A Race Against Time! Wuhan BATTLES coronavirus.* Available online at: http://www.xinhuanet.com/english/2020-01/30/c_138743900.htm (accessed March 12, 2020).

Yang, H., Bin, P., and He, A. J. (2020). Opinions from the epicenter: An online survey of university students in Wuhan amidst the COVID-19 outbreak1. *J. Chin. Gov.* 5, 234–248. doi: 10.1080/23812346.2020.1745411

Ye, M., and Lyu, Z. (2020). Trust, risk perception, and COVID-19 infections: evidence from multilevel analyses of combined original dataset in China. *Soc. Sci. Med.* 265:113517. doi: 10.1016/j.socscimed.2020.113517

Yeager, D. S., Trzesniewski, K. H., and Dweck, C. S. (2013). An implicit theories of personality intervention reduces adolescent aggression in response to victimization and exclusion. *Child Dev.* 84, 970–988. doi: 10.1111/cdev.12003

Zhang, L., Xue, X. J., and Zhao, J. X. (2019). Discrimination perception, depression, and academic achievement in rural left-behind children: a longitudinal mediation model. *J. Psychol. Sci.* 42, 584–590. doi: 10.16719/j.cnki.1671-6981.20190311

Zimet, G. D., Dahlem, N. W., Zimet, S. G., and Farely, G. K. (1988). The multidimensional scale of perceived social support. *J. Personal. Assess.* 52, 30–41. doi: 10.1207/s15327752jpa5201_2

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 07 June 2021
doi: 10.3389/fpsyg.2021.615909

Gender Differences in Anxiety, Depression, and Nursing Needs Among Isolated Coronavirus Disease 2019 Patients

*Yifei Li[1], Juan Li[1], Zhen Yang[2], Jie Zhang[1], Lili Dong[2], Fusheng Wang[2] and Jingping Zhang[1]**

[1] Nursing Psychology Research Center, Xiangya School of Nursing, Central South University, Changsha, China, [2] The Second Affiliated Hospital of Shantou University Medical College, Shantou, China

OPEN ACCESS

Edited by:
Fushun Wang,
Nanjing University of Chinese Medicine, China

Reviewed by:
Bing Xiang Yang,
Wuhan University, China
Abhilash Perisetti,
University of Arkansas for Medical Sciences, United States

***Correspondence:**
Jingping Zhang
jpzhang1965@csu.edu.cn

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *10 October 2020*
Accepted: *07 May 2021*
Published: *07 June 2021*

Citation:
Li Y, Li J, Yang Z, Zhang J, Dong L, Wang F and Zhang J (2021) Gender Differences in Anxiety, Depression, and Nursing Needs Among Isolated Coronavirus Disease 2019 Patients. Front. Psychol. 12:615909. doi: 10.3389/fpsyg.2021.615909

Objective: This study explored gender differences in anxiety, depression, and nursing needs among isolated Coronavirus Disease 2019 (COVID-19) patients, with a particular focus on the influencing factors. The main goal was to elucidate breakthrough points and intervention targets for psychological counseling aimed at the promotion of overall health during isolation treatment.

Methods: A survey was conducted to obtain information about the nursing needs of COVID-19 patients, with mental health assessed via the Hospital Anxiety and Depression Scale (HADS). Participants included 219 isolated COVID-19 patients at a Wuhan module hospital in Hubei province, China.

Results: A total of 216 valid questionnaires were collected (98.63% retrieval rate). Of these participants, 21.76% had anxiety symptoms, while 17.59% had depression symptoms. Colleagues infected with COVID-19 (OR = 3.896, 95%CI: 1.555–9.764, $P = 0.004$) were the main influencing factors for anxiety symptoms, while marital status (OR = 2.700, 95% CI: 1.033–7.055, $P = 0.043$) and family members infected with COVID-19 (OR = 2.969, 95% CI: 1.243–7.095, $P = 0.014$) were the main influencing factors for depression symptoms. As for gender, male patients were generally more prone to depression and anxiety than female patients, especially those who were infected with colleagues. On the other hand, female patients reported greater concerns about safe treatment environments and communication with medical staff.

Conclusion: This study found gender-based differences regarding the factors influencing anxiety and depression in isolated COVID-19 patients, with males reporting a greater general tendency for symptoms. On the other hand, female patients reported greater overall psychological nursing needs than males. Targeted nursing should thus be implemented to address specific psychological characteristics and nursing needs.

Keywords: coronavirus disease 2019, isolated patients, gender, nursing needs, hospital anxiety and depression scale, COVID-19

INTRODUCTION

The highly contagious acute respiratory infection leading to the illness known as Coronavirus Disease 2019 (COVID-19) began spreading across the globe in late 2019 (Wang C. et al., 2020). It has now infected more than 149 million people, resulting in 3.15 million total deaths as of April 30, 2021 (World Health Organization (WHO), 2021). COVID-19 is thus referred to as the sixth worldwide public health crisis (Arab-Mazar et al., 2020). According to the existing case data, COVID-19 is mainly manifested by fever, dry cough and fatigue, and a small number of patients are accompanied by upper respiratory tract and digestive tract symptoms such as nasal obstruction, runny nose and diarrhea. About half of the patients develop dyspnea 1 week later, which in severe cases can lead to acute respiratory distress syndrome or septic shock and even death (Chen and Li, 2020). The primary routes of transmission of the COVID-19 are through respiratory droplets and close person-to-person contact (Amirian, 2020).

In this context, quarantine is one of the most effective measures for halting the spread of the virus (Chen Z. et al., 2020). In fact, the diagnosis and treatment plan issued by the National Health Commission of the People's Republic of China also emphasizes that COVID-19 patients must be isolated and treated in designated hospitals (National Health Commission of the People's Republic of China, 2020). However, this practice has created a dilemma. While isolation provides epidemiological benefits, it can also cause psychosocial harm, thereby resulting in more negative emotions and nursing needs among affected patients (Sharma et al., 2020).

A previous study on severe acute respiratory syndrome (SARS) patients who were placed in isolation found that 96.6% thus experienced feelings of inferiority, loneliness, and abandonment (Yang, 2004). A later follow-up study on discharged SARS patients found that more than one-third had incurred psychological problems, including post-traumatic stress disorder, anxiety, and depression (Kwek et al., 2006). Similarly, an investigation among isolated COVID-19 patients found that anxiety and depression were common psychological problems, with respective incidence rates of 38.5 and 35.9% (Nie et al., 2020). These negative psychological impacts not only harm mental health, but may also affect disease recovery (Fu and Luo, 2011; Pang, 2016).

One of the important purposes of human activity is to satisfy needs. In this regard, isolated COVID-19 patients may require greater nursing needs due to several unique conditions, including separation from relatives, fear of the disease, and unfamiliarity induced by isolation (Fan et al., 2020). Wang Z. Y. et al. (2020) found that COVID-19 patients generally experienced anxiety and depression when being admitted to the hospital. However, most of these symptoms are alleviated through continued treatment and satisfaction with nursing services (Wang Z. Y. et al., 2020). In other words, medical staff can more efficiently deal with negative emotions through a better understanding of the specific nursing needs, thus improving overall mental health for patients.

Many previous studies on COVID-19 patients have found gender-based differences in both anxiety and depression. For example, female patients are more likely to experience negative emotions related to anxiety and depression than male patients (Gu et al., 2020; Nie et al., 2020). Similar studies on SARS patients have also found that males and females tend to have different nursing needs, with female patients reporting a greater need for contact with relatives (Li et al., 2003). These types of studies can produce valuable information for medical staff during targeted interventions aimed at reducing negative emotions for patients. However, there is still a lack of information on gender-based differences in anxiety, depression, and nursing needs among COVID-19 patients. As such, this survey study investigated differences in sociodemographic characteristics, anxiety, depression, and nursing needs between male and female COVID-19 patients who were placed in isolation. Our findings provide a basis for interventions and services aimed at alleviating negative emotions while promoting overall mental health.

MATERIALS AND METHODS

This study implemented a cross-sectional design in which an online survey was conducted to assess anxiety, depression, and nursing needs among isolated COVID-19 patients at a Wuhan module hospital in Hubei province, China. All participants admitted to the hospital were symptomatic patients with mild COVID-19. The data collection period lasted from March 3–7, 2020.

Participants

Patients with COVID-19 were invited to participate in the online survey through the Wenjuanxing platform. All questionnaires were completed anonymously. Specific inclusion criteria were set as follows: patients who (1) were diagnosed with COVID-19 according to treatment protocols, (2) allowed to voluntarily participate in this study, (3) provided their informed written consent. Exclusion criteria were set as follows: patients with self-reported histories of neurological disorders, mental illness, and/or other serious systemic disorders. This resulted in a total of 219 eligible participants patients. After removing data from those with incomplete questionnaires, 216 were ultimately included in the analyses. This study was reviewed by the Institutional Review Board at the researchers' university (Ethical Grant Number: E202073). All patients provided online informed consent prior to their participation.

Measurements

Demographic Characteristics

Demographic data were collected using a self-designed questionnaire, with reported characteristics including gender, age, marital status, education level, occupation, living area, monthly family income, hospitalization time, and whether any family members or friends were infected with COVID-19. Other questions included the following: "Do you have any symptoms such as fever, cough, sore throat, chest tightness, diarrhea or fatigue?" and "Have you felt any improvement since admission?".

Hospital Anxiety and Depression Scale

Participants also completed the Hospital Anxiety and Depression Scale (HADS) (Zigmond and Snaith, 1983), which was used to determine the presence of depression and anxiety. The HADS consists of 14 items, including seven for depression and seven for anxiety. Scores for each subscale may range from 0–21, with scores of 0–7 denoting no symptoms, 8–10 denoting borderline abnormal cases, and 11–21 denoting abnormal cases, respectively. Higher scores on each subscale reflect more severe symptoms. In this study, Cronbach's alpha values of 0.842 and 0.850 were achieved for the anxiety and depression subscales, respectively.

Questionnaire on the Nursing Needs of COVID-19 Patients

Referring to the evaluation model of "functional health patterns" established by Gordon (Sheng et al., 2003) and based on expert advice, we reviewed relevant literature (Zhang, 2012) and designed the "Questionnaire on the nursing Needs of COVID-19 patients" (**Table 4**). The scale consists of 18 items that are each answered with one of three options, including "need," "does not matter," and "do not need." In this study, the scale achieved a Cronbach's alpha value of 0.820.

Data Analysis

IBM SPSS Version 21.0 was used for all statistical analyses (significance threshold set at 0.05). Continuous descriptive data were expressed as means and standard deviations (SDs), whereas categorical data were expressed as frequencies and percentages via the chi-squared test. A multivariate logistic regression was conducted to investigate potential influencing factors for anxiety and depression in three groups, including all participants, male participants, and female participants. The associations between anxiety, depression, and influencing factors were presented as odds ratios (ORs) and 95% confidence intervals (CIs).

RESULTS

Analyzing Basic Participant Characteristics

This study analyzed data from 216 isolated COVID-19 patients, including 124 males and 92 females (average age of 39.21 ± 9.91; range of 18–64 years). The length of hospital stay ranged from 1–38 days, with an average of 13.51 ± 4.17. Of all participants, 21.76% had anxiety symptoms, while 17.59% had depression symptoms. Colleagues infected with COVID-19 were associated with anxiety ($\chi 2$ = 7.446, P = 0.006), while family members infected with COVID-19 were associated with depression ($\chi 2$ = 4.743, P = 0.029). **Table 1** shows the relationship between basic characteristics and the presence of depression and anxiety symptoms.

Gender-Focused Multivariate Analysis of Anxiety Symptoms

A multivariate logistic regression analysis showed that colleagues infected with COVID-19 were the main influencing factors for anxiety symptoms (OR = 3.896, 95% CI: 1.555–9.764, P = 0.004), particularly among male participants (OR = 13.286, 95% CI: 2.902–60.832, P = 0.001). For female participants, on the other hand, occupation (OR = 1.393, 95% CI: 1.007–1.926, P = 0.045) and the item "Do you have any symptoms such as fever, cough, sore throat, chest tightness, diarrhea or fatigue?" (OR = 0.255, 95% CI: 0.068–0.959, P = 0.043) were the main influencing factors of anxiety symptoms (**Table 2**).

Gender-Focused Multivariate Analysis of Depression Symptoms

A multivariate logistic regression analysis showed that marital status (OR = 2.700, 95% CI: 1.033–7.055, P = 0.043) and family members infected with COVID-19 (OR = 2.969, 95%CI: 1.243–7.095, P = 0.014) were the main influencing factors for depression symptoms. For male participants, the main factors included age (OR = 0.859, 95% CI: 0.767–0.962, P = 0.009), marital status (OR = 30.409, 95%CI: 3.485–265.350, P = 0.002), monthly family income (OR = 0.378, 95% CI: 0.165–0.867, P = 0.022), family members infected with COVID-19 (OR = 19.903, 95%CI: 2.616–151.430, P = 0.004), and colleagues infected with COVID-19 (OR = 21.639, 95%CI: 2.571–182.102, P = 0.005). However, none of the tested factors showed statistically significant influences on depression symptoms among female participants (**Table 3**).

Gender-Based Nursing Needs

As shown in **Table 4**, timely examinations and treatments, understanding of the disease prognosis, understanding the effects and side effects of therapeutic agents, and guidance for preventing recurrence were more than 95% in both male and female participants. However, female participants reported a greater general need for three items, including being cared for by family members, safe and comfortable treatment environments, and communication with doctors and nurses. These differences were statistically significant ($P < 0.05$).

DISCUSSION

Analyzing Anxiety, Depression, and the Influencing Factors for Both

As mentioned, 21.76% of participants had anxiety symptoms, while 17.59% had depression symptoms. These results may partly be related to the fact that all were considered mild patients with generally good prognoses and low mortality risks (Xiong et al., 2020). The average length of stay was 13.51 ± 4.17 days. In this context, familiarity with both the inpatient environment and medical staff may have reduced anxiety and depression during the isolation period (Wang Z. Y. et al., 2020). After receiving a series of treatments, 54.63% believed that their condition had significantly improved, which was also conducive to the reduction of negative emotions related to general health concerns.

Participants whose colleagues were also infected with COVID-19 were more prone to anxiety symptoms. This may be related to COVID-19 is highly contagious. Colleague infections mean

TABLE 1 | Demographic characteristics of patients (*N* = 216).

Variables		Non-anxiety, *N* (%)	Anxiety, *N* (%)	$\chi 2$	*P*	Non-depression, *N* (%)	Depression, *N* (%)	$\chi 2$	*P*
Gender	Male	102 (47.22)	22 (10.19)	2.760	0.097	102 (47.22)	22 (10.19)	0.004	0.947
	Female	67 (31.02)	25 (11.57)			76 (35.18)	16 (7.41)		
Age, year	18–39	93 (43.05)	22 (10.19)	3.294	0.193	92 (42.59)	23 (10.65)	1.954	0.377
	40–59	70 (32.41)	25 (11.57)			80 (37.04)	15 (6.94)		
	>60	6 (2.78)	0			6 (2.78)	0		
Marital status	Unmarried	34 (15.74)	7 (3.24)	1.654	0.647	37 (17.13)	4 (1.85)	3.473	0.324
	Married	129 (59.72)	38 (17.59)			135 (62.50)	32 (14.82)		
	Divorce	4 (1.85)	2 (0.93)			5 (2.32)	1 (0.46)		
	Bereft of one's spouse	2 (0.93)	0			1 (0.46)	1 (0.46)		
Educational level	Primary school or below	3 (1.39)	0	3.153	0.533	1 (0.46)	2 (0.93)	5.289	0.259
	Junior high school	19 (8.79)	9 (4.17)			23 (10.64)	5 (2.32)		
	High school	39 (18.05)	9 (4.17)			41 (18.98)	7 (3.24)		
	Junior college or bachelor	100 (46.29)	26 (12.04)			104 (48.15)	22 (10.18)		
	Master or above	9 (4.17)	2 (0.93)			9 (4.17)	2 (0.93)		
Occupation	Students	7 (3.24)	0	7.011	0.220	6 (2.78)	1 (0.46)	4.081	0.538
	HCWs	2 (0.93)	0			2 (0.93)	0		
	Government employees or institutional employees	82 (37.96)	18 (8.33)			87 (40.28)	13 (6.02)		
	Freelancers	28 (12.96)	13 (6.02)			33 (15.28)	8 (3.70)		
	Unemployed	8 (3.70)	1 (0.46)			7 (3.24)	2 (0.93)		
	Others	42 (19.45)	15 (6.95)			43 (19.90)	14 (6.48)		
Living area	Urban	161 (74.54)	46 (21.30)	0.625	0.429	169 (78.24)	38 (17.59)	2.005	0.157
	Rural	8 (3.70)	1 (0.46)			9 (4.17)	0		
Monthly Family income, ¥[a]	2000<	6 (2.78)	2 (0.93)	4.284	0.232	6 (2.78)	2 (0.93)	0.958	0.811
	2001–4000	28 (12.96)	14 (6.48)			33 (15.27)	9 (4.17)		
	4001–6000	43 (19.91)	10 (4.63)			44 (20.37)	9 (4.17)		
	>6000	92 (42.59)	21 (9.72)			95 (43.98)	18 (8.33)		
Hospitalization time, day	0–7	14 (6.48)	4 (1.85)	1.441	0.696	16 (7.40)	2 (0.93)	1.695	0.638
	8–14	66 (30.55)	22 (10.19)			74 (34.26)	14 (6.48)		
	15–21	87 (40.28)	21 (9.72)			86 (39.81)	22 (10.19)		
	>22	2 (0.93)	0			2 (0.93)	0		
Are your family members infected with COVID-19?	No	67 (31.02)	18 (8.33)	0.028	0.867	76 (35.19)	9 (4.17)	4.743	0.029*
	Yes	102 (47.22)	29 (13.43)			102 (47.22)	29 (13.42)		
Are your friends infected with COVID-19?	No	154 (71.30)	43 (19.91)	0.006	0.938	165 (76.39)	32 (14.81)	2.811	0.094
	Yes	15 (6.94)	4 (1.85)			13 (6.02)	6 (2.78)		
Are your colleagues infected with COVID-19?	No	147 (68.05)	33 (15.28)	7.446	0.006*	151 (69.91)	29 (13.42)	1.635	0.201
	Yes	22 (10.19)	14 (6.48)			27 (12.50)	9 (4.17)		
Are your neighbors infected with COVID-19?	No	152 (70.37)	42 (19.44)	0.013	0.908	159 (73.61)	35 (16.20)	0.264	0.607
	Yes	17 (7.87)	5 (2.32)			19 (8.80)	3 (1.39)		
Do you have any symptoms such as fever, cough, sore throat, chest tightness, diarrhea or fatigue?	No	71 (32.87)	17 (7.87)	0.520	0.471	76 (35.18)	12 (5.56)	1.603	0.205
	Yes	98 (45.37)	30 (13.89)			102 (47.22)	26 (12.04)		
Have you felt any improvement since admission?	Improved significantly	97 (44.91)	21 (9.72)	2.536	0.469	98 (45.37)	20 (9.26)	0.281	0.964
	Slight improvement	43 (19.91)	16 (7.41)			49 (22.69)	10 (4.63)		
	unchanged	25 (11.57)	9 (4.17)			27 (12.50)	7 (3.24)		
	Slight worse	4 (1.85)	1 (0.46)			4 (1.85)	1 (0.46)		
	Significantly worse								

[a]*As of November 18, 2020, 1 ¥ = $0.15 US. *P < 0.05 N, Number; HCWs, health care workers; COVID-19, coronavirus disease 2019.*

TABLE 2 | Gender-influencing factors of anxiety symptoms in isolated COVID-19 patients.

Variables		All (*N* = 216)				Male (*N* = 124)				Female (*N* = 92)			
		B	**OR**	**95%CI**	***P***	***B***	**OR**	**95%CI**	***P***	***B***	**OR**	**95%CI**	***P***
Anxiety	Gender	0.499	1.646	0.806–3.364	0.171								
	Age	0.008	1.008	0.963–1.056	0.725	−0.016	0.984	0.916–1.057	0.652	0.023	1.024	0.947–1.106	0.558
	Marital status	0.095	1.100	0.452–2.675	0.834	0.736	2.088	0.442–9.873	0.353	−1.245	0.288	0.057–1.464	0.134
	Educational level	0.291	1.337	0.777–2.302	0.294	0.087	1.091	0.479–2.486	0.836	0.450	1.569	0.624–3.942	0.338
	Occupation	0.198	1.219	0.992–1.497	0.060	0.186	1.205	0.877–1.656	0.250	0.331	1.393	1.007–1.926	0.045*
	Living area	−1.359	0.257	0.026–2.524	0.244	−19.778	0.000	0.000–0.000	0.999	0.758	2.134	0.093–48.854	0.635
	Monthly Family income	−0.390	0.677	0.430–1.067	0.093	−0.406	0.666	0.339–1.310	0.239	−0.182	0.833	0.393–1.768	0.635
	Hospitalization time	−0.027	0.974	0.889–1.067	0.567	−0.102	0.903	0.780–1.045	0.171	0.109	1.115	0.925–1.345	0.253
	Are your family members infected with COVID-19?	0.312	1.366	0.653–2.853	0.407	0.963	2.619	0.740–9.269	0.135	−0.403	0.668	0.218–2.052	0.481
	Are your friends infected with COVID-19?	−0.890	0.411	0.099–1.698	0.219	−0.390	0.677	0.075–6.079	0.727	−1.428	0.240	0.028–2.033	0.190
	Are your colleagues infected with COVID-19?	1.360	3.896	1.555–9.764	0.004*	2.587	13.286	2.902–60.832	0.001*	0.298	1.348	0.332–5.478	0.677
	Are your neighbors infected with COVID-19?	−0.215	0.806	0.235–2.770	0.732	−1.435	0.238	0.020–2.868	0.258	1.038	2.825	0.452–17.674	0.267
	Do you have any symptoms such as fever, cough, sore throat, chest tightness, diarrhea or fatigue?	−0.279	0.757	0.362–1.583	0.459	0.116	1.124	0.386–3.273	0.831	−1.368	0.255	0.068–0.959	0.043*
	Have you felt any improvement since admission?	0.225	1.253	0.818–1.918	0.300	−0.088	0.916	0.481–1.743	0.789	0.353	1.423	0.682–2.969	0.348

**P < 0.05.*

N, Number; CI, confidence interval; OR, odds ratio; COVID-19, coronavirus disease 2019.

TABLE 3 | Gender-influencing factors of depression symptoms in isolated COVID-19 patients.

Variables		All (*N* = 216)				Male (*N* = 124)				Female (*N* = 92)			
		B	**OR**	**95%CI**	***P***	***B***	**OR**	**95%CI**	***P***	***B***	**OR**	**95%CI**	***P***
Depression	Gender	−0.178	0.837	0.378–1.855	0.661								
	Age	−0.032	0.968	0.919–1.020	0.220	−0.152	0.859	0.767–0.962	0.009*	0.023	1.023	0.939–1.114	0.604
	Marital status	0.993	2.700	1.033–7.055	0.043*	3.415	30.409	3.485–265.350	0.002*	−0.225	0.798	0.175–3.636	0.771
	Educational level	−0.011	0.989	0.536–1.825	0.972	0.813	2.256	0.734–6.934	0.156	−0.474	0.623	0.236–1.641	0.338
	Occupation	0.205	1.227	0.979–1.539	0.075	0.391	1.479	0.985–2.221	0.059	0.196	1.216	0.849–1.742	0.285
	Living area	−18.603	0.000	0.000–0.000	0.999	−17.949	0.000	0.000–0.000	0.999	−19.731	0.000	0.000–0.000	0.999
	Monthly Family income	−0.228	0.797	0.483–1.313	0.373	−0.973	0.378	0.165–0.867	0.022*	0.511	1.667	0.701–3.966	0.248
	Hospitalization time	0.046	1.047	0.948–1.156	0.368	0.226	1.253	0.992–1.583	0.058	−0.023	0.978	0.812–1.177	0.812
	Are your family members infected with COVID-19?	1.088	2.969	1.243–7.095	0.014*	2.991	19.903	2.616–151.430	0.004*	0.419	1.520	0.434–5.319	0.513
	Are your friends infected with COVID-19?	0.732	2.080	0.556–7.782	0.277	1.154	3.170	0.228–44.027	0.390	0.463	1.589	0.228–11.076	0.640
	Are your colleagues infected with COVID-19?	0.932	2.539	0.890–7.244	0.081	3.075	21.639	2.571–182.102	0.005*	−0.661	0.516	0.092–2.903	0.453
	Are your neighbors infected with COVID-19?	−1.515	0.220	0.043–1.135	0.070	−26.017	0.000	0.000–0.000	0.998	0.341	1.406	0.197–10.058	0.734
	Do you have any symptoms such as fever, cough, sore throat, chest tightness, diarrhea or fatigue?	−0.528	0.590	0.263–1.319	0.198	−0.771	0.463	0.126–1.706	0.247	−1.181	0.307	0.069–1.366	0.121
	Have you felt any improvement since admission?	0.133	1.142	0.710–1.838	0.584	0.263	1.301	0.570–2.969	0.532	0.470	1.600	0.660–3.875	0.298

**P < 0.05.*

N, Number; CI, confidence interval; OR, odds ratio; COVID-19, coronavirus disease 2019.

TABLE 4 | Gender-nursing needs of isolated COVID-19 patients (*N* = 216).

Variables	Male						Female						χ^2
	Need		Does not matter		Do not need		Need		Does not matter		Do not need		
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	
Be understood and sympathized.	70	56.45	18	14.52	36	29.03	44	47.83	14	15.22	34	36.95	0.410
Being taken care of by family members.	33	26.61	17	13.71	74	59.68	33	35.87	4	4.35	55	59.78	0.044*
Provide for oneself life.	40	32.26	15	12.10	69	55.64	33	35.87	10	10.87	49	53.26	0.849
Keep in touch with colleagues or friends.	81	65.32	25	20.16	18	14.52	59	64.13	21	22.83	12	13.04	0.874
Get the attention of the society.	63	50.81	29	23.39	32	25.80	50	54.35	13	14.13	29	31.52	0.216
You will receive a warm reception during the treatment.	103	83.06	14	11.29	7	5.65	78	84.78	12	13.04	2	2.18	0.432
The treatment environment is safe and comfortable.	104	83.87	15	12.10	5	4.03	87	94.57	5	5.43	0	0	0.012*
Timely examination and treatment.	118	95.16	5	4.03	1	0.81	90	97.82	1	1.09	1	1.09	0.420
Communicate with your doctor or nurse.	116	93.55	8	6.45	0	0	90	97.82	1	1.09	1	1.09	0.047*
When you are in hospital, you can confide in others if you have unpleasant things.	91	73.39	25	20.16	8	6.45	75	81.53	12	13.04	5	5.43	0.349
Communicate and talk with fellow patients.	91	73.39	24	19.35	9	7.26	73	79.35	15	16.30	4	4.35	0.532
Doctor or nurse can tell the truth about a patient's condition.	115	92.74	8	6.45	1	0.81	87	94.56	4	4.35	1	1.09	0.785
Learn about the spread of COVID-19.	112	90.32	11	8.87	1	0.81	86	93.48	6	6.52	0	0	0.557
Understand the effects and side effects of therapeutic agents.	121	97.58	3	2.42	0	0	89	96.74	3	3.26	0	0	0.510
Understand the prognosis of the disease	120	96.77	4	3.23	0	0	91	98.91	1	1.09	0	0	0.291
Guidance for preventing recurrence.	119	95.97	5	4.03	0	0	90	97.82	2	2.18	0	0	0.362
Understand hospital and medical team structure.	93	75.00	22	17.74	9	7.26	66	71.74	21	22.83	5	5.43	0.597
Know the names of doctors and nurses.	79	63.71	34	27.42	11	8.87	59	64.13	27	29.35	6	6.52	0.802

*$P < 0.05$.

that the workplace of participants may be in the outbreak area, which could company bankruptcy or patient unemployment. Male participants as pillars of their family, are particularly more likely to experience anxiety symptoms due to these stresses (Shi et al., 2020). On the other hand, occupation and COVID-19 accompanying symptoms can affect the anxiety symptoms in female participants. Female participants who were unemployed or freelance workers and who developed symptoms related to COVID-19 had higher anxiety. This may be related to the influence of job instability on their economic conditions (Xiao et al., 2020) and/or physical discomfort caused by the disease (Xue et al., 2008). More specifically, previous studies have shown that hypoxia and dyspnea are among the most common symptoms for COVID-19 patients (Chen N. et al., 2020). In this context, dyspnea is significantly and positively correlated with negative emotions such as anxiety, depression, and fear (Jiao, 2013).

Previous studies on depression in COVID-19 patients have found that those who are married or have other family members with the disease are more likely to develop depression symptoms. In particular, married men aged 18–39 years with lower family incomes and family members or colleagues with COVID-19 are more likely to suffer from depression (Shi et al., 2020; Xiao et al., 2020). In this regard, individuals with those attributes are also more likely undertake heavy work tasks and family support roles, thus incurring greater psychological burdens and negative emotions (Xiao et al., 2020). Male isolated COVID-19 patients with lower monthly household incomes may experience even more depressive symptoms due to financial stress (Cheng et al., 2020), while

those with infected family members and colleagues may develop additional concerns. In general, disease-related uncertainties may lead to depression during isolation, particularly when there is otherwise a high amount of close daily contact with family members and/or colleagues. In other words, the isolation environment may create a lack of information, thus increasing the level of concern.

The influencing factors for anxiety and depression differ between genders. This may be related to the different roles, responsibilities, and jobs held by men and women in society (Weich et al., 1998). Further, research has shown that women are more prone to negative emotions when facing stressful events, particularly when under the influences of physiological and cognitive factors (McLean and Hope, 2010). When treating COVID-19 patients, medical staff should therefore implement targeted psychological interventions aimed at the different psychological characteristics of male and female patients. This will provide a better way to target the unique elements that contribute to anxiety and depression while enhancing confidence and courage among those facing the disease.

Analyzing Nursing Needs

In this study, more than 95% of patients reported on timely examinations and treatments, an understanding of the disease prognosis, understanding the effects and side effects of therapeutic agents, and guidance for preventing recurrence. This may be related to the nature and severity of COVID-19 itself. Indeed, novel coronaviruses may pose serious harm to humans, and are typically highly contagious (Wei and Li, 2020). For COVID-19, the number of deaths in China now exceeds the total number during the SARS epidemic of 2002–2003 (Jingwei Network, 2003), and there is no specific drug that targets the virus. Patients may therefore express more nursing needs related to examinations, drug treatments, prognoses, and recurrence and prevention guidance due to increased worries and uncertainties about their conditions and outlooks.

Notably, female participants reported greater need than male participants in three specific areas, including being cared for by family members, a safe and comfortable treatment environment, and communication with doctors and nurses. These differences were statistically significant, which is consistent with previous research (Li et al., 2003). In general, this may be due to the fact that female patients are more sensitive to the perception of negative emotions and more likely to have physiological/psychological reactions related to negative emotions than males (McLean and Anderson, 2009; Zhang and Li, 2020). Healthcare workers should therefore pay increased attention to the unique psychological needs of patients while increasing the overall level of communication. This includes a particular focus on providing timely diagnosis, treatment, and nursing information to female patients.

LIMITATIONS

This study had two main limitations. First, it only investigated COVID-19 patients at one makeshift hospital in Wuhan, which may have resulted in selection bias. Second, only general data from patients were analyzed. In this case, the effects of personality traits, disease cognition, social support, and other factors are unknown. Future studies should address both these issues, thus contributing to a more comprehensive discussion on the psychological status of COVID-19 patients.

CONCLUSION

Of the isolated COVID-19 patients included in this analysis, 21.76% had anxiety symptoms, while 17.59% had depression symptoms. When broken down to look at gender, there were different influencing factors for both anxiety and depression. More specifically, female patients reported greater psychological nursing needs than male patients. While treating the illness, healthcare workers should therefore pay increased attention to any emotional changes, especially among patients who are more susceptible to anxiety and depression. Targeted nursing should thus be implemented to meet specific nursing needs, while psychological interventions should aim to promote overall mental health while preventing the development of more serious mental diseases.

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 Xiang Ya Nursing School of Central South University (Ethical Grant Number: E201946). – Written informed consent to participate in this study was provided by the patient/participants.

AUTHOR CONTRIBUTIONS

JPZ was the primary investigator of the study and provided comments and ideas, and revised this manuscript. YL conducted the data analysis and contributed to writing the manuscript. JL and JZ helped with the data analysis and coding and contributed to writing the manuscript. LD and FW helped with the questionnaire survey. ZY contributed conceptually to data generation and analysis and suggested revisions. All authors contributed to the article and approved the submitted version.

ACKNOWLEDGMENTS

Thanks to all the participants and researchers involved in this study.

REFERENCES

Amirian, E. S. (2020). Potential fecal transmission of SARS-CoV-2: current evidence and implications for public health. *Int. J. Infec. Dis.* 95, 363–370. doi: 10.1016/j.ijid.2020.04.057

Arab-Mazar, Z., Sah, R., Rabaan, A. A., Dhama, K., and Rodriguez-Morales, A. J. (2020). Mapping the incidence of the COVID-19 hotspot in Iran - implications for travellers. *Travel Med. Infect. Dis.* 34:101630. doi: 10.1016/j.tmaid.2020.101630

Chen, N., Zhou, M., Dong, X., Qu, J., Gong, F., Han, Y., et al. (2020). Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet* 395, 507–513. doi: 10.1016/S0140-6736(20)30211-7

Chen, Y. H., and Li, W. (2020). The Clinical Symptoms, Classification and Diagnosis of COVID-19. *Genomics Appl. Biol.* 39, 3904–3907. doi: 10.13417/j.gab.039.003904

Chen, Z., Zhuang, Y. J., Li, J., Yang, X. L., Li, J., Feng, Y., et al. (2020). Medical management of hospitals designated for patients with COVID-19. *Chin. J. Nosocomiol.* 30, 821–825. doi: 10.11816/cn.ni.2020-200237

Cheng, J. G., Tan, X. D., Zhang, L., Zhu, S. R., Yao, H., and Liu, B. (2020). Research on the psychological status and influencing factors of novel coronavirus pneumonia patients and people under medical observation. *J. Nurs. Adm.* 20, 247–251.

Fan, P., Aloweni, F., Lim, S. H., Ang, S. Y., Perera, K., Quek, A. H., et al. (2020). Needs and concerns of patients in isolation care units - learnings from COVID-19: a reflection. *World J. Clin. Cases* 8, 1763–1766. doi: 10.12998/wjcc.v8.i10.1763

Fu, Y. N., and Luo, X. (2011). The role of psychosocial factors in the significant emergencies disease responding. *Chin. J. Soc. Med.* 28, 279–280.

Gu, Y., Zhu, Y., Xu, F., Xi, J., and Xu, G. (2020). Factors associated with mental health outcomes among patients with COVID-19 treated in the Fangcang shelter hospital in China. *Asia Pacific Psychiatry* 13:e12443. doi: 10.1111/appy.12443

Jiao, T. (2013). *A Prevalence of Anxiety and Depression in Patients With an Acute Exacerbation of COPD*. Hefei: Anhui Medical University.

Jingwei Network (2003). *The Ministry of Health Announced the Last Daily Outbreak: No SARS Patients in Mainland China*. Avaliable online at: http://www.huaxia.com/xw/dlxw/2003/08/234782.html (accessed August 17, 2003).

Kwek, S. K., Chew, W. M., Ong, K. C., Ng, A. W., Lee, L. S., Kaw, G., et al. (2006). Quality of life and psychological status in survivors of severe acute respiratory syndrome at 3 months postdischarge. *J. Psychosom. Res.* 60, 513–519. doi: 10.1016/j.jpsychores.2005.08.020

Li, S. J., Yang, S., Zhang, Y. R., Zhang, Y., Wang, Y. L., Sun, C. L., et al. (2003). Investigation of SARS patients' health service needs. *Chin. J. Nurs.* 12, 18–20.

McLean, C. P., and Anderson, E. R. (2009). Brave men and timid women? A review of the gender differences in fear and anxiety. *Clin. Psychol. Rev.* 29, 496–505. doi: 10.1016/j.cpr.2009.05.003

McLean, C. P., and Hope, D. A. (2010). Subjective anxiety and behavioral avoidance: gender, gender role, and perceived confirmability of self-report. *J. Anxiety Disord.* 24, 494–502. doi: 10.1016/j.janxdis.2010.03.006

National Health Commission of the People's Republic of China (2020). *Interpretation of COVID-19 Diagnosis and Treatment Protocol (trial version 7)*. Avaliable online at: http://www.nhc.gov.cn/yzygj/s7652m/202003/a31191442e29474b98bfed5579d5af95.shtml (accessed March 4, 2020).

Nie, X. D., Wang, Q., Wang, M. N., Zhao, S., Liu, L., Zhu, Y. L., et al. (2020). Anxiety and depression and its correlates in patients with coronavirus disease 2019 in Wuhan. *Int. J. Psychiatry Clin. Pract.* 1–6. doi: 10.1080/13651501.2020.1791345. [Epub ahead of print].

Pang, S. X. (2016). Effect of nursing intervention on negative emotion and quality of life of patients with acute respiratory infection. *J. Qilu Nurs.* 22, 32–34. doi: 10.3969/j.issn.1006-7256.2016.09.017

Sharma, A., Pillai, D. R., Lu, M., Doolan, C., Leal, J., Kim, J., et al. (2020). Impact of isolation precautions on quality of life: a meta-analysis. *J. Hosp. Infect.* 105, 35–42. doi: 10.1016/j.jhin.2020.02.004

Sheng, Y., Gao, F. L., and Zhu, L. X. (2003). Investigation and analysis for nursing needs of SARS patients with "functional health patterns" of Gordon. *Chin. J. Nurs.* 12, 4–6.

Shi, L., Lu, Z. A., Que, J. Y., Huang, X. L., Liu, L., Ran, M. S., et al. (2020). Prevalence of and risk factors associated with mental health symptoms among the general population in china during the coronavirus disease 2019 pandemic. *JAMA Netw. Open* 3:e2014053. doi: 10.1001/jamanetworkopen.2020.14053

Wang, C., Horby, P. W., Hayden, F. G., and Gao, G. F. (2020). A novel coronavirus outbreak of global health concern. *Lancet* 395, 470–473. doi: 10.1016/S0140-6736(20)30185-9

Wang, Z. Y., Gao, X. L., Cui, Y. Y., Huang, J. Y., and Qian, H. (2020). Analysis of anxiety and depression in patients with mild coronary pneumonia. *Psychologies* 15, 40–42. doi: 10.19738/j.cnki.psy.2020.20.014

Wei, Z. X., and Li, Q. F. (2020). An overview of the clinical manifestations of novel coronavirus infection and its laboratory detection methods. *Int. J. Lab. Med.* 41, 988–992. doi: 10.3969/j.issn.1673-4130.2020.08.023

Weich, S., Sloggett, A., and Lewis, G. (1998). Social roles and gender difference in the prevalence of common mental disorders. *Br. J. Psychiatry* 173, 489–493. doi: 10.1192/bjp.173.6.489

World Health Organization (WHO) (2021). *World Health Organization Coronavirus Disease (COVID-19) Pandemic*. Avaliable online at: https://www.who.int/emergencies/diseases/novel-coronavirus-2019 (accessed April 30, 2021).

Xiao, J. L., Chen, Y., Fang, F., Liu, W. T., Zhong, Y. Y., Tao, J., et al. (2020). Public anxiety and depression and its influencing factors under public health emergencies. *Modern Prev. Med.* 47, 3557–3562.

Xiong, J., Jiang, W. L., Zhou, Q., Hu, X. Q., and Liu, C. Y. (2020). Clinical characteristics, treatment, and prognosis in 89 cases of COVID-19. *Med. J. Wuhan Univ.* 41, 542–546. doi: 10.14188/j.1671-8852.2020.0103

Xue, Y. Z., Lu, L., Liang, Z. Q., Xu, Y., and Zhang, K. R. (2008). Investigation on psychosomatic symptoms of SARS patients at different stages. *Chin. Prev. Med.* 04, 268–270.

Yang, H. (2004). *Exploration of Response of Psychology and Psychological Nursing Intervention in SARS Patients*. Jinzhong: Shanxi Medical University.

Zhang, Y. (2012). Mental health needs survey and intervention analysis of infectious disease patients. *Med. Innov. China* 9, 72–73. doi: 10.3969/j.issn.1674-4985.2012.24.041

Zhang, Y. Z., and Li, X. F. (2020). Investigation and analysis of current situation of pain management in inpatients. *Clin. Res. Pract.* 5, 3–5. doi: 10.19347/j.cnki.2096-1413.202010002

Zigmond, A. S., and Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta Psych. Scand* 67, 361–370. doi: 10.1111/j.1600-0447.1983.tb09716.x

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 10 June 2021
doi: 10.3389/fpsyg.2021.684830

Factors That Influence Perceived Organizational Support for Emotional Labor of Chinese Medical Personnel in Hubei

Zhi Zeng[1†], Xiaoyu Wang[1], Haoran Bi[1], Yawen Li[1], Songhua Yue[2], Simeng Gu[3*†] and Gaoyue Xiang[4*†]*

[1] School of Health Economics and Management, Nanjing University of Chinese Medicine, Nanjing, China, [2] School of Humanities and Social Science, Nanjing Institute of Technology, Nanjing, China, [3] Department of Psychology, Jiangsu University Medical School, Zhenjiang, China, [4] Organization Department, The First Affiliated Hospital of Soochow University, Suzhou, China

OPEN ACCESS

Edited by:
Fang Pan,
Shandong University, China

Reviewed by:
Serap Aydin,
Hacettepe University, Turkey
Rachele Mariani,
Sapienza University of Rome, Italy

***Correspondence:**
Zhi Zeng
zengzhinju@163.com
Simeng Gu
gsm_2007@126.com
Gaoyue Xiang
xianggaoyue@126.com

†These authors have contributed equally to this work

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *24 March 2021*
Accepted: *18 May 2021*
Published: *10 June 2021*

Citation:
Zeng Z, Wang X, Bi H, Li Y, Yue S, Gu S and Xiang G (2021) Factors That Influence Perceived Organizational Support for Emotional Labor of Chinese Medical Personnel in Hubei. Front. Psychol. 12:684830. doi: 10.3389/fpsyg.2021.684830

At the outbreak of coronavirus disease in Wuhan, China, 42,322 medical personnel from other provinces and municipalities in China volunteered to rush to Hubei to assist their colleagues. Their all-out efforts contributed to Hubei finally winning the fight to prevent and control the pandemic. The aim of this study is to explore the influence of perceived organizational support on the emotional labor of medical personnel in Hubei Province. A group of 170 medical personnel from (tertiary) hospitals who participated in the pandemic aid operation in Hubei completed self-administered questionnaires, including the perceived organizational support scale, emotional labor scale, and professional identity scale. This study used Pearson's correlation in SPSS to analyze the three variables of organizational support, emotional labor, and professional identity. Organizational support and emotional labor ($r = 0.443$, $P < 0.01$), organizational support and professional identity ($r = 0.631$, $P < 0.01$), and emotional labor and occupational identity ($r = 0.511$, $P < 0.01$) showed a significant positive correlation. The bootstrapping mediating effect test was used to determine the overall mediating effect of occupational identity. Occupational identity was a complete mediating effect between organizational support and emotional labor. The results show that a strong sense of organizational support can promote higher emotional labor among medical workers in Hubei Province. A strong sense of organizational support will also promote a stronger professional identity; further, a strong professional identity completely mediates the effect of perceived organizational support on emotional labor. These results infer that in emergency medical and health services, medical personnel can realize a high sense of organizational support, which could enhance their professional identity; this enables them to combine their professional goals with organizational goals more actively and to finally pay higher emotional labor to achieve organizational goals.

Keywords: organizational support, emotional labor, professional identity, medical personnel, fight against COVID-19

INTRODUCTION

To win the battle against coronavirus disease (COVID-19), 42,322 medical workers from various provinces and cities in China went to Hubei Province to support their colleagues. When treating COVID-19 patients (especially critically ill patients), doctors and nurses rely on their beliefs and empathy to curb their own anxiety and fear; when faced with dying patients with severe infection, medical personnel must regulate their own emotions to accept the limitations of treatments and avoid excessive empathy, which may impact their performance in the battle against the disease. These circumstances require medical workers who are highly professional and who are able to work in these circumstances while investing appropriate emotional labor.

Existing studies show that emotional labor is the manner in which medical personnel express emotion according to the established requirements of the organization or the emotional expression of the organization's needs (Ashforth and Humphrey, 1993). In this type of medical emergency, the organization regulating the emotional labor of medical personnel is significant for both the patients and the well-being of the organization (Henderson and Borry, 2020).

Therefore, we can infer that when the medical personnel in Hubei feel trust and support from their organization, they will experience a sense of purpose and be more willing to accept the high-intensity work overload and invest higher emotional labor in the frontlines of the fight against the COVID-19 pandemic. This study uses organizational identity as a mediator to explore the mechanism of the impact of perceived organizational support on the emotional labor of medical personnel, which has both theoretical value and practical significance. Against the current social backdrop of the COVID-19 pandemic, this study innovatively considers the emotional labor of medical personnel from the perspective of organizational support. Our findings enrich existing theoretical research on medical personnel's emotional labor. It also provides practical constructive outcomes, such as possible countermeasures against the negative aspects of investing emotional labor, for hospital management to implement from the perspective of human resources management.

THEORETICAL BASIS AND RESEARCH HYPOTHESIS

Perceived Organization Support and Emotional Labor

Based on the social exchange theory and the organizational support theory, Eisenberger, an American social psychologist specializing in emotional labor, put forward the concept of organizational support according to the principle of reciprocity. This work lays the foundation for future studies on organizational support (Eisenberger et al., 1986; MacMillan, 1997). and Rhoades and Eisenberger (2002) continued to enrich and update the concept of organizational support. Chinese scholar Ling et al. (2006) and others first put forward that the concept of organizational support in China differs from that of foreign countries. They posit that in a Chinese environment, employees perceive organizational support as support in their work, concern for their interests, and recognition of their values. This concept has been well-supported and verified in the study of organizational support in China.

During the past 10 years, scholars in other countries went beyond superficial research; studies gradually started showing organizational support to be a mediating variable and an adjusting variable. Further, the relationship between the two factors have been investigated to determine the mechanism and model construction of the sense of organizational support as a whole; thus, the professional status of medical personnel has been comprehensively analyzed according to the model (Galletta et al., 2011; Labrague et al., 2018; Yang et al., 2019; Poghosyan et al., 2020). Based on this research, corresponding countermeasures and suggestions to improve employees' sense of organizational support, reduce turnover intention, and manage emotional labor were put forward. Research shows that good social support can enhance self-awareness, reduce psychological stress reactions, and moderate the negative impact of stressful events (Li et al., 2021).

During his research on airline flight attendants, American social psychologist (Russell, 1983) proposed the concept of emotional labor for the first time. He posits that emotional labor is the third form of labor, after physical and mental labor. It can be said that Hochschild's work pioneered the current research area of emotional labor. Scholars from different countries have investigated emotional labor based on different service industries, including both qualitative research and empirical research (Ashforth and Humphrey, 1993; Grandey, 2000; Delgado et al., 2017; Zhao and Xi, 2017).

A literature review shows that qualitative research generally analyzes the connotation, theory, and strategy of emotional labor, while empirical research mainly focuses on the service industry, teachers, medical personnel, and other professions (Glomb and Tews, 2004; Larson and Yao, 2005; Back et al., 2020; Wang et al., 2020). It has been found that the focus of research on medical personnel's emotional labor by scholars globally has gradually shifted from the adverse effects of medical personnel's emotional labor (work pressure, job burnout, etc.) to developing methods for stabilizing the medical team, improving the quality of medical service (reducing the turnover rate, improving job satisfaction, etc.), formulating emotional labor management strategies, and improving the current situation of medical service quality.

Considering previous scholars' theoretical research on organizational support and emotional labor, we observe a close relationship between organizational support and emotional labor; further, considering whether organizational support has a negative impact on emotional labor, we propose the following hypotheses:

Hypothesis H1: The sense of organizational support can positively predict emotional labor among medical personnel in Hubei Province.

Hypothesis H2: The sense of organizational support has a positive effect on the emotional labor of medical personnel in Hubei Province.

Organizational Support and Professional Identity

Based on Erikson's ego identity theory, early scholars in various industries have proposed their own views on professional identity (Zhou and Guo, 2006). Some scholars suggest that professional identity is more of an emotional construct, a desire to stay in the current occupation, and a degree of love for the existing occupation (Blau, 1988; Moore and Hofman, 1998). With the supplementing and improvement of the concept of professional identity by other scholars, researchers gradually started investigating professional identity in each industry. Some researchers also started conducting in-depth research on professional identity in various industries. The professional identity of medical industry personnel were included in the construction of a model and used to study the interaction between professional identity and other factors or as an intermediary (Selma and Selma, 2015; Kyratsis et al., 2017; Matthews et al., 2020). Previous studies found that professional identity is influenced by perceived organizational support. This means that, if the medical personnel in Hubei Province have a higher sense of organizational support, they will identify with their work more and put more energy into medical treatment. Therefore, we propose the following hypothesis:

Hypothesis H3: Perceived organizational support has a positive impact on the professional identity of medical personnel in Hubei Province.

Emotional Labor and Professional Identity

In the process of medical treatment, the emotional labor of medical personnel can be expressed in diverse ways, such as hiding real emotions, changing emotions to adapt to the requirements of the organization, or naturally showing and revealing emotions. Di Monte et al. (2020), Di Trani et al. (2021), and their research teams conducted in-depth research on the relationship between job burnout and various psychological characteristics of Italian medical personnel during the COVID-19 emergency. They found that when relevant conditions at the organizational level are difficult to control, medical personnel can help prevent job burnout caused by emotional labor by enhancing individual resources such as personal skills training and self-psychological support. This is especially true for medical personnel who came to aid Hubei during the pandemic. However, the degree and performance of emotional labor are affected by various factors. Scholars from all walks of life have launched a fierce discussions on the influencing factors of emotional labor. Here, empirical research investigating the impact of professional identity on emotional labor attracted wide attention (Zeng and Shen, 2013; Forouzadeh et al., 2018; Willetts and Garvey, 2020). Research shows that professional identity also has a positive effect on emotional labor; that is, when medical personnel have high professional identity, they are willing to invest more emotional labor to meet organizational and professional requirements. We therefore propose the following hypothesis:

H4: Professional identity has a positive impact on emotional labor.

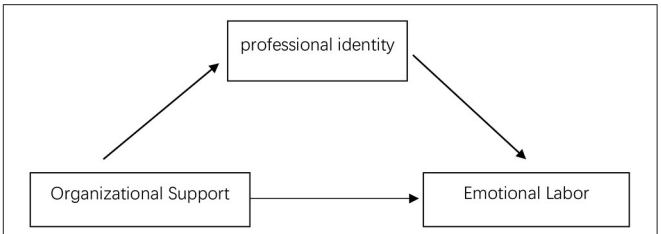


FIGURE 1 | Theoretical model of this study.

The Intermediary Effect of Professional Identity

Although few empirical studies have directly explored the relationship between perceived organizational support, professional identity, and emotional labor, some related studies focused on the internal connection among these three variables. Accordingly, this study introduces professional identity as a variable. We believe that the influence of the emotional labor invested by medical personnel while aiding Hubei is realized through the intermediary variable of professional identity. The organizational support experienced by medical personnel has an impact on their professional identity first; then, professional identity affects the emotional labor invested by medical personnel in the fight against the pandemic. We therefore propose the following hypothesis:

H5: The effect of perceived organizational support on emotional labor among medical workers in Hubei Province is mediated by professional identity.

Based on these theories and hypotheses, this study can be summarized as a theoretical model that includes intermediary links, as shown in **Figure 1**.

RESEARCH DESIGN

Research Objects

This study adopted a convenience sampling method. The respondents were medical personnel from third tier (tertiary) hospitals in Beijing, Jiangsu, Shanghai, Hunan, Guangdong, Sichuan, and other towns or cities who participated in the pandemic aid operation in Hubei. Electronic questionnaires were distributed to respondents and each questionnaire included an agreement of informed written consent. A total of 170 questionnaires were distributed and all 170 valid questionnaires were returned, a response rate of 100%. There were no missing answers in the questionnaires and no repetitive answers. Written informed consent was obtained before the experiments, and the study was approved by the committee of the ethnic board of Nanjing University of Chinese Medicine and the latest revision of the Declaration of Helsinki.

Research Tools

Perceived Organizational Support Scale

This study adopted the perceived organizational support scale (Ling et al., 2006) and used a 6-point Likert scale ranging from 1 = "Strongly oppose" to 6 = "strongly approve." Based on the

pre-survey reliability and validity analysis results, 20 items and three dimensions were retained and four items were eliminated. These items were eliminated as they influenced the validity and reliability of the scale negatively; this applies to all other items removed from the research tools. The Cronbach's α coefficient of the scale was 0.968, indicating acceptable reliability.

Emotional Labor Scale

We adopted the emotional labor scale (Diefendorff et al., 2011) and used a five-point Likert scale ranging from 1 = "Never" to 5 = "Always" for the answers. Based on the pre-survey analysis results, nine items and three dimensions were retained after eliminating five items. The Cronbach's α coefficient of the emotional labor scale was 0.852.

Professional Identity Scale

We used the nurse's professional identity scale, translated and verified by Hong et al. (2010). We used a five-point Likert scale ranging from 1 = "Never" to 5 = "Completely." Based on the pre-survey and analysis results, one question was excluded and 20 items in seven dimensions were retained. The Cronbach's α coefficient of the professional identity scale was 0.934.

Procedure and Analysis

The three scales described above were either from a questionnaire developed by foreign scholars or from a questionnaire developed for personnel in other industries as research targets; therefore, while ensuring the equivalence of item meaning, we made appropriate adjustments and corrections by combining the relevant items in the scales according to the professional characteristics of the participants and conducted a pilot survey before the formal survey. We then revised the relevant items of the questionnaire according to the feedback of the pilot survey. To ensure the quality of the questionnaires, we contacted the nursing departments and medical administration divisions of the relevant hospitals and asked them to distribute the electronic questionnaires to their personnel. We emphasized that the questionnaire information would only be used for research purposes and that personal information will be kept confidential. The participants were asked to complete the questionnaires according to their working conditions and the completed questionnaires were handed directly to the researchers, without any feedback to the hospital. Therefore, the questionnaire recovery rate in this study was 100%.

SPSS 23.0 software was used for descriptive statistics. We also used a Pearson's correlation analysis and a bootstrap test. The specific statistical analysis process was as follows: first, we used the pilot survey data to test the reliability and validity of the three research tools using a reliability analysis, validity analysis, and confirmatory factor analysis. Second, we conducted a descriptive statistical analysis and correlation analysis of the main research variables. Finally, we used an intermediary regression analysis and an Amos path analysis to investigate the mediating role of professional identity.

TABLE 1 | Demographic characteristics of the medical personnel.

Demographic variables	Category	Frequency	Percentage (%)
Gender	Male	48	28.24
	Female	122	71.76
Working years	5 years or less	12	7.06
	6–10 years	50	29.41
	11–15 years	59	34.71
	16–20 years	22	12.94
	More than 20 years	27	15.88
Professional level	Junior	37	21.76
	Intermediate	85	50
	Deputy high	40	23.53
	Senior	8	4.71

RESEARCH RESULTS

Participants' Demographic Characteristics

The demographic characteristics of the medical personnel surveyed in this study are shown in **Table 1**. Of the sample, 48 (28.24%) were male medical personnel and 122 (71.76%) were female. The sample age was concentrated in the 31–40 years old range, accounting for 62.94%. Regarding marital status, most participants (83.53%) were married. Considering education level, 90% of the participants have a bachelor's degree or master's degree. The years of work experience were concentrated in the 6–10 and 11–15 years brackets, accounting for 29.41 and 34.71%, respectively. This indicates that most of the medical personnel who participated in the pandemic aid operation in Hubei were employees with a number of years' experience. From the perspective of the composition of the titles of medical personnel, those with intermediate titles accounted for half of the total. In terms of personnel structure, 77.65% of them were nurses, 18.82% were doctors, 1.18% were medical technicians, and 2.35% were administrative staff. The basic composition of the sample was shown to be consistent with that of the more than 40,000 medical workers who took part in the pandemic aid initiative in Hubei Province, according to the National Health Commission of China (China News Network, 2020). This indicates that the sample is representative and accurately reflects the medical personnel situation in Hubei Province.

Analysis of Differences Based on Demographic Variables

This study selected three demographic variables (gender, working years, professional level) to test whether they

TABLE 2 | Results of the *t*-test of independent samples based on gender differences.

Variables	Male ($n = 48$)	Female ($n = 122$)	T
Organizational support	4.493 ± 0.916	4.475 ± 0.931	0.112
Emotional labor	3.833 ± 1.012	4.184 ± 0.870	−2.259*
Professional identity	4.266 ± 0.445	4.233 ± 0.501	0.404

*$p < 0.05$.

impact organizational support, emotional labor, and professional identity.

Analysis of Differences Based on Gender

To examine differences based on gender, this study conducted an independent sample *t*-test on the organizational support, emotional labor, and professional identity of medical personnel assisting Hubei. The test results are shown in **Table 2**.

According to the statistical results, the differences based on gender for the two variables of organizational support and occupational identity were not significant. However, for emotional labor, the mean for men was 3.833, the mean for women was 4.412, the *T*-value was −2.259, and it was significant at the level of $P < 0.05$. This shows that women's emotional labor is significantly higher than men's, which may be due to differences in thinking, behavior, and empathy between the sexes.

Analysis of Differences Based on Working Years

To examine differences based on working years, this study conducted a one-way analysis of variance test on the organizational support, emotional labor, and professional identity of medical personnel assisting Hubei. The test results are shown in **Table 3**.

According to the statistical results, the differences based on working years for the two variables of organizational support and emotional labor were not significant. However, there were significant differences in occupational identity among medical personnel based on working years. Among the medical personnel assisting Hubei, generally, as the number of working years increased, there was a stronger recognition of their work and professional roles. This may be because as work experience increases, medical personnel deepen their understanding of their work and are more able to integrate into the job role, leading to a higher understanding of the professional role.

Analysis of Differences Based on Professional Level

To examine differences based on professional level, this study conducted a one-way analysis of variance test on the organizational support, emotional labor, and professional identity of medical personnel assisting Hubei. The test results are shown in **Table 4**.

According to the statistical results, there were no significant differences based on professional level for the three variables of organizational support, emotional labor and professional identity.

Descriptive Statistical Analysis of Variables

The study involves three variables—perceived organizational support, emotional labor, and professional identity—and we focus on descriptive statistics to determine the overall performance of these variables. We conducted descriptive statistics analyses for each variable; the results are shown in **Table 5**. We see that the average value for organizational support is 4.4799, with a standard deviation of ±0.92402. The maximum value is 6, and the minimum value is 2; this indicates that although there are differences in the sense of organizational support among the medical personnel participants, their sense of organizational support is still strong. The average value for emotional labor is 4.2059 (±0.57747), indicating that the emotional labor level of medical personnel in Hubei Province was very high. The average value of professional identity was 4.2424 (±0.28286). This indicates that the professional identity of medical workers in Hubei Province was very high.

Analysis of the Correlation Between Variables

To determine the relationships among perceived organizational support, emotional labor, and professional identity, we must first determine whether correlations exist among the three variables. We utilized a Pearson's correlation analysis to analyze the three variables; the results are shown in **Table 6**.

Table 6 shows that the relationships among the variables—perceived organizational support and emotional labor ($r = 0.443$, $p < 0.01$), perceived organizational support and professional identity ($r = 0.631$, $p < 0.01$), and emotional labor and professional identity ($r = 0.511$, $p < 0.01$)—were all significantly positively correlated. We can therefore state that the perceived organizational support, emotional labor, and professional identity of medical workers in Hubei Province are pairwise correlated.

Mediating Effect of Professional Identity

The above empirical analysis verified the influence of perceived organizational support on emotional labor; these results confirm our hypotheses. In terms of the pandemic aid operation, perceived organizational support has a positive impact on emotional labor. Further, this conclusion applies equally to the causal relationship between perceived organizational support and professional identity and the causal relationship between emotional labor and professional identity. Next, we need to verify the mediating effect of professional identity on perceived organizational support and emotional labor. Considering that the test for mediating effect using the SPSS regression method may not be sufficient, this study uses the Amos path analysis method for further testing and obtains the final test results. First, the path test method is used to determine whether the path is significant; next, bootstrapping is used to observe whether the upper and lower limits contain zero.

The mediating effect of professional identity was tested and a model diagram was drawn (**Figure 2**). The results show that the X2 / DF is 4.104 < 5, which is acceptable. The fitting indexes are ∼0.9 and the fitting is passed. The path test results showed that the critical value (composite reliability – CR) of

TABLE 3 | Results of the one-way analysis of variance test based on working years.

Variables	5 years or less ($n = 12$)	6–10 years ($n = 50$)	11–15 years ($n = 59$)	16–20 years ($n = 22$)	More than 20 years ($n = 27$)	*F*
Organizational support	4.289 ± 0.956	4.528 ± 0.941	4.671 ± 0.886	4.214 ± 0.931	4.275 ± 0.914	1.605
Emotional labor	4.188 ± 0.749	4.243 ± 0.509	4.311 ± 0.625	4.085 ± 0.509	4.232 ± 0.555	0.994
Professional identity	4.417 ± 0.515	4.607 ± 0.470	4.627 ± 0.480	4.455 ± 0.520	4.840 ± 0.338	2.782*

*$p < 0.05$.

TABLE 4 | Results of the one-way analysis of variance based on professional title.

Variables	Junior ($n = 37$)	Intermediate ($n = 85$)	Deputy high ($n = 40$)	Senior ($n = 8$)	*F*
Organizational support	4.307±0.859	4.652±0.945	4.334±0.904	4.184±0.896	2.059
Emotional labor	4.128±0.603	4.302±0.542	4.125±0.574	3.953±0.750	1.796
Professional identity	4.138±0.487	4.285±0.495	4.255±0.484	4.204±0.359	0.819

TABLE 5 | Descriptive statistics of main variables.

Variables	Average	Maximum	Minimum	Standard deviation
Organizational support	4.4799	6.00	2.00	±0.92402
Emotional labor	4.2059	5.00	2.63	±0.57747
Professional identity	4.2424	5.00	2.53	±0.48486

TABLE 6 | Pearson's correlation analysis of variables ($N = 170$).

	Organizational support	Emotional labor	Professional identity
Organizational support	1		
Emotional labor	0.443**	1	
Professional identity	0.631**	0.511**	1

**$p < 0.01$.

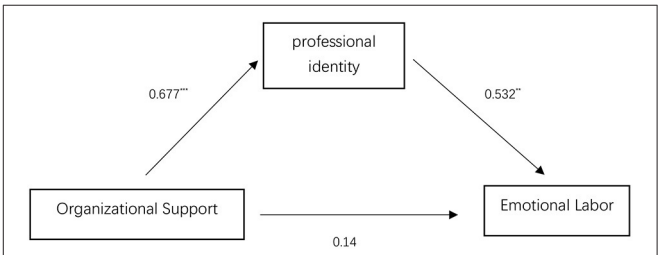


FIGURE 2 | Mediating effect model of professional identity on the relationship between perceived organizational support and emotional labor.

TABLE 7 | Mediating effect of professional identity on perceived organizational support and emotional labor.

Effect	Path	Path coefficient	95% confidence interval (CI)
Indirect effect	Path 1	0.080	[0.029, 0.179]
Direct effect	Path 2	0.031	[−0.027, 0.112]
Total	Path 3	0.111	[0.038, 0.193]

Path 1: Organizational Support → Professional Identity → Emotional Labor.
Path 2: Organizational Support → Emotional Labor.
Path 3: Path 1 + Path 2.

organizational support for professional identity was CR = 7.872 > 1.96, the critical value of professional identity to emotional labor is CR = 2.808 > 1.96. The critical value of organizational support to emotional labor is CR = 1.147 < 1.96, which is not up to the standard. It was found that all factor load *p*-values were significantly lower than 0.01, except for the path between perceived organizational support and emotional labor, which was not significant ($p = 0.252$). This shows that perceived organizational support has a significant influence on professional identity, which, in turn, has a significant influence on the path of emotional labor.

Next, we used a bootstrapping mediating effect test to examine the mediating effect of overall professional identity (**Table 7**).

The path coefficient of the indirect effect of professional identity on the relationship between perceived organizational support and emotional labor is 0.080, and the upper and lower limits of the confidence interval are 0.029 and 0.179, respectively. These are both positive and do not contain zero, indicating that there is an indirect effect. The path coefficient of the direct effect of professional identity between perceived organizational support and emotional labor is 0.031 and the upper and lower limits of the confidence interval are−0.027 and 0.112, respectively, including zero. This means that there is no direct effect. The total effect path coefficient of professional identity on the relationship between perceived organizational support and emotional labor was 0.111 and the upper and lower limits of confidence interval were 0.038 and 0.193, respectively, excluding zero. We can therefore conclude that professional identity has an absolute mediating effect on the relationship between perceived organizational support and emotional labor.

RESEARCH CONCLUSIONS AND IMPLICATIONS

Research Conclusion

During the national pandemic aid operation to Hubei, medical personnel represented the main force of the hospital organization. The main goal of the aid operation was to control the outbreak and successfully offer aid to Hubei as soon as possible. Realizing the maximum value of medical personnel was an important part of the success of the pandemic aid operation. By considering the emotional labor of medical workers in Hubei Province as the breakthrough point and taking professional identity as the intermediary, this study examined the effect of perceived organizational support on the emotional labor of medical workers in Hubei Province. We constructed a theoretical framework with professional identity as the mediating variable and conducted a questionnaire survey on a sample of 170 medical personnel in Hubei Province. We used the empirical method to verify the hypotheses and obtained the following conclusions:

(1) A strong sense of organizational support will encourage medical personnel to invest more emotional labor.
(2) A strong sense of organizational support will promote a stronger professional identity among medical personnel.
(3) A strong professional identity is helpful in encouraging medical workers to invest more emotional labor.
(4) Professional identity completely mediates the influence of perceived organizational support on emotional labor.

Research Implications

This study found that medical personnel in Hubei felt great support from the hospitals they were working at and that they would show more recognition and understanding of their own work. They were also willing to work hard to achieve the requirements and goals of the hospital and link the achievement of self-goals with the achievement of hospital goals. This means that there is a great sense of organizational support among medical workers in Hubei Province. This psychological perception, enhanced by professional identity, encouraged medical personnel to fight harder in the front lines of pandemic prevention, invest more emotional labor to cure COVID-19 infected patients, and finally defeat the pandemic. Based on our results, in modern hospital management, managers should enhance workers' sense of organizational support and their professional identity. This would enable medical personnel to combine their own career goals with organizational goals. Further, in the event of public emergencies, such as the COVID-19 pandemic, they are willing to invest more emotional labor to achieve organizational goals.

DATA AVAILABILITY STATEMENT

The original contributions generated for the study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

ETHICS STATEMENT

Written informed consent was obtained before the experiments, and the study was approved by the committee of the ethics board of Nanjing University of Chinese Medicine and the latest revision of the Declaration of Helsinki.

AUTHOR CONTRIBUTIONS

ZZ and SG designed the study. XW, HB, SY, and YL performed the experiments. XW, GX, and HB analyzed the data. ZZ, GX, and SG wrote the paper. All authors contributed to the article and approved the submitted version.

FUNDING

This paper was supported by Later funded projects of national philosophy and Social Science Foundation of China (20FZXB018).

REFERENCES

Ashforth, B. E., and Humphrey, R. H. (1993). Emotional labor in service roles: the influence of identity. *Acad. Manag. Rev.* 18, 88–115. doi: 10.5465/amr.1993.3997508

Back, C.-Y., Hyun, D. S., Jeung, D. Y., and Chang, S. J. (2020). Mediating effects of burnout in the association between emotional labor and turnover intention in Korean clinical nurses. *Saf. Health Work* 11, 88–96. doi: 10.1016/j.shaw.2020.01.002

Blau, G. J. (1988). Further exploring the meaning and measurement of career commitment. *J. Vocat. Behav.* 32, 284–297. doi: 10.1016/0001-8791(88)90020-6

China News Network (2020). *National Health Commission of China*. Available online at: https://www.chinanews.com/gn/2020/04-07/9149952.shtml (accessed January 01, 2021).

Delgado, C., Upton, D., Ranse, K., Furness, T., and Foster, K. (2017). Nurses' resilience and the emotional labour of nursing work: an integrative review of empirical literature. *Int. J. Nurs. Stud.* 70, 71–88. doi: 10.1016/j.ijnurstu.2017.02.008

Di Monte, C., Monaco, S., Mariani, R., and Di Trani, M. (2020). From resilience to burnout: psychological features of Italian general practitioners during COVID-19 emergency. *Front. Psychol.* 11:567201. doi: 10.3389/fpsyg.2020.567201

Di Trani, M., Mariani, R., Ferri, R., De Berardinis, D., and Frigo, M. G. (2021). From resilience to burnout in healthcare workers during the COVID-19 emergency: the role of the ability to tolerate uncertainty. *Front. Psychol.* 12:646435. doi: 10.3389/fpsyg.2021.646435

Diefendorff, J. M., Erickson, R. J., Grandey, A. A., and Dahling, J. J. (2011). Emotional display rules as work unit norms: a multilevel analysis of emotional labor among nurses. *J. Occup. Health Psychol.* 16, 170–186. doi: 10.1037/a0021725

Eisenberger, R., Huntington, R., Hutchison, S., and Sowa, D. (1986). Perceived organizational support. *J. Appl. Psychol.* 71, 500–507. doi: 10.1037/0021-9010.71.3.500

Forouzadeh, M., Kiani, M., and Bazmi, S. (2018). Professionalism and its role in the formation of medical professional identity. *Front. Psychol.* 32:130. doi: 10.14196/mjiri.32.130

Galletta, M., Portoghese, I., Penna, M. P., Battistelli, A., and Saiani, L. (2011). Turnover intention among Italian nurses: the moderating roles of supervisor support and organizational support. *Nurs. Health Sci.* 13, 185–191. doi: 10.1111/j.1442-2018.2011.00596.x

Glomb, T. M., and Tews, M. J. (2004). Emotional labor: a conceptualization and scale development. *J. Vocat. Behav.* 64, 1–23. doi: 10.1016/S0001-8791(03)00038-1

Grandey, A. A. (2000). Emotional regulation in the workplace: a new way to conceptualize emotional labor. *J. Occup. Health Psychol.* 5:95. doi: 10.1037/1076-8998.5.1.95

Henderson, A. C., and Borry, E. L. (2020). The emotional burdens of public service: rules, trust, and emotional labour in emergency medical services. *Public Money Manag.* 40, 1–10. doi: 10.1080/09540962.2020.1831180

Hong, Z., Tiao-tiao, L., and Cai-yun, Z. (2010). Testing for reliability and validity of chinese version of the nurse's career identity scale. *Chin. Nurs. Manag.* 10, 49–51. doi: 10.3969/j.issn.1672-1756.2010.11.018

Kyratsis, Y., Atun, R., Phillips, N., Tracey, P., and George, G. (2017). Health systems in transition: professional identity work in the context of shifting institutional logics. *Acad. Manag. J.* 60, 610–641. doi: 10.5465/amj.2013.0684

Labrague, L. J., McEnroe, P. D. M., Leocadio MC Van Bogaert, P., and Tsaras, K. (2018). Perceptions of organizational support and its impact on nurses' job outcomes. *Nurs. Forum* 5, 339–347. doi: 10.1111/nuf.12260

Larson, E. B., and Yao, X. (2005). Clinical empathy as emotional labor in the patient–physician relationship. *JAMA* 239, 1100–1106. doi: 10.1001/jama.293.9.1100

Li, Y., Liang, F., Xu, Q., Gu, S., Wang, Y., Li, Y., et al. (2021). Social support, attachment closeness, and self-esteem affect depression in international students in China. *Front. Psychol.* 12:399. doi: 10.3389/fpsyg.2021.618105

Ling, W., Yang, H., and Fang, L. (2006). Perceived organizational support (POS) of the employees. *Acta Psychol. Sinica* 38, 281–287. doi: 10.1186/xlxb.0.2006-02-014

MacMillan, R. (1997). *Customer Satisfaction and Organizational Support for Service Providers* (Doctoral dissertation). Gainesville, FL: University of Florida.

Matthews, R., Smith-Han, K., and Nicholson, H. (2020). From physiotherapy to the army: negotiating previously developed professional identities in mature medical students. *Adv. Health Sci. Educ. Theory Pract.* 25, 607–627. doi: 10.1007/s10459-019-09942-0

Moore, M., and Hofman, J. E. (1998). Professional identity in institutions of higher learning in Israel. *Higher Educ.* 17, 69–79. doi: 10.1007/BF00130900

Poghosyan, L., Ghaffari, A., Liu, J., and McHugh, M. D. (2020). Organizational support for nurse practitioners in primary care and workforce outcomes. *Nurs. Res.* 69, 280–288. doi: 10.1097/NNR.0000000000000425

Rhoades, L., and Eisenberger, R. (2002). Perceived organizational support: a review of the literature. *J. Appl. Psychol.* 87, 698–714. doi: 10.1037/0021-9010.87.4.698

Russell, H. A. (1983). *The Managed Heart: The Commercialization of Human Feeling*. London: University of California Press, Ltd. p. 223–241.

Selma, S., and Selma, D. (2015). Effects of the professional identity development programme on the professional identity, job satisfaction and burnout levels of nurses: a pilot study. *Int. J. Nurs. Pract.* 21, 847–857. doi: 10.1111/ijn.12330

Wang, J., Liu, W., Mi, J., Xiao, M., and Zhao, Q. (2020). Status and correlation analysis of perceived organizational support, psychological capital and work engagement among frontline nurses fighting against COVID-19 in Chongqing. *Chin. Nurs. Res.* 34, 3068–3073. doi: 10.12102/j.issn.1009-6493.2020.17.011

Willetts, G., and Garvey, L. (2020). Constructing nurses' professional identity through group performance. *Int. J. Nurs. Pract.* 26:e12849. doi: 10.1111/ijn.12849

Yang, T., Ma, T., Liu, P., Liu, Y., Chen, Q., Guo, Y., et al. (2019). Perceived social support and presenteeism among healthcare workers in China: the mediating role of organizational commitment. *Environ. Health Prev. Med.* 24:55. doi: 10.1186/s12199-019-0814-8

Zeng, Z., and Shen, J. (2013). Review and prospect of research on emotion studies in organizations. *Manag. Rev. Soc. Sci.* 2, 73–77. doi: 10.1186/SHGP.0.2013-02-010

Zhao, H., and Xi, Y. (2017). Emotional labor and turnover intention: emotional exhaustion as mediator and perceived organizational support as moderator. *Res. Econ. Manag.* 38, 80–86. doi: 10.13502/j.cnki.issn1000-7636.2017.02.009

Zhou, H., and Guo, Y. (2006). Theory and research of ego identity. *Adv. Psychol. Sci.* 14, 133–137. doi: 10.3969/j.issn.1671-3710.2006.01.021

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 14 July 2021
doi: 10.3389/fpsyg.2021.687165

The Effect of Computerized Cognitive Behavioral Therapy on People's Anxiety and Depression During the 6 Months of Wuhan's Lockdown of COVID-19 Epidemic: A Pilot Study

Zhangwei Lv[1,2†], *Jinyang Li*[1,2†], *Bin Zhang*[3], *Ning Zhang*[1,2] *and Chun Wang*[1,2*]

[1] Nanjing Brain Hospital, Nanjing Medical University, Nanjing, China, [2] Cognitive Behavioral Therapy Institute of Nanjing Medical University, Nanjing, China, [3] Department of Psychiatry, Nanfang Hospital, Southern Medical University, Guangzhou, China

OPEN ACCESS

Edited by:
Yi-Yuan Tang,
Texas Tech University, United States

Reviewed by:
Meng Yu,
Sun Yat-sen University, China
Ana Isabel Rosa-Alcázar,
University of Murcia, Spain

***Correspondence:**
Chun Wang
chun_wang@njmu.edu.cn

[†] *These authors have contributed equally to this work*

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *29 March 2021*
Accepted: *03 June 2021*
Published: *14 July 2021*

Citation:
Lv Z, Li J, Zhang B, Zhang N and Wang C (2021) The Effect of Computerized Cognitive Behavioral Therapy on People's Anxiety and Depression During the 6 Months of Wuhan's Lockdown of COVID-19 Epidemic: A Pilot Study. Front. Psychol. 12:687165. doi: 10.3389/fpsyg.2021.687165

Background: The effectiveness of computerized cognitive behavioral therapy (CCBT) has been proven for mild and moderate anxiety and depression. In 2016, the first official Chinese CCBT system was launched by Chinese Cognitive Behavior Therapy Professional Organizations and included four items: getting out of depression, overcoming anxiety, staying away from insomnia and facing Obsessive-compulsive disorder. During the COVID-19 epidemic, Chinese CCBT system served the public for free. This study explored the effects of CCBT on anxiety and depression by comparing the use of the platform during the epidemic and during the same period in 2019.

Methods: Users were divided into a depression group or an anxiety group according to their own discretion. The subjects used the self-rating anxiety scale (SAS) and self-rating depression scale (SDS) before each training. Each training group completed the corresponding CCBT training project, which had 5–6 training sessions, an average of once every 5 days. The training content in 2019 and 2020 was identical. This study compared the demographic characteristics, depression, and anxiety levels of CCBT platform users during the lockdown period in Wuhan (LP2020), where the outbreak was concentrated in China, from January 23 to July 23, 2020 and the same period in 2019 (SP2019).

Result: (1) There were significant differences in gender ($\chi 2 = 7.215$, $P = 0.007$), region ($\chi 2 = 4.225$, $P = 0.040$) and duration of illness ($\chi 2 = 7.867$, $P = 0.049$) between the two periods. (2) There was a positive Pearson correlation between the number of users of CCBT platform during LP2020 and number of confirmed cases of COVID-19 in each province ($r = 0.9429$, $P < 0.001$). (3) In LP2020, the SAS ($t = 2.579$, $P = 0.011$) and SDS ($t = 2.894$, $P = 0.004$) scores at T0 in Hubei were significantly higher than those in other regions. (4) The CCBT platform has an obvious effect on anxiety ($F = 4.74$, $P = 0.009$) and depression on users ($F = 4.44$, $P = 0.009$).

Conclusion: This study showed women, students and people who are more seriously affected by the epidemic were more likely to accept the CCBT training. The CCBT platform made a significant contribution toward alleviating the anxiety and depression symptoms of users during the epidemic. When face-to-face psychotherapy is not available during the epidemic, CCBT can be used as an effective alternative.

Keywords: COVID-19, anxiety, depression, lockdown of Wuhan, computerized cognitive behavioral therapy

INTRODUCTION

At the end of 2019, the epidemic caused by COVID-19 (SARS-CoV-2) suddenly hit, causing a serious impact on the politics, economy and society in various countries around the world (Lai et al., 2020). In order to prevent and control the COVID-19 epidemic and effectively cut off the spread of the virus, the Chinese government enacted city lockdown measures on Wuhan beginning 10:00 on January 23, 2020. The country's emergency measures successfully delayed the spread of the epidemic and ultimately limited the scale of COVID-19 (Tian et al., 2020).

Measures such as isolation and lockdown achieved the expected results, however, they resulted in unintended consequences for people's mental health. For instance, the social and physical distancing measures of quarantine turned out to be key risk factors for mental health issues. A multinational study showed that starting from March 2020, 19.1% of Chinese respondents were at risk of severe mental illness (95% CI: 16.9–21.6%), and 16.6% of British respondents were at risk of severe mental illness (95% CI: 14.6–18.8%) (Goodwin et al., 2021). Furthermore, the investigation of a non-clinical, non-infected sample showed that in the early stage of the COVID-19 epidemic, the anxiety level of respondents increased significantly, and the anxiety level of women increased more than that of men (De Pietri and Chiorri, 2021). In addition, a study assessed 1,036 children and adolescents quarantined as a result of the COVID-19 epidemic, of which 112 (11.78%) cases of depression and 196 (18.92%) cases of anxiety were identified; 68 (6.56%) cases presented both (Chen et al., 2020).

A recent study has shown that the COVID-19 epidemic will have a serious impact on the mental health of many people, but the negative psychological consequences can be minimized by taking corresponding intervention measures (Paredes et al., 2021). Although many forms of psychotherapy are effective in treating depression, cognitive behavioral therapy (CBT) is by far the most well-studied form of psychotherapy for depression (Cuijpers, 2017). A total of 115 unique studies identified from 127 publications were eventually included in a meta-Analysis. In summary, the sample included 7,719 patients and the final results consistently proved the effectiveness of CBT in reducing anxiety symptoms in adolescents (Wang et al., 2017), which is consistent with the results of a previous systematic review (Manassis et al., 2010). Besides, other studies have provided robust evidence for the effectiveness of CBT in the treatment of anxiety and depressive disorders in adolescents and young adults compared with passive controls (A-Tjak et al., 2021; Riise et al., 2021; Wakefield et al., 2021; Wergeland et al., 2021). These studies indicate that CBT is a great choice for alleviating the mental health problems caused by COVID-19.

Due to the extreme infectiousness of COVID-19 and the isolation and lockdown measures taken to prevent the epidemic, classical treatment methods such as traditional face-to-face interactive psychological evaluation and intervention have been hindered (Alqahtani et al., 2021). With the therapist and patient being isolated, innovative approaches need to be taken in order to continue providing excellent medical services while minimizing the risk of exposure to or spreading of COVID-19. The obstacles impeding face-to-face psychotherapy can be solved by computerized cognitive behavioral therapy. For patients, CCBT can reduce barriers to access mental health resources in remote areas (Anderson et al., 2004), especially since it is so urgently needed by patients during the epidemic. Another advantage of CCBT is that it can be used to enhance follow-up treatment. CCBT can also reduce the shame of requiring psychiatric treatment (Carlbring et al., 2011). Further, trained therapists can increase their ability to provide mental services by using CCBT (Andrews and Erskine, 2002; Anderson et al., 2004). Additionally, because all forms of CCBT use less therapeutic support than conventional psychotherapy, CCBT has been demonstrated as a cost-effective strategy (Eells et al., 2014; Andersson et al., 2015; Wright et al., 2019; Wright and Caudill, 2020). Because of its effectiveness, acceptability and feasibility, CCBT has been popular since its inception in the 1990s (Andersson et al., 2019) and its effectiveness for treating mild and moderate depression and anxiety has been proven by many studies since (Bowler et al., 2012; Carlbring et al., 2018; Kuechler et al., 2019; Wright et al., 2019; Christ et al., 2020). Thus, computerized cognitive behavioral therapy is the most suitable form of psychotherapy in isolation due to its convenience, non-contact, and effectiveness.

In April 2016, Chinese Cognitive Behavioral Therapy Professional Organization launched China's first official CCBT system and its effectiveness against depression and anxiety has since been verified by numerous studies (Li et al., 2018). In order to mitigate the effects of the epidemic, CCBT was made available to the public for free during the COVID-19 epidemic. The purpose of this study is to explore the level of public anxiety and depression during the epidemic and which people tended to choose CCBT platform, and to explore the effect of CCBT platform on relieving public anxiety and depression.

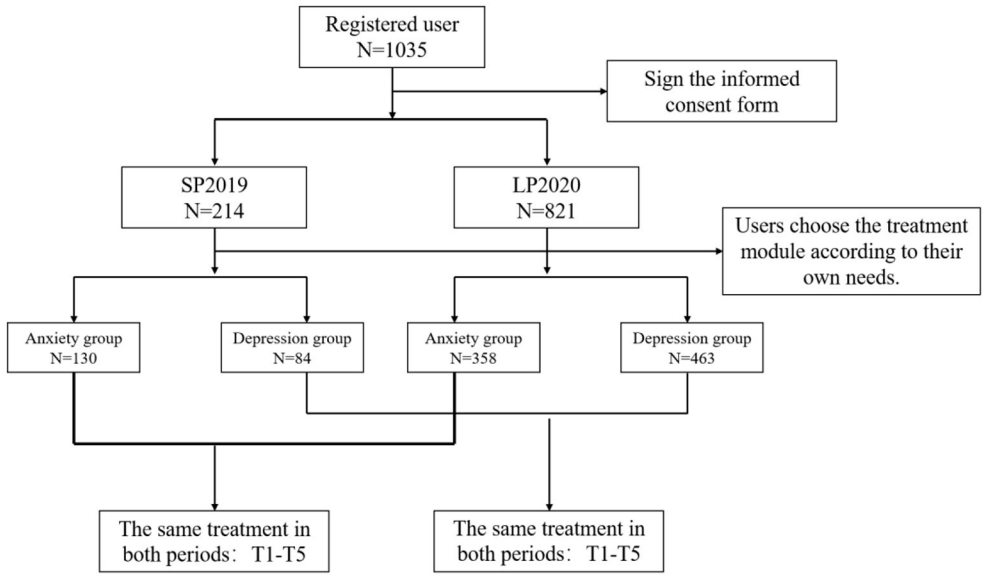


FIGURE 1 | Diagram of participant flow.

METHODS

Materials

The CCBT platform (http://CCBT.cbtchina.com.cn and mobile phone "CCBT" APP) has been online since April 15, 2016. The CCBT platform includes four training projects: getting out of depression, overcoming anxiety, staying away from insomnia and facing obsessive-compulsive disorder. Users who did not select anxiety or depression programs among those registered in SP2019 and LP2020 were screened out. Users' general information including age, gender, ethnicity, geographic area and region, occupation and clinical variables (e.g., other psychological problems, duration of illness, onset frequency, medical visits, physical disease, etc.) were collected. All outcome measures were collected digitally via the same digital platform where patients accessed the training.

Participants

Users registered on the CCBT platform by searching on the Internet or in the mobile application platform and selected a training project according to their own needs. When registering for the CCBT platform, all users participate voluntarily and sign informed consent. All users who registered during SP2019 and LP2020 and used anxiety and depression programs in CCBT platform were included in this study. A user who did not complete the training or did not log in again for more than 90 days was defined as a dropout. In SP2019 and LP2020, 214 and 821 users signed up for the CCBT platform, respectively. Their ages ranged from 10 to 73. There were 712 (68.79%) women. **Figure 1** is a diagram of flow of participants through the study. This study was reviewed and approved by the Ethics Committee of Nanjing Medical University.

Self-Rating Measures

In the anxiety group, symptoms were assessed using the self-rating anxiety scale (SAS) (Zung, 1971). SAS measures 20 items across a total of six training sessions and adopts a four-level scoring method with scores ranging from 1 to 4. A higher score indicates more severe symptoms. According to Chinese norm results, a total score from 50 to 59 is classified as mild anxiety, from 60 to 69 as moderate anxiety, and above 70 as severe anxiety. In the depression group, the self-rating depression scale (SDS) (Zung, 1965) was used to evaluate symptoms. The SDS evaluates 20 items across six training sessions and adopts a four-level scoring method with scores ranging from 1 to 4. A higher score indicates more severe symptoms. Users conducted self-assessment of symptoms before each training. According to Chinese norm results, a total score of 53–62 is classified as mild depression, 63–72 as moderate depression, and more than 72 as severe depression. We recorded the level of anxiety or depression before the first training as the baseline level (T0), and asked users to complete a symptom assessment before each subsequent training (T1–T5).

Intervention Measures

The depression group and the anxiety group completed their corresponding CCBT training projects, respectively. Each project was set with six training sessions, which were conducted once every 5 days on average. The training sessions of each project were the same in both time periods. The contents of each training in the anxiety group and depression group are shown in the **Table 1**.

Data Analysis

The chi-square test was used to compare the differences in demographic characteristics, depression and anxiety levels

TABLE 1 | Theme of six training sessions for users in the anxiety group and depression group.

	Anxiety group	Depression group
Session 1	Anxiety and CBT model	Depression and CBT model
Session 2	Automatic thought restructuring and relaxation training	Automatic thought restructuring and behavior activation
Session 3	Distorted cognition and anxiety rating list	Distorted cognition and function behavior
Session 4	Exposure training and breathing training	Change in attribution Style and task Decomposition
Session 5	Core belief and positive orientation	Core belief and problem-solving techniques
Session 6	Review of goals and plans, frustration response, and recurrence prevention	Review of goals and plans, frustration response, and recurrence prevention

between the two time periods. Correlation analysis was used to compare the relationship between the number of confirmed cases of COVID-19 announced by the Chinese government (HNC, 2021) in different provinces and the number of CCBT users. One-way repeated measure analysis of variance (ANOVA) was used to analyze the trend of anxiety and depression symptoms after each training. Repeated measure ANOVA was used to analyze multiple scores on the symptom scales in the anxiety and depression groups. Due to the very high dropout rate in SP2019, we regard the effect after three trainings as the indicator of therapeutic effect. The Kolmogorov-Smirnov Test was used to complete the normal test of all count data, and the homogeneity test of variance was carried out for the normal distribution data. All data analysis was performed in SPSS 21.0 statistical software (IBM, Chicago, IL, USA), and data is presented in the form of average and standard deviation ($M \pm SD$), or number and percentage. GraphPad Prism 6.02 (GraphPad Software Inc., San Diego, California, USA) was utilized for plotting of graphs. Statistical significance was set by p-values of <0.05.

RESULTS

Comparison of Demographic Characteristics Among Users of CCBT Platform in SP2019 and LP2020

The chi-square test was used to compare the demographic characteristics of users in the two periods (**Table 2**). The results showed that there were significant differences in gender ($\chi 2 = 7.215$, $P = 0.007$), region ($\chi 2 = 4.225$, $P = 0.040$) and duration of illness ($\chi 2 = 7.867$, $P = 0.049$) between the two periods. Among all users, most were aged 19–27 (34.36%) and 28–36 (34.46%). Out of 1,035 participants, 712 were female, the mean age was 29.01 years (range = 10–73; $SD = 10.01$) and the dropout rate was 27.50%. The proportion of students was 13.43%. For most users, the incidence of disease was within the past 3 months (81.12%), it was the first onset (86.21%) and no other physical diseases were reported (85.89%).

TABLE 2 | Comparison of demographic characteristics of CCBT platform users in the two periods.

	SP2019 ($N = 214$)	LP2020 ($N = 821$)	$\chi 2$	P
Age group, y[a]				
10–18	12	50	8.267	0.142
19–27	75	261		
28–36	73	264		
37–45	18	131		
46–54	12	62		
Over 54	4	16		
Gender				
Male	83	240	7.215	**0.007**
Female	131	581		
Occupation				
Student	29	110	0.003	0.953
Other	185	711		
Region[b]				
Han nationality	175	782	4.225	**0.040**
Minority	13	29		
Duration of illness[c]				
Within 3 months	154	628	7.867	**0.049**
3 months−1 year	8	51		
1–5 years	13	53		
Over 5 years	19	38		
Onset frequency[d]				
1 time	105	664	0.021	0.989
2–5 times	9	58		
Over 5 times	8	48		
Physical disease				
Yes	38	108	2.968	0.085
No	176	713		

[a]Missing value: n = 57(5.51%); [b]missing value: n = 36(3.48%); [c]missing value: n = 71(6.86%); [d]missing value: n = 143(13.82%). The meaning of bold words indicates P-value < 0.05.

Differences in Demographic Characteristics and Number of Users of CCBT Platform in Different Regions During the Epidemic

In LP2020, there were significant differences between CCBT users from Hubei province and those not from Hubei province in terms of occupational distribution ($\chi 2 = 25.534$, $P = 0.001$), region distribution ($\chi 2 = 5.172$, $P = 0.023$) and treatment situation ($\chi 2 = 6.855$, $P = 0.009$). Regardless of province, students made up the highest proportion of users. The proportion of minorities among users from Hubei (3.80%) was lower than that of users who were not from Hubei (5.12%). Users in Hubei displayed a greater tendency to seek help at professional medical institutions (23.75%). Pearson correlation between the number of users of CCBT platform during LP2020 and number of confirmed cases of COVID-19 in each province was positive ($r = 0.9710$, $P < 0.001$) (**Figure 2A**). During LP2020, the number of CCBT users in Hubei Province was 181 (37.63%),

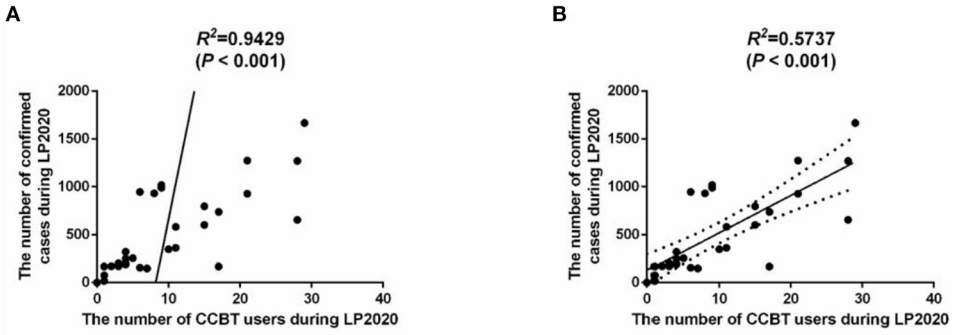


FIGURE 2 | (A) Correlation analysis of the number of people confirmed cases of COVID-19 and the number of users of the CCBT platform during LP2020. **(B)** Correlation analysis of the number of people confirmed cases of COVID-19 and the number of users of the CCBT platform during LP2020 without Hubei province.

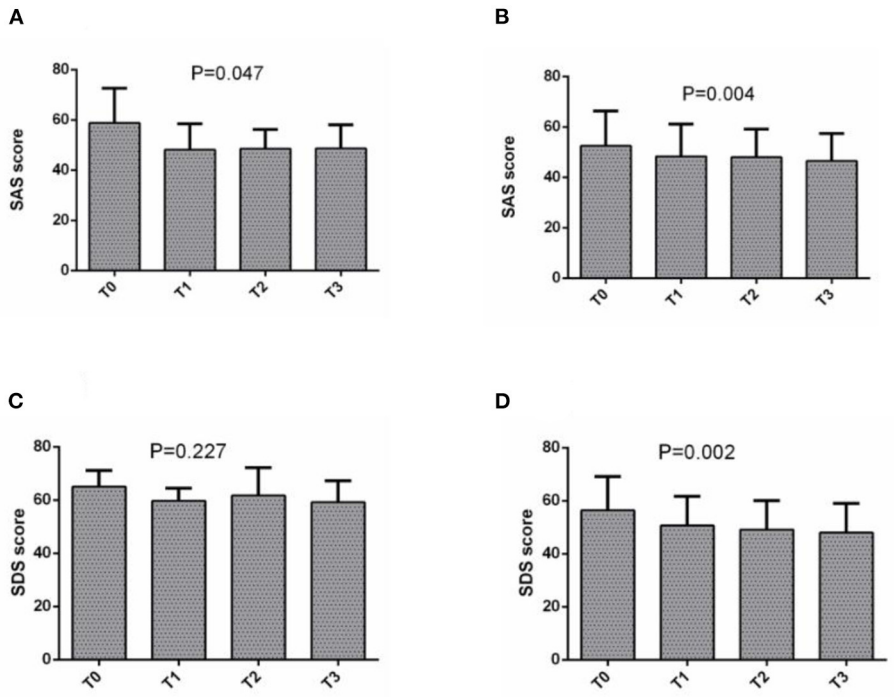


FIGURE 3 | (A) The change of SAS score in SP2019, **(B)** the change of SAS score in LP2020, **(C)** the change of SDS score in SP2019, and **(D)** the change of SAS score in LP2020.

and the number of confirmed cases was 68,135 (81.36%). After removing the extreme value of Hubei Province, there was a positive correlation between the number of users and the number of confirmed cases ($r = 0.7574$, $P < 0.0001$) (**Figure 2B**).

Dropout Rate

The dropout rates in SP2019 and LP2020 were 94.71 and 10.92%, respectively. Further analysis showed that in LP2020, there were significant differences in the dropout rates at different ages ($\chi 2 = 7.572$, $P = 0.006$) with medical visits ($\chi 2 = 6.481$, $P = 0.011$) and physical diseases ($\chi 2 = 7.572$, $P = 0.006$). The dropout rate of users aged 37–45 (8.87%) without medical visits (4.90%) or physical diseases (1.96%) was lower.

Anxiety and Depression in CCBT Users

In the anxiety group, training had the effect of gradually decreasing SAS score in LP2020 ($P = 0.047$) and SP2019 ($P = 0.004$). In the depression group, the SDS score ($P = 0.002$) also continued to decline (**Figure 3**). An unpaired t-test was used to examine anxiety and depression symptoms among CCBT users before training in SP2019 and LP2020. The results showed that there was no significant difference in users' anxiety symptoms between the two periods, but depression levels in SP2019 were higher than in LP2020 ($t = 6.751$, $P < 0.001$). For LP2020, SAS

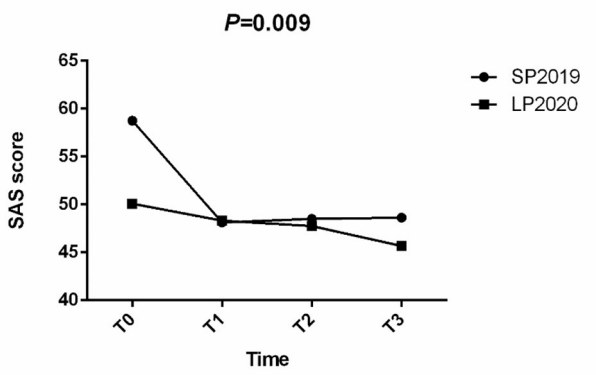


FIGURE 4 | SAS scores at T0, T1, T2, and T3, by group (SP2019, LP2020).

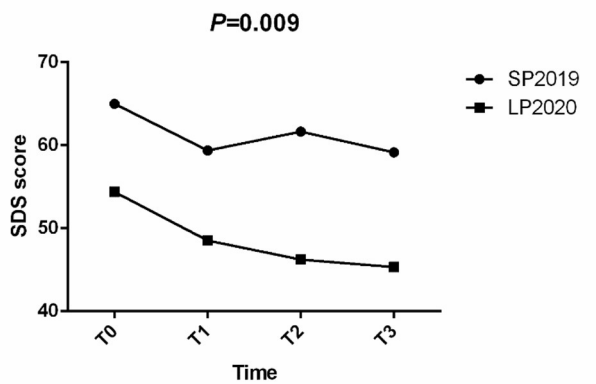


FIGURE 5 | SDS scores at T0, T1, T2, and T3, by group (SP2019, LP2020).

($t = 2.579$, $P = 0.011$) and SDS ($t = 2.894$, $P = 0.004$) scores at T0 in Hubei were significantly higher than in other regions.

Effect of CCBT on Anxiety and Depression

A repeated measures ANOVA was conducted to compare the mean scores on the SAS and SDS before and after CCBT training. Group (SP2019 vs. LP2020) was included as the between-subjects factor. The results showed that in the anxiety group, the interaction between time period and training times was not significant (**Figure 4**), but the main effect of training times was significant ($F = 4.742$, $P = 0.009$). In the depression group, the main effect of training times was significant ($F = 4.438$, $P = 0.009$), but the interaction between training times and time period was not significant (**Figure 5**).

DISCUSSION

In the present study, CCBT was used as a substitute for traditional face-to-face CBT to help people affected by the epidemic. CCBT was shown to be effective for anxiety and depression during lockdown. This study provides important findings about the mental health status and the likelihood of people of different geographical locations, ages and genders to use CCBT, which can help decision makers design targeted interventions and allocate resources reasonably in order to effectively improve specific mental health status.

Compared with other regions, CCBT users in Hubei Province (an epicenter of the epidemic in China) displayed more severe anxiety and depression. This finding is in agreement with a previous study suggesting that during the rising stage of the outbreak, psychological and behavioral responses of the masses are significant (Zhang et al., 2020). Based on the relationship between the confirmed number of cases and the number of CCBT users, it can be extrapolated that as the severity of the epidemic grows, the number of residents using CCBT will increase. In particular, younger users, women and people from Hubei are more likely to use the CCBT platform, which is consistent with the results of previous studies (Li et al., 2018).

In this study, we found that people between the ages of 19 and 27 had higher levels of anxiety and depression and were more likely to use CCBT. In contrast, anxiety level before training in SP2019 and LP2020 decreased with age. This finding is consistent with the results of similar studies (Balsamo and Carlucci, 2020). Early studies have also shown that young people are more likely to have mental health problems after an outbreak of a disease (Main et al., 2011). This may be because compared with other age groups, the youth group (19–27) receives more distressing information on the Internet and exhibits reduced psychological resilience (Cheng et al., 2014), prompting them to choose CCBT platform to alleviate their anxiety and depression levels. In terms of gender differences, in LP2020, women accounted for a larger proportion of CCBT users, which may be caused by a higher degree of psychological distress among women than men (Ho et al., 2020). This evidence suggests that women are more sensitive to stressors than men (Wang et al., 2020), and that women engage in self-help behaviors as a result. In terms of geographical differences, anxiety and depression levels in Hubei Province, the center of China's epidemic, were higher than those not from Hubei in LP2020, but there was no significant difference in distribution between the two regions in SP2019. The residents in the areas most affected by the epidemic experienced higher levels of anxiety and depression, which is consistent with the results of previous studies (Balsamo and Carlucci, 2020). A cross-sectional study found that anxiety and depressive symptoms were positively associated with current residence in Wuhan and college locations based in Wuhan (Wu et al., 2021). Another study showed that location is very influential on mental health, with residents in big cities displaying higher levels of anxiety and depression than participants living in rural areas (Zhong et al., 2020). During the epidemic, residential area was an important predictor of anxiety and depression (Lenzo et al., 2020). For example, residents in Hubei Province isolated at home, so inadequate access to daily necessities and medical care may explain increased anxiety and depressive symptoms compared to other provinces. In the absence of face-to-face medical treatment, looking for computerized treatment on the Internet has become the best choice, especially during the epidemic. CCBT not only saves medical resources, it also helps to reduce inequalities in access to health care (Jaffe et al., 2020).

In this study, the dropout rates of CCBT in SP2019 and LP2020 are 94.71 and 10.92%, respectively. Previous studies have

also pointed out that CCBT has a higher dropout rate than traditional face-to-face psychotherapy (Cai et al., 2015). Due to the lack of doctor's guidance, this computer-based, self-service, unsupervised treatment method not only shows its efficiency and convenience, but also reduces the compliance of users (Melville et al., 2011). In view of this situation, some researchers believe that on the basis of the standardized guiding theoretical model, the matching degree between CCBT and its users should be improved from demographic variables such as patients' gender, age, education level and stressful life events; on the other hand, the setting and content of CCBT should be improved to enhance its attractiveness to patients (Zhang and Qian, 2018).

CCBT users reduced their SAS and SDS scores through training in SP2019 and LP2020, indicating that CCBT is effective in relieving anxiety and depression. This is consistent with results of a previous meta-analysis (Andrews et al., 2018). Because CCBT is effective and acceptable for patients with anxiety and depression (Ebert et al., 2015), some researchers recommend that CCBT may be a promising treatment option when face-to-face treatment is not feasible (Wright et al., 2019; De Luca and Calabrò, 2020). Because CCBT reduces medical costs while ensuring positive training effects, CCBT can be used not only as a regular tool for patients with anxiety and depression, but also as a resource in times of emergency.

In this study, we discovered that there was a correlation between the number of confirmed cases of COVID-19 and the number of CCBT users. To be more specific, there were more CCBT users in provinces with a more severe epidemic. This should inform policy makers that the allocation of health care should be skewed toward areas with severe outbreaks, and that the use of CCBT is recommended.

Based on the results of this study, psychological intervention needs to be implemented during the epidemic, especially in areas where the epidemic is more serious. Our study found that public anxiety and depression levels increased in areas with severe outbreaks, so more medical resources should be allocated to these areas.

There are some limitations in this study. First of all, participants were recruited through the Internet, and there is no guarantee that users will complete all treatment. This resulted in a high dropout rate which affected the evaluation of the effectiveness of CCBT. Secondly, in this study, only the self-rating anxiety and depression scale were used to evaluate the symptoms of the users, so the symptoms could not be evaluated comprehensively or accurately. Third, users' attitudes, experience and feedback on the CCBT platform were not collected. Although the number of users in LP2020 was much higher than in SP2019, the reason for the increase cannot be accurately explained. Fourth, in order to explore the effectiveness of the CCBT platform in the actual application scenario, this study did not set up a randomized controlled trial, which will be added to follow-up studies to explore how CCBT works.

CONCLUSION

This study showed that young CCBT users from Hubei Province had higher levels of anxiety and depression during the first 6 months of the lockdown of Wuhan. Women, students and people who are more seriously affected by the epidemic were more likely to accept the CCBT training. The CCBT platform made a significant contribution toward alleviating the anxiety and depression symptoms of users during the epidemic. When face-to-face psychotherapy is not available during the epidemic, CCBT can be used as an effective alternative.

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.

ETHICS STATEMENT

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

AUTHOR CONTRIBUTIONS

BZ designed and built the CCBT platform. JL completed the data collection and sorting. ZL completed the data analysis and manuscript writing. After reviewing the manuscript, CW and NZ proposed amendments. All authors approved the submitted version.

FUNDING

This work was supported by National Natural Science Foundation of China (No. 81971289), the Medical Science and Technology Development Major Foundation of Nanjing (No. ZKX19028).

ACKNOWLEDGMENTS

We would like to thank all those who have contributed to this research, and we would like to thank each participant for their experience and time for this research.

REFERENCES

Alqahtani, M. M. J., Alkhamees, H. A., Alkhalaf, A. M., Alarjan, S. S., Alzahrani, H. S., AlSaad, G. F., et al. (2021). Toward establishing telepsychology guideline. Turning the challenges of COVID-19 into opportunity. *Ethics Med. Public Health* 16, 100612–100612. doi: 10.1016/j.jemep.2020.100612

Anderson, P., Jacobs, C., and Rothbaum, B. O. (2004). Computer-supported cognitive behavioral treatment of anxiety disorders. *J. Clin. Psychol.* 60, 253–267. doi: 10.1002/jclp.10262

Andersson, G., Titov, N., Dear, B. F., Rozental, A., and Carlbring, P. (2019). Internet-delivered psychological treatments: from innovation to implementation. *World Psychiatry* 18, 20–28. doi: 10.1002/wps.20610

Andersson, G., Topooco, N., Havik, O., and Nordgreen, T. (2015). Internet-supported versus face-to-face cognitive behavior therapy for depression. *Expert Rev. Neurother.* 16, 55–60. doi: 10.1586/14737175.2015.1125783

Andrews, G., Basu, A., Cuijpers, P., Craske, M. G., McEvoy, P., English, C. L., et al. (2018). Computer therapy for the anxiety and depression disorders is effective, acceptable and practical health care: an updated meta-analysis. *J. Anxiety Disord.* 55, 70–78. doi: 10.1016/j.janxdis.2018.01.001

Andrews, G., and Erskine, A. (2002). Reducing the burden of anxiety and depressive disorders: the role of computerized clinician assistance. *Curr. Opin. Psychiatry* 16, 41–44. doi: 10.1097/00001504-200301000-00009

A-Tjak, J. G. L., Morina, N., Topper, M., and Emmelkamp, P. M. G. (2021). One year follow-up and mediation in cognitive behavioral therapy and acceptance and commitment therapy for adult depression. *BMC Psychiatry* 21:41. doi: 10.1186/s12888-020-03020-1

Balsamo, M., and Carlucci, L. (2020). Italians on the age of COVID-19: the self-reported depressive symptoms through web-based survey. *Front. Psychol.*11:569276. doi: 10.3389/fpsyg.2020.569276

Bowler, J. O., Mackintosh, B., Dunn, B. D., Mathews, A., Dalgleish, T., and Hoppitt, L. (2012). A comparison of cognitive bias modification for interpretation and computerized cognitive behavior therapy: effects on anxiety, depression, attentional control, and interpretive bias. *J. Consul. Clin. Psychol.* 80, 1021–1033. doi: 10.1037/a0029932

Cai, H., Wei, S., Xue, H., Xu, L., Sha, X., and Hu, B. (2015). "Brief discussion on current computerized cognitive behavioral therapy," in Paper presented at the International Conference on Brain Informatics and Health (London).

Carlbring, P., Andersson, G., Cuijpers, P., Riper, H., and Hedman-Lagerlöf, E. (2018). Guided Internet-based vs. face-to-face cognitive behavior therapy for psychiatric and somatic disorders: a systematic review and meta-analysis. *Cogn. Behav. Ther.* 47, 1–18. doi: 10.1080/16506073.2017.1401115

Carlbring, P., Furmark, T., Steczk,ó, J., Ekselius, L., and Andersson, G. (2011). An open study of Internet-based bibliotherapy with minimal therapist contact via email for social phobia. *Clin. Psychol.* 10, 30–38. doi: 10.1080/13284200500378662

Chen, F., Zheng, D., Liu, J., Gong, Y., Guan, Z., and Lou, D. (2020). Depression and anxiety among adolescents during COVID-19: a cross-sectional study. *Brain Behav. Immun.* 88, 36–38. doi: 10.1016/j.bbi.2020.05.061

Cheng, C., Jun, H., and Liang, B. (2014). Psychological health diathesis assessment system: a nationwide survey of resilient trait scale for Chinese adults. *Stud. Psychol. Behav.* 12, 735–742.

Christ, C., Schouten, M. J. E., Blankers, M., van Schaik, D. J. F., Beekman, A. T. F., Wisman, M. A., et al. (2020). Internet and computer-based cognitive behavioral therapy for anxiety and depression in adolescents and young adults: systematic review and meta-analysis. *J. Med. Internet Res.* 22:e17831. doi: 10.2196/17831

Cuijpers, P. (2017). Four decades of outcome research on psychotherapies for adult depression: an overview of a series of meta-analyses. *Can. Psychol.* 58, 7–19. doi: 10.1037/cap0000096

De Luca, R., and Calabrò, R. S. (2020). How the COVID-19 pandemic is changing mental health disease management: the growing need of telecounseling in Italy. *Innov. Clin. Neurosci.* 17, 16–17.

De Pietri, S., and Chiorri, C. (2021). Early impact of COVID-19 quarantine on the perceived change of anxiety symptoms in a non-clinical, non-infected Italian sample: effect of COVID-19 quarantine on anxiety. *J. Affect. Disord. Rep.* 4:100078. doi: 10.1016/j.jadr.2021.100078

Ebert, D. D., Zarski, A.-C., Christensen, H., Stikkelbroek, Y., Cuijpers, P., Berking, M., et al. (2015). Internet and computer-based cognitive behavioral therapy for anxiety and depression in youth: a meta-analysis of randomized controlled outcome trials. *PLoS ONE* 10:e0119895. doi: 10.1371/journal.pone.0119895

Eells, T. D., Barrett, M. S., Wright, J. H., and Thase, M. (2014). Computer-assisted cognitive-behavior therapy for depression. *Psychotherapy* 51, 191–197. doi: 10.1037/a0032406

Goodwin, R., Hou, W. K., Sun, S., and Ben-Ezra, M. (2021). Psychological and behavioural responses to COVID-19: a China-Britain comparison. *J. Epidemiol. Community Health* 75, 189–192. doi: 10.1136/jech-2020-214453

HNC (2021). http://www.nhc.gov.cn/xcs/xxgzbd/gzbd_index.shtml (accessed June 27, 2020).

Ho, C. S. H., Chee, C. Y. I., and Ho, R. C. M. (2020). Mental health strategies to combat the psychological impact of coronavirus disease 2019 (COVID-19) beyond paranoia and panic. *Ann. Acad. Med. Singapore* 49, 155–160. doi: 10.47102/annals-acadmedsg.202043

Jaffe, D. H., Lee, L., Huynh, S., and Haskell, T. P. (2020). Health inequalities in the use of telehealth in the united states in the lens of COVID-19. *Popul. Health Manag.* 23, 368–377. doi: 10.1089/pop.2020.0186

Kuechler, A.-M., Albus, P., Ebert, D. D., and Baumeister, H. (2019). Effectiveness of an internet-based intervention for procrastination in college students (StudiCare Procrastination): study protocol of a randomized controlled trial. *Internet Interv. Appl. Inf. Technol. Ment. Behav. Health* 17:100245. doi: 10.1016/j.invent.2019.100245

Lai, C.-C., Wang, C.-Y., Wang, Y.-H., Hsueh, S.-C., Ko, W.-C., and Hsueh, P.-R. (2020). Global epidemiology of coronavirus disease 2019 (COVID-19): disease incidence, daily cumulative index, mortality, and their association with country healthcare resources and economic status. *Int. J. Antimicrob. Agents* 55:105946. doi: 10.1016/j.ijantimicag.2020.105946

Lenzo, V., Quattropani, M. C., Musetti, A., Zenesini, C., Freda, M. F., Lemmo, D., et al. (2020). Resilience contributes to low emotional impact of the COVID-19 outbreak among the general population in Italy. *Front. Psychol.* 11:576485. doi: 10.3389/fpsyg.2020.576485

Li, J., Zhang, N., Zhang, B., Wang, Z., and Wang, C. (2018). The application and effectiveness of computerized cognitive behavioral therapy in the Chinese population [网络版计算机化的认知行为治疗在中国人群的应用及有效性]. *Chin. J. Behav. Med. Brain Sci.* 27, 115–120.

Main, A., Zhou, Q., Ma, Y., Luecken, L. J., and Liu, X. (2011). Relations of SARS-related stressors and coping to Chinese college students' psychological adjustment during the 2003 Beijing SARS epidemic. *J. Couns. Psychol.* 58, 410–423. doi: 10.1037/a0023632

Manassis, K., Russell, K., and Newton, A. S. (2010). The Cochrane Library and the treatment of childhood and adolescent anxiety disorders: an overview of reviews. *Evide. Based Child Health Cochrane Rev. J.* 5, 541–554. doi: 10.1002/ebch.508

Melville, K. M., Casey, L. M., and Kavanagh, D. J. (2011). Dropout from internet-based treatment for psychological disorders. *Br. J. Clin. Psychol.* 49, 455–471. doi: 10.1348/014466509X472138

Paredes, M. R., Apaolaza, V., Fernandez-Robin, C., Hartmann, P., and Yanez-Martinez, D. (2021). The impact of the COVID-19 pandemic on subjective mental well-being: the interplay of perceived threat, future anxiety and resilience. *Pers. Individ. Differ.* 170:110455. doi: 10.1016/j.paid.2020.110455

Riise, E. N., Wergeland, G. J. H., Njardvik, U., and Ost, L.-G. (2021). Cognitive behavior therapy for externalizing disorders in children and adolescents in routine clinical care: a systematic review and meta-analysis. *Clin. Psychol. Rev.* 83:101954. doi: 10.1016/j.cpr.2020.101954

Tian, H., Liu, Y., Li, Y., Wu, C.-H., Chen, B., Kraemer, M. U. G., et al. (2020). An investigation of transmission control measures during the first 50 days of the COVID-19 epidemic in China. *Science* 368, 638–642. doi: 10.1126/science.abb6105

Wakefield, S., Delgadillo, J., Kellett, S., White, S., and Hepple, J. (2021). The effectiveness of brief cognitive analytic therapy for anxiety and depression: a quasi-experimental case-control study. *Br. J. Clin. Psychol.* 60, 194–211. doi: 10.1111/bjc.12278

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., et al. (2020). Immediate psychological responses and associated factors during the initial stage of the 2019 Coronavirus Disease (COVID-19) epidemic among the general population in China. *Int. J. Environ. Res. Public Health* 17:1729. doi: 10.3390/ijerph17051729

Wang, Z., Whiteside, S. P. H., Sim, L., Farah, W., Morrow, A. S., Alsawas, M., et al. (2017). Comparative effectiveness and safety of cognitive behavioral therapy and pharmacotherapy for childhood anxiety disorders a systematic review and meta-analysis. *JAMA Pediatr.* 171, 1049–1056. doi: 10.1001/jamapediatrics.2017.3036

Wergeland, G. J. H., Riise, E. N., and Ost, L.-G. (2021). Cognitive behavior therapy for internalizing disorders in children and adolescents in routine clinical care: a systematic review and meta-analysis. *Clin. Psychol. Rev.* 83:101918. doi: 10.1016/j.cpr.2020.101918

Wright, J., and Caudill, R. (2020). Remote treatment delivery in response to the COVID-19 pandemic. *Psychother. Psychosom.* 89, 1–3. doi: 10.1159/000507376

Wright, J. H., Owen, J. J., Richards, D., Eells, T. D., and Thase, M. E. (2019). Computer-assisted cognitive-behavior therapy for depression: a systematic review and meta-analysis. *J. Clin. Psychiatry* 80:18r12188. doi: 10.4088/JCP.18r12188

Wu, X., Tao, S., Zhang, Y., Li, S., Ma, L., Yu, Y., et al. (2021). Geographic distribution of mental health problems among Chinese college students during the COVID-19 pandemic: nationwide, web-based survey study. *J. Med. Internet Res.* 23:e23126. doi: 10.2196/23126

Zhang, J., and Qian, M. (2018). "Influencing factors and improving measures of loss rate of Cognitive Behavioral Therapy based on Network," in *Paper Presented at the* 第二十一届全国心理学学术会议, 中国北京.

Zhang, W., Yang, X., Zhao, J., Yang, F., Jia, Y., Cui, C., et al. (2020). Depression and psychological-behavioral responses among the general public in china during the early stages of the COVID-19 pandemic: survey study. *J. Med. Internet Res.* 22:e22227. doi: 10.2196/22227

Zhong, B., Jiang, Z., Xie, W., and Qin, X. (2020). Association of social media use with mental health conditions of nonpatients during the COVID-19 outbreak: insights from a national survey study. *J. Med. Internet Res.* 22:e23696. doi: 10.2196/23696

Zung, W. W. (1965). A self-rating depression scale. *Arch. Gen. Psychiatry* 12:63. doi: 10.1001/archpsyc.1965.01720310065008

Zung, W. W. (1971). A rating instrument for anxiety disorders. *Psychosomatics* 12, 371–379. doi: 10.1016/S0033-3182(71)71479-0

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 22 July 2021
doi: 10.3389/fpsyg.2021.687928

Sense of Coherence and Mental Health in College Students After Returning to School During COVID-19: The Moderating Role of Media Exposure

Man Li[1,2,3†], Zhansheng Xu[1,2,3†], Xinyue He[2], Jiahui Zhang[2], Rui Song[2], Wenjin Duan[2], Tour Liu[1,2,3] and Haibo Yang[1,2,3]*

[1] Key Research Base of Humanities and Social Sciences of the Ministry of Education, Tianjin Normal University, Academy of Psychology and Behavior, Tianjin, China, [2] Faculty of Psychology, Tianjin Normal University, Tianjin, China, [3] Tianjin Social Science Laboratory of Students' Mental Development and Learning, Tianjin, China

OPEN ACCESS

Edited by:
Fushun Wang,
Nanjing University of Chinese Medicine, China

Reviewed by:
Jan Taylor,
University of Canberra, Australia
Jessica Klöckner Knorst,
Federal University of Santa Maria, Brazil

****Correspondence:***
Haibo Yang
yanghaibo@tjnu.edu.cn

[†] These authors have contributed equally to this work

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *30 March 2021*
Accepted: *28 June 2021*
Published: *22 July 2021*

Citation:
Li M, Xu Z, He X, Zhang J, Song R, Duan W, Liu T and Yang H (2021) Sense of Coherence and Mental Health in College Students After Returning to School During COVID-19: The Moderating Role of Media Exposure. Front. Psychol. 12:687928. doi: 10.3389/fpsyg.2021.687928

The COVID-19 pandemic not only threatens people's physical health, but also affects their mental health in the long term. Although people had returned to work and school, they are closely monitoring the development of the epidemic and taking preventive measures. This study attempted to examine the relationship between media exposure, sense of coherence (SOC) and mental health, and the moderating effect of media exposure in college students after returning to school. In the present study, we conducted a cross sectional survey on 424 college students returning to school around May 2020. Self-report questionnaires were used to assess media exposure scale, SOC, depression, anxiety and stress. Correlation and moderation analysis was conducted. The results showed that (1) negative epidemic information exposure, rather than positive epidemic information exposure, was significantly associated with depression, anxiety, and stress. (2) SOC was also associated with depression, anxiety, and stress. (3) The effect of SOC on depression was modified by negative epidemic information exposure. With the increase of negative epidemic information exposure, the predictive effect of SOC on depression is increasing gradually. These findings demonstrated that negative epidemic information exposure was associated with an increased psychological distress in the sample. A high SOC played a certain protective role in the adaptation of college students in the post-epidemic period. It is important to find more ways to increase the colleges' SOC level and avoid negative information exposure.

Keywords: sense of coherence, mental health, COVID-19, media exposure, anxiety, depression

INTRODUCTION

According to the Worldometers, as of January 2021, the number of COVID-19 patients has exceeded 91.35 million in worldwide. As an international public health emergency, the COVID-19 pandemic has had serious social, psychological, and economic impacts on a global scale (Li et al., 2020; Yang et al., 2020). Recent studies have shown that anxiety and depression symptoms are more

common in the population during COVID-19 (Tng et al., 2020). Salari et al. (2020) conducted a meta-analysis about the impact of COVID-19 on mental health in the general population prior to May 2020 and found that the prevalence of stress was 29.6% with a total sample size of 9074, the prevalence of anxiety 31.9% with a sample size of 63,439 and the prevalence of depression 33.7% with a total sample size of 44,531 people.

The negative emotions caused by COVID-19 may further damage the physical and mental health of individuals (Ren et al., 2020). Previous studies showed that the individual's resilience will decline under long-term chronic stresses, and then do harm to individuals' physical and mental health (Bijlsma and Loeschcke, 2005; De Kloet et al., 2005). A recent web-based cross-sectional study showed that during the COVID-19 outbreak, the prevalence of anxiety and depressive symptoms in young people was significantly higher than that in older people (Huang and Zhao, 2020). Depression is significantly correlated with maladjustment in college students (Horgan et al., 2016). As the epidemic has been brought under control, some college students have returned to school. Therefore, the research on depression, anxiety and stress of college students is of certain practical significance to understand the current psychological state of college students and provide guidance for college students to better adapt to their study and life in the post-epidemic period.

Sense of coherence (SOC) is a stable psychological tendency of the individual's overall feeling and cognition of life, and it is a universal, lasting, and dynamic self-confidence within the individual. SOC consists of three factors: (1) in the course of life, internal and external pressures from individuals are structured, predictable and explainable (understandable); (2) individuals have access to resources to deal with these stresses (controllable); (3) these stresses are challenging and worthy of investment and participation (sense of meaning) (Antonovsky, 1987, p. 191). According to the salutogenic model, it is more important to pay attention to people's access to health resources and the process of health promotion than to risk factors (Antonovsky, 1979). As the core concept of beneficial health model theory, SOC is a kind of ability to successfully cope with stress (Antonovsky, 1993), which aims to explain the reasons for individual differences in stress situations (Geyer, 1997). Previous studies have shown that there is a close relationship between SOC and mental health (Togari et al., 2008), which plays an important intermediary or buffer role between stressful life events and emotional symptoms (such as depression, anxiety) (Schnyder et al., 1999).

During the COVID-19 pandemic, a long-term and strict quarantine policy enabled young people to use mobile media more to get information. Some studies have shown that watching negative epidemic reports (such as epidemic severity, hospital reports) is associated with more depression, while watching positive epidemic reports (such as heroic behavior, expert speeches, etc.) is associated with less depression (Chao et al., 2020). However, the spread of COVID-19 news in the mainstream media is dominated by negative epidemic information (Cowper, 2020; Dyer, 2020; Wang Y. et al., 2020), and more studies have shown that frequent contact with COVID-19 news in the mainstream media is associated with higher levels of audience depression (Keles et al., 2020; Olagoke et al., 2020). Social media is also one of the important channels to update COVID-19's information, but social media networks may involve a lot of false information, thus exacerbating public panic (Kilgo et al., 2019). In addition, social media is rife with negative emotions from the epidemic, which can infect the social network (Kramer et al., 2014), and excessive use of social media can also increase the risk of depression (Hunt et al., 2018). Bendau et al. (2020) found that the frequency, duration, and diversity of media exposure were significantly positively correlated with depression. For example, the longer people spent on social media, the more severe their depressive symptoms were (Lee et al., 2020). Therefore, further research on media exposure is helpful for us to explore how to interfere with negative emotions.

In the post-epidemic era, students return to campus one after another, but what is the emotional adaptation of college students after the epidemic pressure and long-term home isolation? The influencing factors of college students' adaptation after returning to school are worth discussing. Previous studies have shown that SOC is a protective factor of mental health (Togari et al., 2008), and there is a positive correlation between media exposure and individual psychological abnormalities (Bendau et al., 2020). In view of the relationship between SOC, media exposure and mental health, we can infer that higher SOC and less media exposure may be related to fewer negative emotions. However, few studies have examined the regulatory effect of media exposure on the relationship between psychological identity and emotion. The Antonovsky's salutogenic model showed that the formation of SOC is mainly influenced by two kinds of factors, one is generalized resistance deficiency and the other is generalized resistance resources. The stress appraisal theory showed that two cognitive processes were related to coping stress: the primary appraisal and secondary appraisal (Hjemdal et al., 2006). The primary appraisal includes determining whether the event is stressful and whether the stressor poses a threat or causes harm. The secondary appraisal mainly includes the individual's assessment of the resources. By comparing the salutogenic model and the stress appraisal theory, it can be found that the content of primary appraisal is highly similar to the generalized resistance deficiency, and the content of secondary appraisal is also very similar to the generalized resistance resources. Studies have shown that media exposure related to COVID-19 is associated with more obvious psychological stress (Bendau et al., 2020), and media exposure may affect individuals' perception of stress. So, we reason that media exposure may affect the development of college students' SOC through stress evaluation, and then play a moderating role in the relationship between SOC and mental health. In addition, since positive epidemic information exposure and negative epidemic information exposure may cause individuals to make opposite stress evaluations of COVID-19, there may be differences in their effects on SOC and mental health. Therefore, this study subdivides media exposure into positive epidemic information exposure and negative epidemic information exposure, in order to explore the relationship between psychological identity, media exposure, and college

students' emotional adaptation after returning to school, and further investigate the moderating effect of positive and negative epidemic information exposure on psychological identity and emotional adaptation of college students (see **Figure 1**). This study hypothesizes that media exposure plays a moderating role in the relationship between SOC and mental health, and that the effects of positive and negative epidemic information exposure are different.

MATERIALS AND METHODS

Study Design and Procedure

A cross-sectional study was conducted on college students returning to school around May 2020. Self-report questionnaires were used to assess media exposure scale, SOC, depression, anxiety and stress. SPSS24.0 was used for statistical analysis of the questionnaire results. By the end of April 2020, China's epidemic prevention and control efforts had entered a normal stage. Students began to return to campus in May, 2020. The current study was conducted 1 month after their returning, from June 2nd, 2020 to June 12th, 2020. We distributed QR codes of questionnaires in the classrooms and libraries of Tianjin Normal University. In addition, we also released questionnaires via WeChat and QQ, two popular social media platforms in China. The study purpose was disclosed and the consent to participate was provided. This study was approved by the ethical committee of Tianjin Normal University.

Participants

A total of 500 participants were recruited. Subjects were excluded if they filled out the questionnaire too quickly (less than 60 s, $n = 60$) and filled with obvious repetition answers ($n = 16$). As such, 424 college students ($M = 20.49$ years, $SD = 1.95$) were included in our study. Previous literature indicated that the observations (i.e., the collected questionnaires) should be 5–10 times the number of items for considered variables (Austin and Steyerberg, 2015). Because 44 items were used to assess our considered variables in the present study, the minimum sample size should be 220–440. The sample size ($n = 424$) was adequate for the conducted statistical analyses.

Measures

Epidemic-Related Information Exposure Through Media

Ten items following previous research (Hall et al., 2019) were used to examine participants' media exposure during the COVID-19 pandemic. Five questions asked about the positive epidemic information that participants viewed, including positive responses to the epidemic, stories about heroes, official reports and interviews about the epidemic, good news about patients being discharged from hospitals, and encouraging videos or songs related to the epidemic (range from 1 = Almost nothing to 4 = Very much). Five questions asked about the negative epidemic information that participants viewed, including the lack of treatment for COVID-19 patients, the helplessness and suffering of people in affected areas, poor preparedness, the increasing number of COVID-19 diagnoses and deaths, and the lack of medical supplies (range from 1 = Almost nothing to 4 = Very much). The scores of each part were calculated by summing the scores of relevant items, ranging from 5 to 20 points. The higher the score, the higher the media exposure.

Sense of Coherence Scale (SOC-13)

The validated Chinese version of the Sense of Coherence Scale-13 (SOC-13) was used in our study (Antonovsky, 1993; Bao and Liu, 2005). The items address the degree to which participants experience various aspects of life as meaningful, comprehensible and manageable. This version consists of 13 items rated on 7-point scales with the anchors defined. The total scale score ranges from 13 to 91, with higher scores denoting a stronger SOC. The Cronbach's alpha coefficient is reported to be 0.76 (Bao and Liu, 2005).

Depression-Anxiety-Stress Scale (DASS-21)

We used the validated Chinese version of the 21-item Depression Anxiety Stress Scale (DASS-21) (Gong et al., 2010) to measure depression, anxiety, and stress symptoms. This scale is comprised of three subscales assessing anxiety (7 items), depression (7 items), and stress (7 items). Respondents are asked to respond on a Likert scale from 0 (did not apply to me at all) to 3 (applied to me very much or most of the time). Each subscale score ranges from 0–21, with higher scores indicating higher degrees

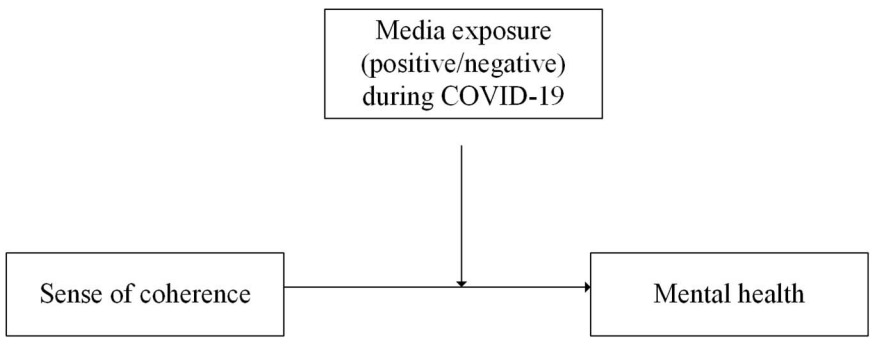


FIGURE 1 | Hypothetical model of the moderating effect for the relationship between sense of coherence (SOC) and mental health.

of anxiety, depression or stress. As the DASS-21 is a short form version of the DASS (42 items), the final score of each scale were multiplied by two, so that they can be compared with the normal DASS scores (Lovibond and Lovibond, 1995; Antony et al., 1998). Example items include "I felt I was close to panic" for anxiety, "I couldn't seem to experience any positive feeling at all" for depression, and "I found it difficult to relax" for stress. In the current study, the time frame adopted was "during the last week." The internal consistencies for each scale for DASS-21 in the current study were as follows: depression, 0.77; anxiety, 0.79; stress, 0.76.

Statistical Analysis

SPSS 24.0 was used for descriptive statistics and correlation analysis of the data, and then Model 1 (as a simple regulation model) in SPSS Process component developed by Hayes (2013) was used to test the regulation effect, and the regulation effect was analyzed by Bootstrap method. Hierarchical multiple regression was used to investigate the predictive effect of positive and negative epidemic information exposure on depression, anxiety and stress, and their moderating effect on the relationship between SOC and depression, anxiety and stress after controlling for age and gender. The subjects were divided into low group (Z – 1SD) and high group (Z + 1SD) according to the standard score of exposure to negative epidemic information. Participants whose scores were more than one standard deviation above the mean were classified as high group, and those whose scores were less than one standard deviation below the mean were classified as low group. The simple slope test was used to further investigate the influence of SOC on depression at different levels of exposure to negative epidemic information.

RESULTS

Single Factor Common Deviation Test Analyses

According to Harman single factor common deviation test, exploratory factor analysis was conducted for six factors: negative epidemic information exposure, positive epidemic information exposure, SOC, depression, anxiety, and stress. The first factor explained 27.93% of variation, less than 40%, which meant there was no common deviation in our data.

Descriptive Analyses

Among the participants, 116 were male (27.4%) and 308 were female (72.6%). The participants were mainly from Tianjin Normal University, with a small number of participants from other colleges. For the regional distribution, 325 (76.65%) students' college was in Tianjin, 55 (12.97%) in Guangxi, 9 (2.12%) in Beijing, 5 (1.18%) in Zhejiang, 5 (1.18%) in Guizhou, and 20 (4.72%) in other regions (Jiangsu, Shanxi, Chongqing and other 13 regions). During the COVID-19 pandemic, 87 students stayed in Tianjin (20.52%), 79 in Guangxi (18.63%), 33 in Shanxi (7.78%), 30 in Hebei (7.08%), 23 in Henan (5.42%), and 154 (36.32%) in other regions (Sichuan, Jiangxi, Guizhou and other 22 regions). 18 participants (4.25%) did not specify their location during the COVID-19 pandemic. Among them, 171 freshmen (40.3%), 108 sophomores (25.5%), 75 juniors (17.7%), 30 seniors (7.1%), and 40 postgraduates or above (9.4%). There are 232 (54.7%) students majoring in science and engineering, 137 (32.3%) students majoring in liberal arts (philosophy, law, etc.), 22 (5.2%) students majoring in art (PE, music, etc.) and 33 (7.8%) students majoring in other subjects.

Table 1 shows the descriptive statistics and correlations between media information exposure, SOC, depression, anxiety, and stress symptoms in the sample. Most participants read a lot of positive news through the media and a relatively little negative news. The average data showed that the students had a related lower level of depression, anxiety, and stress after exposed to multiple media information related to COVID-19. Gender was positively correlated with positive epidemic exposure ($r = 0.10$, $p < 0.05$; 1 = male, 2 = female), indicating that female reported more positive epidemic exposure. Age was positively correlated with negative epidemic information exposure ($r = 0.14$, $p < 0.01$), which means that the older people reported more negative epidemic exposure than younger people. In **Figure 2**, the results showed that negative epidemic information exposure was significantly positively correlated with depression ($r = 0.14$, $p < 0.01$), anxiety ($r = 0.11$, $p < 0.05$), and stress ($r = 0.12$, $p < 0.05$). Positive epidemic information exposure was not significantly correlated with depression ($r = -0.02$, $p = 0.68$), anxiety ($r = 0.01$, $p = 0.84$), and stress ($r = 0.04$, $p = 0.47$). SOC was negatively correlated with depression ($r = -0.56$, $p < 0.01$), anxiety ($r = -0.51$, $p < 0.01$), and stress ($r = -0.55$, $p < 0.01$), and positively correlated with positive epidemic information exposure ($r = 0.14$, $p < 0.01$). There was no significant correlation between negative epidemic information exposure and SOC ($r = -0.08$, $p = 0.09$) or positive epidemic information exposure ($r = 0.07$, $p = 0.14$). The result of correlation analysis conforms to the condition of regulating effect test and is suitable for further analysis.

Moderation Effect Analyses

The models containing depression, anxiety, and stress were established, respectively. Since gender and age were significantly correlated with positive epidemic information exposure and negative epidemic information exposure, respectively, the moderating effect of gender and as control variables on positive and negative epidemic information exposure when the models were tested. The moderation effect of positive epidemic information exposure and negative epidemic information exposure between SOC and depression was tested, respectively. And the same procedure was used to test the effect on anxiety and stress.

Table 2 presents the results of regression analysis, the product of SOC and positive epidemic information exposure had no significant predictive effect on depression ($\beta = 0.01$, $p = 0.42$, 95% CI [–0.01, 0.03]), anxiety ($\beta = 0.01$, $p = 0.50$, 95% CI [–0.01, 0.03]), and stress ($\beta = 0.004$, $p = 0.71$, 95% CI [–0.02, 0.02]). It indicates that positive epidemic information exposure has no moderating effect between SOC and depression, anxiety, and stress. In addition, the product

TABLE 1 | Descriptive statistics and correlations among study variables (N = 424).

	M	SD	1	2	3	4	5	6	7	8	9
1. Gender											
2. Course			0.12*								
3. School location			−0.37**	−0.13**							
4. Age	20.49	1.95	−0.07	0.08	−0.07						
5. Negative epidemic information exposure	9.98	3.09	0.09	0.05	−0.12*	0.14**					
6. Positive epidemic information exposure	16.17	2.96	0.10*	0.06	−0.08	−0.05	0.07				
7. SOC	55.39	10.56	−0.07	−0.07	0.07	0.04	−0.08	0.14**			
8. Depression	6.94	7.7	−0.01	0.04	−0.04	−0.03	0.14**	−0.02	−0.56**		
9. Anxiety	7.62	7.38	−0.01	0.05	−0.02	−0.06	0.11*	0.01	−0.51**	0.82**	
10. Stress	9.01	8.02	−0.04	0.03	−0.01	0.02	0.12*	0.04	−0.55**	0.82**	0.84**

*Gender: 1 = male, 2 = female; Course:1 = science and engineering, 2 = liberal arts, 3 = art, 4 = other subjects; School location: 1 = Tianjin, 2 = Guangxi, 3 = other regions; SOC: sense of coherence; *p < 0.05; **p < 0.01.*

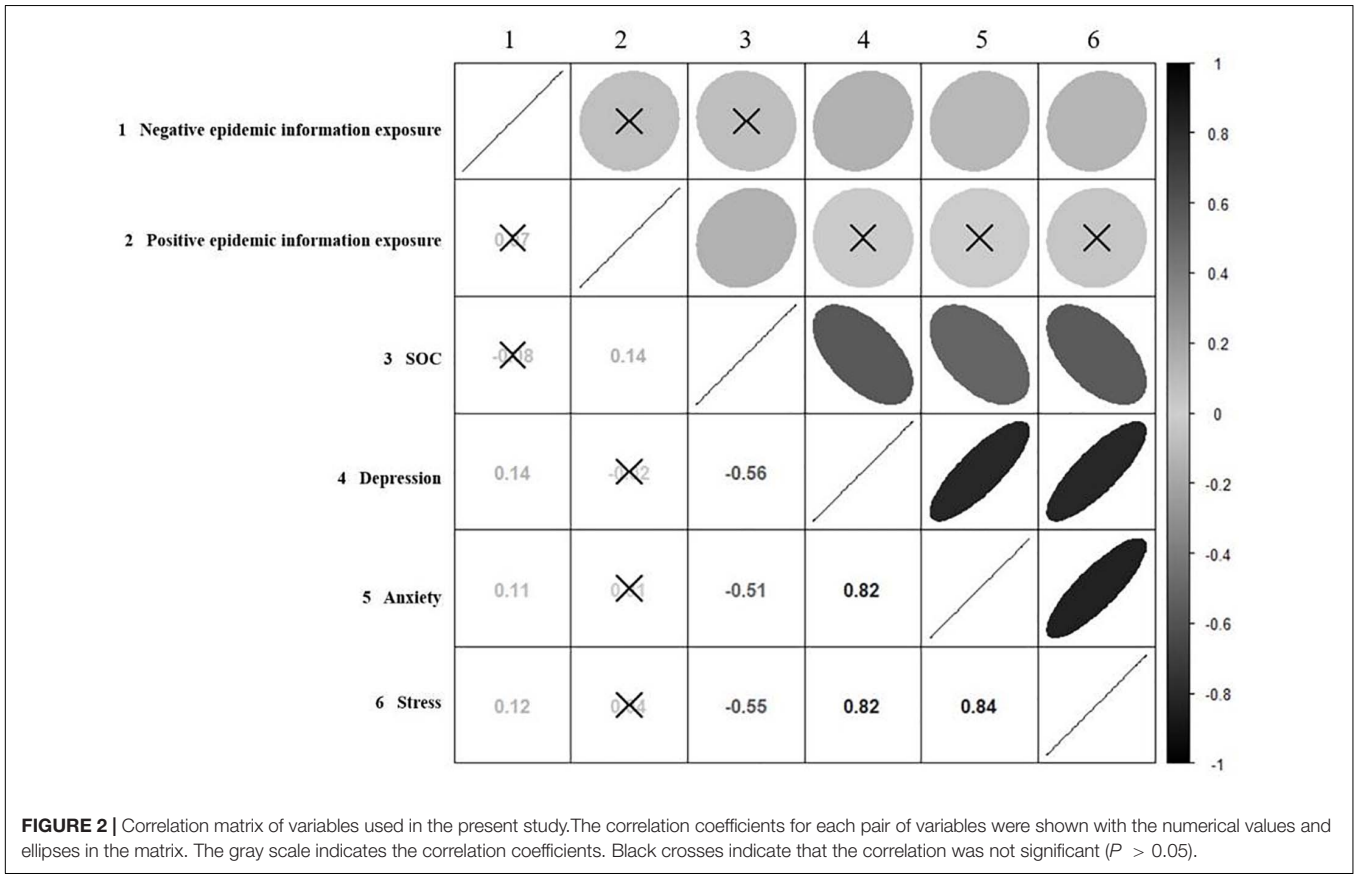


FIGURE 2 | Correlation matrix of variables used in the present study.The correlation coefficients for each pair of variables were shown with the numerical values and ellipses in the matrix. The gray scale indicates the correlation coefficients. Black crosses indicate that the correlation was not significant ($P > 0.05$).

of SOC and negative epidemic information exposure had a significant negative predictive effect on depression (β = –0.03, $p < 0.01$, 95% CI [–0.04, –0.01]) (**Table 3**), indicating that exposure to negative epidemic information can regulate the effect of SOC on depression. The product of SOC and negative epidemic information exposure had no significant predictive effect on anxiety (β = –0.01, $p = 0.16$, 95% CI [–0.03, 0.01]) and stress (β = –0.02, $p = -0.11$, 95% CI [–0.04, 0.004]). It indicates that negative epidemic information exposure has no moderating effect on the influence of SOC on anxiety and stress.

In order to further explain the specific regulation of negative epidemic information exposure, participants were divided into low-exposure group (Z – 1SD) and high- exposure group (Z + 1SD) according to the standard score of negative epidemic information exposure. The simple slope test was used to investigate the effect of SOC on depression at different levels of exposure to negative epidemic information.

Figure 3 shows that SOC has a significant negative predictive effect on depression in low-exposure group (β = –0.45, $p < 0.001$) and high-exposure group (β = –0.67, $p < 0.001$). Compared with low-exposure, high-exposure has a higher predictive

TABLE 2 | Hierarchical regression analyses of positive epidemic information exposure on negative emotions (*N* = 424).

	Depression				Anxiety				Stress			
	***b* [CI]**	***SE B***	***t***	***p***	***b* [CI]**	***SE B***	***t***	***p***	***b* [CI]**	***SE B***	***t***	***p***
Constant	36.97 [17.57, 56.36]	9.87	3.75	0.00	34.96 [15.75, 54.18]	9.77	3.58	0.00	30.26 [10.09, 50.43]	10.26	2.95	0
Age	–0.04 [–0.35, 0.27]	0.16	–0.24	0.81	–0.14 [–0.45, 0.17]	0.16	–0.87	0.38	0.16 [–0.16, 0.49]	0.17	0.99	0.32
Gender	–0.93 [–2.31, 0.45]	0.70	–1.33	0.18	–0.91 [–2.27, 0.46]	0.70	–1.30	0.19	–1.47 [–2.91, –0.04]	0.73	–2.02	0.04
SOC	–0.55 [–0.89, –0.22]	0.17	–3.26	0.00	–0.48 [–0.81, –0.15]	0.17	–2.87	0.00	–0.5 [–0.85, –0.15]	0.18	–2.84	0
Positive epidemic information	–0.27 [–1.36, 0.83]	0.56	–0.48	0.63	–0.15 [–1.23, 0.94]	0.55	–0.27	0.79	0.13 [–1.01, 1.27]	0.58	0.23	0.82
Interaction	0.01 [–0.01, 0.03]	0.01	0.81	0.42	0.01 [–0.01, 0.03]	0.01	0.68	0.50	0.004 [–0.02, 0.02]	0.01	0.37	0.71
R^2	0.32				0.28				0.32			
ΔR^2	0.001				0.0008				0.0002			

SOC, sense of coherence; b, unstandardized beta; SE B, standard error for the unstandardized beta; t, t-test statistic; p, p-value.

TABLE 3 | Hierarchical regression analyses of Negative epidemic information exposure on negative emotions (*N* = 424).

	Depression				Anxiety				Stress			
	***b* [CI]**	***SE B***	***t***	***p***	***b* [CI]**	***SE B***	***t***	***p***	***b* [CI]**	***SE B***	***t***	***p***
Constant	16.36 [3.48, 29.24]	6.55	2.50	0.01	23.61 [10.7, 36.52]	6.57	3.60	0.00	21.78 [8.15, 35.41]	6.93	3.14	0.00
Age	–0.10 [–0.41, 0.21]	0.16	–0.64	0.53	–0.19 [–0.51, 0.12]	0.16	–1.22	0.22	0.1 [–0.23, 0.43]	0.17	0.60	0.55
Gender	–0.87 [–2.23, 0.49]	0.69	–1.25	0.21	–0.81 [–2.18, 0.55]	0.69	–1.17	0.24	–1.28 [–2.73, 0.16]	0.73	–1.75	0.08
SOC	–0.15 [–0.34, 0.05]	0.10	–1.50	0.13	–0.22 [–0.42, –0.03]	0.10	–2.27	0.02	–0.26 [–0.46, –0.06]	0.10	–2.50	0.01
Negative epidemic information	1.66 [0.64, 2.68]	0.52	3.19	0.00	0.91 [–0.11, 1.93]	0.52	1.75	0.08	1.05 [–0.03, 2.13]	0.55	1.91	0.06
Interaction	–0.03 [–0.04, –0.01]	0.01	–2.74	0.01	–0.01 [–0.03, 0.01]	0.01	–1.40	0.16	–0.02 [–0.04, 0.004]	0.01	–1.59	0.11
R^2	0.34				0.28				0.32			
ΔR^2	0.01**				0.003				0.004			

*SOC, sense of coherence; **p < 0.01; b, unstandardized beta; SE B, standard error for the unstandardized beta; t, t-test statistic; p, p-value.*

effect. It shows that with the increase of negative epidemic information exposure, the predictive effect of SOC on depression is increasing gradually.

DISCUSSION

This study attempted to examine the relationship between media exposure, SOC and mental health, and the moderating effect of media exposure in college students after returning to school. The results of the present study indicate that negative epidemic information exposure has a moderating effect on the relationship between SOC and depression, while positive epidemic information exposure has no significant effect. This is consistent with our research hypothesis. Consistent with the results of previous studies, our study found that the SOC was significantly correlated with college students' depression, anxiety, and stress, and had a significant negative predictive effect on college students' depression, anxiety, and stress (Schnyder et al., 2000; Gustavsson et al., 2007; Moksnes et al., 2013). The SOC is a controllable and meaningful self-confident tendency that an individual maintains when dealing with internal and external environmental stimuli in his or her life, reflecting one's understanding of environmental stress and his or her ability to use existing resources to cope with difficulties, and his or her attitude to invest energy and take responsibility for difficulties (Eriksson and Lindström, 2007; Yoshida et al., 2014). In other words, individuals with a high SOC will be more likely to see it as a predictable and meaningful challenge that can be actively addressed with appropriate strategies. Therefore, individuals with a higher SOC are better at exploring and utilizing internal and external resources and adopting appropriate strategies to cope with them, so as to maintain a healthier physical and mental state and experience fewer negative emotions (such as depression, anxiety, and stress) (Gustavsson-Lilius et al., 2012).

Previous studies have shown that media reports related to crises may lead to severe psychological stress or obvious mental conditions (Holman et al., 2014; Pfefferbaum et al., 2014). Several recent studies have also found that higher levels of COVID-19 media exposure are significantly associated with greater psychological stress (Bendau et al., 2020; Yao, 2020). Media reports on specific topics caused great pressure for most people (Veer et al., 2020). Therefore, reports of COVID-19 may be a source of stress, and frequently exposure to such information may cause people to experience greater stress. In fact, previous studies have found that media exposure can prolong people's experience of acute stress and produce substantial stress symptoms (Holman et al., 2014), and the perceived stress when experiencing negative life events is one of the main factors leading to depression (Disner et al., 2011; Li et al., 2014; Treadway et al., 2015). In the present study, information exposure was divided into positive and negative exposure. Correlation analysis showed that

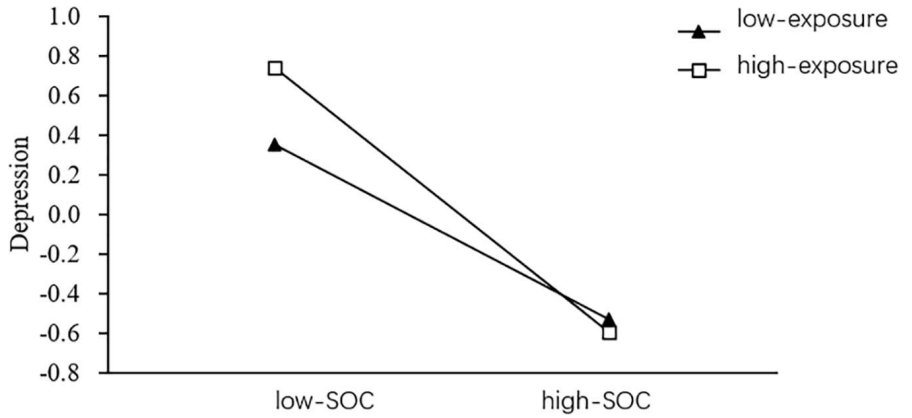


FIGURE 3 | Moderated effect of negative epidemic information exposure between SOC and depression (SOC: sense of coherence; *N* = 424).

positive epidemic information exposure was not significantly correlated with depression, anxiety, and stress. It should be noted that female reported more positive epidemic information exposure than male. This may be because of gender difference in media choice and preference (Hou et al., 2020; Twenge and Martin, 2020). The results of this study also show that there is a significant positive correlation between negative epidemic information exposure and stress. Therefore, media exposure may influence the level of depression by influencing the individual's perception of stress. Different from previous studies (Chao et al., 2020), our study found that negative emotions such as depression, anxiety, and stress were significantly positively correlated with exposure to negative epidemic information, but not significantly correlated with exposure to positive epidemic information. This may be due to the fact that all kinds of information at the beginning of the epidemic increased individual's sense of uncertainty and psychological burden triggering mental health symptoms. With the epidemic under control, people can better distinguish the positive information instead of using it as a burden. When exposed to negative information about COVID-19, people may perceive more stress and have more depressive and anxiety symptoms due to the severity and harmfulness of the epidemic (Guessoum et al., 2020; Wang H. et al., 2020). Therefore, when public health events occurred, how to avoid excessive transmission of negative information in the process of correct reporting of disaster events was worth paying attention to and thinking about.

In this study, negative epidemic information exposure was positively correlated with stress, and meanwhile, negative epidemic information exposure was also positively correlated with depressive and anxiety symptoms. There was no significant correlation between positive epidemic information exposure and stress. At the same time, positive epidemic information exposure was also not significantly associated with depressive and anxiety symptoms. Studies have shown that repeated exposure to media trauma-related information may affect individuals' assessment of threats (Marshall et al., 2007), and media reports are one of the strongest emotional stressors in the context of the current pandemic (Veer et al., 2020). In our study, no moderating role was found for the positive information exposure. At present, the COVID-19 pandemic is still spreading, and people are well-prepared for long-term anti-epidemic. The positive information exposure plays a limited soothing role, and has little impact on the risk and stress cognition of college students. However, we found that exposure of negative epidemic information plays a moderating role in the influence of SOC on depressive symptoms. That is, with the increase exposure to negative epidemic information, the negative predictive effect of SOC on depressive symptoms is gradually increasing. Under the exposure of low negative epidemic information, individuals with a high SOC can adopt appropriate strategies, while individuals with a low SOC are lack of adequate coping strategies. According to the salutogenic model, SOC determines the individual's perception of the external environment, that is, less stress, less interference, and less chaos. Therefore, the higher the SOC, the less they experience depressive symptoms. When exposed to highly negative epidemic information, individuals with a higher SOC would selectively receive the information based on its value as a resistance resource against stressors. They could ignore the negative information (Antonovsky, 1987), avoid excessive perception of risk and stress, and thus maintain a lower level of depression. However, due to the lack of confidence in their own adaptability, individuals with low SOC are often accompanied by the impression that they are at a loss and in an out-of-control environment (Antonovsky, 1987), and a large amount of negative epidemic information is more likely to amplify their perception of risk and stress, thus increasing their level of depression. Therefore, college students' SOC is still in the process of development. We need to take certain measures to help college students develop and enhanced their SOC, improving their ability to deal with pressure and reducing their negative emotions.

This study also has some shortcomings. First of all, this study adopted a cross-sectional design. Although this study shows that exposure to negative epidemic information plays a moderating role between psychological concordance and depressive symptoms, the cause-and-effect relationship remains unclear. Future longitudinal or quasi-experimental

studies may shed light on the causal relationship between the variables. Secondly, the universality of the results of the present study may be limited by time, geography, gender, and socio-cultural background. Although gender has been controlled in data analysis as control variable in the moderation analyses, gender bias may still affect the present study results. Besides, the data of this study were collected in June 2020, and the subjects were mainly from Tianjin, Guangxi, and other places, with a small coverage area and insufficient representativeness, which may affect the generalization of the research results. Finally, self-reports may be affected by response biases, and more research, including longitudinal study design and experimental comparisons, is needed to expand our understanding of the relationship between SOC, media exposure, and depressive symptoms.

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

AUTHOR CONTRIBUTIONS

ML, ZX, and HY designed the study and drafted and wrote the manuscript. XH, ML, JZ, and RS performed the research and acquired the data. JZ, RS, WD, and ZX interpreted and analyzed the data. ML, ZX, TL, and HY revised and replied to the reviewer's comments.

FUNDING

This work was supported by the National Social Science Foundation of China (Grant No. 20ZDA079).

REFERENCES

Antonovsky, A. (1979). *Health, Stress and Coping*. San Francisco, CA: Jossey-Bass.

Antonovsky, A. (1987). *Unraveling the Mystery of Health: How People Manage Stress and Stay Well*. Jossey-Bass, CA: San Francisco.

Antonovsky, A. (1993). The structure and properties of the sense of coherence scale. *Soc. Sci. Med.* 36, 725–733. doi: 10.1016/0277-9536(93)90033-z

Antony, M. M., Bieling, P. J., Cox, B. J., Enns, M. W., and Swinson, R. P. (1998). Psychometric properties of the 42-item and 21-item versions of the Depression Anxiety Stress Scales in clinical groups and a community sample. *Psychol. Assessment* 10, 176–181. doi: 10.1037/1040-3590.10.2.176

Austin, P. C., and Steyerberg, E. W. (2015). The number of subjects per variable required in linear regression analyses. *J. Clin. Epidemiol.* 68, 627–636. doi: 10.1016/j.jclinepi.2014.12.014

Bao, L. P., and Liu, J. S. (2005). The reliability and validity of chinese version of SOC-13. *Chinese J. Clin. Psychol.* 13, 399–401.

Bendau, A., Petzold, M. B., Pyrkosch, L., Mascarell Maricic, L., Betzler, F., Rogoll, J., et al. (2020). Associations between COVID-19 related media consumption and symptoms of anxiety, depression and COVID-19 related fear in the general population in Germany. *Eur. Arch. Psychiatry Clin. Neurosci.* 271, 283–291. doi: 10.1007/s00406-020-01171-6

Bijlsma, R., and Loeschcke, V. (2005). Environmental stress, adaptation and evolution: an overview. *J. Evolutionary Biol.* 18, 744–749. doi: 10.1111/j.1420-9101.2005.00962.x

Chao, M., Xue, D., Liu, T., Yang, H., and Hall, B. J. (2020). Media use and acute psychological outcomes during COVID-19 outbreak in China. *J. Anxiety Disord.* 74:102248. doi: 10.1016/j.janxdis.2020.102248

Cowper, A. (2020). COVID-19: are we getting the communications right? *BMJ* 368:m919. doi: 10.1136/bmj.m919

De Kloet, E. R., Joëls, M., and Holsboer, F. (2005). Stress and the brain: from adaptation to disease. *Nat. Rev. Neurosci.* 6, 463–475. doi: 10.1038/nrn1683

Disner, S., Beevers, C. G., Haigh, E. A. P., and Beck, A. T. (2011). Neural mechanisms of the cognitive model of depression. *Nat. Rev. Neurosci.* 12, 467–477. doi: 10.1038/nrn3027

Dyer, O. (2020). Trump claims public health warnings on covid-19 are a conspiracy against him. *BMJ* 368:m941. doi: 10.1136/bmj.m941

Eriksson, M., and Lindström, B. (2007). Antonovsky's sense of coherence scale and its relation with quality of life: a systematic review. *J. Epidemiol. Commun. Health* 61, 938–944. doi: 10.1136/jech.2006.056028

Geyer, S. (1997). Some conceptual considerations on the sense of coherence. *Soc. Sci. Med.* 44, 1771–1779. doi: 10.1016/s0277-9536(96)00286-9

Gong, X., Xie, X. Y., Xu, R., and Luo, Y. J. (2010). Psychometric properties of the Chinese versions of DASS-21 in Chinese college students. *Chinese J. Clin. Psychol.* 18, 443–446. doi: 10.16128/j.cnki.1005-3611.2010.04.020

Guessoum, S. B., Lachal, J., Radjack, R., Carretier, E., Minassian, S., Benoit, L., et al. (2020). Adolescent psychiatric disorders during the COVID-19 pandemic and lockdown. *Psychiatry Res.* 291:113264. doi: 10.1016/j.psychres.2020.113264

Gustavsson, L. M., Julkunen, J., Keskivaara, P., and Hietanen, P. (2007). Sense of coherence and distress in cancer patients and their partners. *Psycho-Oncology* 16, 1100–1110. doi: 10.1002/pon.1173

Gustavsson-Lilius, M., Julkunen, J., Keskivaara, P., Lipsanen, J., and Hietanen, P. (2012). Predictors of distress in cancer patients and their partners: the role of optimism in the sense of coherence construct. *Psychol. Health* 27, 178–195. doi: 10.1080/08870446.2010.484064

Hall, B. J., Xiong, Y. X., Yip, P. S., Lao, C. K., Shi, W., Sou, E. K. L., et al. (2019). The association between disaster exposure and media use on post-traumatic stress disorder following Typhoon Hato in Macao, China. *Eur. J. Psychotraumatol.* 10:1558709. doi: 10.1080/20008198.2018.1558709

Hayes, A. F. (2013). *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*. New York: Guilford Press.

Hjemdal, O., Friborg, O., Stiles, T. C., Rosenvinge, J. H., and Martinussen, M. (2006). Resilience predicting psychiatric symptoms: a prospective study of protective factors and their role in adjustment to stressful life events. *Clin. Psychol. Psychother.* 13, 194–201. doi: 10.1002/cpp.488

Holman, E. A., Garfin, D. R., and Silver, R. C. (2014). Media's role in broadcasting acute stress following the Boston Marathon bombings. *Proc. Natl. Acad. Sci. U.S.A.* 111, 93–98. doi: 10.1073/pnas.1316265110

Horgan, A., Sweeney, J., Behan, L., and McCarthy, G. (2016). Depressive symptoms, college adjustment and peer support among undergraduate nursing and midwifery students. *J. Adv. Nursing* 72, 3081–3092. doi: 10.1111/jan.13074

Hou, F. S., Bi, F. Y., Jiao, R., Luo, D., and Song, K. X. (2020). Gender differences of depression and anxiety among social media users during the COVID-19 outbreak in China: a crosssectional study. *BMC Public Health* 20:1648. doi: 10.1186/s12889-020-09738-7

Huang, Y., and Zhao, N. (2020). Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey. *Psychiatry Res.* 288:112954. doi: 10.1016/j.psychres.2020.112954

Hunt, M. G., Marx, R., Lipson, C., and Young, J. (2018). No more fomo: limiting social media decreases loneliness and depression. *J. Soc. Clin. Psychol.* 37, 751–768. doi: 10.1521/jscp.2018.37.10.751

Keles, B., McCrae, N., and Grealish, A. (2020). A systematic review: the influence of social media on depression, anxiety and psychological distress in adolescents. *Int. J. Adolescence Youth* 25, 79–93. doi: 10.1080/02673843.2019.1590851

Kilgo, D. K., Yoo, J., and Johnson, T. J. (2019). Spreading ebola panic: newspaper and social media coverage of the 2014 ebola health crisis. *Health Commun.* 34, 811–817. doi: 10.1080/10410236.2018.1437524

Kramer, A. D., Guillory, J. E., and Hancock, J. T. (2014). Experimental evidence of massive-scale emotional contagion through social networks. *Proc. Natl. Acad. Sci. U.S.A.* 111, 8788–8790. doi: 10.1073/pnas.1320040111

Lee, Y., Yang, B. X., Liu, Q., Luo, D., Kang, L., Yang, F., et al. (2020). The synergistic effect of social media use and psychological distress on depression in China during the COVID-19 epidemic. *Psychiatry Clin. Neurosci.* 74, 552–553. doi: 10.1111/pcn.13101

Li, H. J., Li, W. F., Wei, D. T., Chen, Q. L., Jackson, T., Zhang, Q. L., et al. (2014). Examining brain structures associated with perceived stress in a large sample of young adults via voxel-based morphometry. *Neuroimage* 92, 1–7. doi: 10.1016/j.neuroimage.2014.01.044

Li, X., Lu, P., Hu, L., Huang, T., and Lu, L. (2020). Factors associated with mental health results among workers with income losses exposed to COVID-19 in China. *Int. J. Environ. Res. Public Health* 17:5627. doi: 10.3390/ijerph17155627

Lovibond, P. F., and Lovibond, S. H. (1995). The structure of negative emotional states: comparison of the depression anxiety stress scales (DASS) with the beck depression and anxiety inventories. *Behav. Res. Ther.* 33, 335–343. doi: 10.1016/0005-7967(94)00075-U

Marshall, R. D., Bryant, R. A., Amsel, L., Suh, E. J., Cook, J. M., and Neria, Y. (2007). The psychology of ongoing threat: relative risk appraisal, the September 11 attacks, and terrorism-related fears. *Am. Psychol.* 62, 304–316. doi: 10.1037/0003-066X.62.4.304

Moksnes, U. K., Espnes, G. A., and Haugan, G. (2013). Stress, sense of coherence and emotional symptoms in adolescents. *Psychol. Health* 29, 32–49. doi: 10.1080/08870446.2013.822868

Olagoke, A. A., Olagoke, O. O., and Hughes, A. M. (2020). Exposure to coronavirus news on mainstream media: the role of risk perceptions and depression. *Br. J. Health Psychol.* 25, 865–874. doi: 10.1111/bjhp.12427

Pfefferbaum, B., Newman, E., Nelson, S. D., Nitiema, P., Pfefferbaum, R. L., and Rahman, A. (2014). Disaster media coverage and psychological outcomes: descriptive findings in the extant research. *Curr. Psychiatry Rep.* 16:464. doi: 10.1007/s11920-014-0464-x

Ren, Y., Qian, W., Zhang, X., Liu, Z., Zhou, Y., Wang, R., et al. (2020). Public mental health under the long-term influence of COVID-19 in China: geographical and temporal distribution. *J. Affective Disord.* 277, 893–900. doi: 10.1016/j.jad.2020.08.045

Salari, N., Hosseinian-Far, A., Jalali, R., Vaisi-Raygani, A., Rasoulpoor, S., Mohammadi, M., et al. (2020). Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: a systematic review and meta-analysis. *Globalization Health* 16:57. doi: 10.1186/s12992-020-00589-w

Schnyder, U., Büchi, S., Mörgeli, H., Sensky, T., and Klaghofer, R. (1999). Sense of coherence – a mediator between disability and handicap? *Psychother. Psychosomatics* 68, 102–110. doi: 10.1159/000012320

Schnyder, U., Büchi, S., Sensky, T., and Klaghofer, R. (2000). Antonovsky's sense of coherence: trait or state? *Psychother. Psychosomatics* 69, 296–302. doi: 10.1159/000012411

Tng, X., Chew, Q. H., and Sim, K. (2020). Psychological sequelae within different populations during the COVID-19 pandemic: a rapid review of extant evidence. *Singapore Med. J. [Online ahead of print]*. doi: 10.11622/smedj.2020111

Togari, T., Yamazaki, Y., Takayama, T. S., Yamaki, C. K., and Nakayama, K. (2008). Follow- up study on the effects of sense of coherence on well - being after two years in Japanese university undergraduate students. *Person. Individ. Diff.* 44, 1335–1347. doi: 10.1016/j.paid.2007.12.002

Treadway, M. T., Waskom, M. L., Dillon, D. G., Holmes, A. J., and Park, M. T. M. (2015). Illness progression, recent stress, and morphometry of hippocampal subfields and medial prefrontal cortex in major depression. *Biol. Psychiatry* 77, 285–294. doi: 10.1016/j.biopsych.2014.06.018

Twenge, J. M., and Martin, G. N. (2020). Gender differences in associations between digital media use and psychological well-being: evidence from three large datasets. *J. Adolescence* 79, 91–102. doi: 10.1016/j.adolescence.2019.12.018

Veer, I. M., Riepenhausen, A., Zerban, M., Carolin, W., Lara, M. C., Haakon, E., et al. (2020). Mental resilience in the Corona lockdown: first empirical insights from Europe. *PsyArXiv. Adv. Online Publ. [preprint]*

Wang, H., Xia, Q., Xiong, Z., Li, Z., Xiang, W., Yuan, Y., et al. (2020). The psychological distress and coping styles in the early stages of the 2019 coronavirus disease (COVID-19) epidemic in the general mainland Chinese population: a web-based survey. *PLoS One* 15:e0233410. doi: 10.1371/journal.pss

Wang, Y., Wang, Y., Chen, Y., and Qin, Q. (2020). Unique epidemiological and clinical features of the emerging 2019 novel coronavirus pneumonia (COVID-19) implicate special control measures. *J. Med. Virol.* 92, 568–576. doi: 10.1002/jmv.25748

Yang, Y., Peng, F., Wang, R., Guan, K., Jiang, T., Xu, G., et al. (2020). The deadly coronaviruses: the 2003 SARS pandemic and the 2020 novel coronavirus epidemic in China. *J. Autoimmunity* 109:102434. doi: 10.1016/j.jaut.2020.102434

Yao, H. (2020). The more exposure to media information about COVID-19, the more distressed you will feel. *Brain Behav. Immun.* 87, 167–169. doi: 10.1016/j.bbi.2020.05.031

Yoshida, E., Yamada, K., and Morioka, I. (2014). Sense of Coherence (SOC), occupational stress reactions, and the relationship of SOC with occupational stress reactions among male nurses working in a hospital. *Sangyo Eiseigaku Zasshi* 56, 152–161.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 22 July 2021
doi: 10.3389/fpsyg.2021.696132

Perceived Stress, Resilience, and Anxiety Among Pregnant Chinese Women During the COVID-19 Pandemic: Latent Profile Analysis and Mediation Analysis

Zheng Luo[1], *Yaqing Shen*[1], *Jiajia Yuan*[1], *Yifan Zhao*[1], *Zhengkui Liu*[2,3]* *and Fangfang Shangguan*[1]*

[1] *Beijing Key Laboratory of Learning and Cognition, School of Psychology, Capital Normal University, Beijing, China,* [2] *CAS Key Laboratory of Mental Health, Institute of Psychology, Chinese Academy of Sciences, Beijing, China,* [3] *Department of Psychology, University of Chinese Academy of Sciences, Beijing, China*

OPEN ACCESS

Edited by:
Jason H. Huang, Baylor Scott and White Health, United States

Reviewed by:
Ramakrishna Biswal, National Institute of Technology Rourkela, India
Ana Conde, Portucalense University, Portugal

***Correspondence:**
Zhengkui Liu
liuzk@psych.ac.cn
Fangfang Shangguan
shanggff@cnu.edu.cn

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *16 April 2021*
Accepted: *18 June 2021*
Published: *22 July 2021*

Citation:
Luo Z, Shen Y, Yuan J, Zhao Y, Liu Z and Shangguan F (2021) Perceived Stress, Resilience, and Anxiety Among Pregnant Chinese Women During the COVID-19 Pandemic: Latent Profile Analysis and Mediation Analysis. Front. Psychol. 12:696132. doi: 10.3389/fpsyg.2021.696132

Objective: The coronavirus disease 2019 (COVID-19) pandemic has posed a major threat to pregnant women's mental health. This study aimed to characterize the patterns of perceived stress in pregnant Chinese women during the COVID-19 pandemic, to examine the profile differences on anxiety and resilience, and to investigate whether the differences in these profiles on anxiety were mediated by resilience.

Methods: From February 28, 2020 to April 26, 2020, a sample of 2,116 pregnant Chinese women who participated in online crisis interventions completed an online self-reporting questionnaire assessing their demographic characteristics, perceived stress, resilience, and anxiety.

Results: Latent profile analysis (LPA) on two stress dimensions [perceived helplessness (HEL) and perceived self-efficacy (SEL)] indicated four perceived stress profiles: adaptive (33.7% of the sample), resistant (44.6%), insensitive (19.1%), and sensitive (2.6%). The women with both adaptive and insensitive profiles had the lowest levels of anxiety, whereas those with the resistant profile had the lowest levels of resilience. Multicategorical mediation analysis showed that resilience partially mediated the differences in the pregnant women's anxiety between the adaptive/insensitive and resistant profile.

Conclusion: This study showed the heterogeneity in the perceived stress patterns of pregnant women during the COVID-19 pandemic, revealing the internal mechanisms of pregnant women's anxiety using a person-centered approach, and provided initial evidence guiding the development of differentiated stress interventions to alleviate pregnant women's anxiety during the pandemic.

Keywords: perceived stress, person-centered, resilience, anxiety, pregnant women, COVID-19

INTRODUCTION

Since late December 2019, a novel coronavirus disease 2019 (COVID-19) has spread rapidly in China and between countries, with high morbidity and mortality rates. It was declared as a global pandemic by the WHO on March 11, 2020. Emerging evidence from around the world suggests that pregnant women during the COVID-19 pandemic are experiencing elevated anxiety (Berthelot et al., 2020; Preis et al., 2020a; Wu et al., 2020), a well-documented risk factor during pregnancy for adverse obstetric and neonatal outcomes (Stein et al., 2014; Vollrath et al., 2016; Hasanjanzadeh and Faramarzi, 2017). During the initial phase of the COVID-19 outbreak in China, pregnant women reported higher levels of anxiety after the announcement of human-to-human transmission (Wu et al., 2020). A meta-analysis showed that the prevalence rate of anxiety among pregnant women during the COVID-19 pandemic was 37% (95% CI: 25–49%) (Yan et al., 2020). To date, approximately 20% of pregnant women in China have suffered from anxiety (Ding et al., 2021; Jiang et al., 2021) and 43.3% of pregnant women in the USA experience moderate-to-severe anxiety (Preis et al., 2020a). Additionally, in Iran, approximately 21% of pregnant women reported pregnancy-related anxiety (Hamzehgardeshi et al., 2021) and the same percentage of women in the third trimester of pregnancy had severe health anxiety (Saadati et al., 2021). Anxiety among pregnant women during the global pandemic should be one of the priorities of public health.

Anxiety among pregnant women may be affected by the COVID-19 pandemic due to their perceived stress (Preis et al., 2020a; Romero-Gonzalez et al., 2021). Perceived stress is experiencing distress while responding to stressors. Cumulative evidence (e.g., Hewitt et al., 1992; Martin et al., 1995; Leung et al., 2010; Taylor, 2015) has indicated that perceived stress is a multidimensional construct containing two dimensions: perceived helplessness (HEL; also known as "negative feelings" and "perceived distress") and perceived self-efficacy (SEL; also known as "positive feelings" and "perceived coping ability"). The former refers to negative affective reactions and general distress, whereas the latter refers to the perception of an ability to cope with existing stressors. In terms of COVID-19, the perceived stress of pregnant women highlights the extent to which they believe they can control unexpected or difficult events or emotions resulting from the pandemic, such as quarantine and social distancing precautions, the uncertainty of viral infection, the lack of social support (Ding et al., 2021; Hamzehgardeshi et al., 2021), and their preparedness stress and perinatal infection stress (Preis et al., 2020b).

Research on the relation between perceived stress and anxiety among pregnant women during the COVID-19 pandemic overwhelmingly took a variable-centered approach that overlooked individual differences (e.g., Preis et al., 2020a; Romero-Gonzalez et al., 2021). Although some studies have found that both HEL and SEL can predict psychological problems (e.g., depression; Hewitt et al., 1992), others have found that HEL but not SEL is related to psychological problems (Martin et al., 1995). One reason for this inconsistent pattern is the heterogeneous distribution of the study samples. "Adaptability and resistance to stress are fundamental prerequisites for life" (Selye, 1950). Pregnant women may have adaptive or resistant responses to stressors during the COVID-19 pandemic. Meanwhile, because of individual differences in stress sensitivity (Zubin and Spring, 1977), some pregnant women may be stress sensitive (i.e., responding to stress with heightened levels of negative emotions) and some others may be stress insensitive. Accordingly, the perceived stress of pregnant women associated with the pandemic may be clustered according to different dimensions (i.e., HEL and SEL). To explore the patterns or profiles of the combination of HEL and SEL among pregnant women during the COVID-19 pandemic and how the patterns predict anxiety among pregnant women, a person-centered analysis approach was adopted in the current study.

As a person-centered analysis technique, the latent profile analysis (LPA) groups individuals into latent classes or profiles or subgroups according to the correlations on continuous variables. The LPA results reveal a typical co-occurrence of HEL and SEL among subgroups, which makes it possible to identify the patterns of pregnant women's perceived stress during the COVID-19 pandemic. This understanding can then be used to recognize the group to which each pregnant woman belongs and in turn to guide appropriate intervention efforts aimed at each group's unique needs rather than the target variables.

A few studies have explored the profiles of perceived stress (e.g., Berlin et al., 2012; Liao et al., 2018; Langford et al., 2019) using LPA. Most of these studies focused on how individuals evaluated different stressors rather than using a global stress appraisal. "Low stress" (Berlin et al., 2012) or "ordinary" (Liao et al., 2018) or "normative" (Langford et al., 2019) profiles characterized by relatively low levels of perceived stress indicators have been consistently identified from a prior work. One study conducted by Fernández et al. (2020) identified three latent classes of psychological distress associated with COVID-19 quarantine among Argentine volunteers. The majority of the individuals could be classified into mild (40.9%) and severe classes (41.0%). To our knowledge, no study has examined the perceived stress profile of pregnant women using LPA. Meanwhile, although the evidence has shown that there are differences in depression levels among different perceived stress profiles (Liao et al., 2018), it is still not clear whether there are differences in anxiety among different perceived stress profiles of pregnant women exposed to the COVID-19 epidemic.

Resilience is a "dynamic process encompassing positive adaptation within the context of significant adversity" (Luthar et al., 2000). Many personal abilities and traits, such as optimism (Connor and Davidson, 2003) and tenacity (Rutter, 1985), are associated with resilience. There is no comprehensive and unifying theoretical framework in the field of resilience research, and the causal trajectory is controversial (Fletcher and Sarkar, 2013). Some cross-sectional studies have investigated the mediating role (questions of "how"; e.g., Tam et al., 2020), moderating role (questions of "when"; e.g., Tsourtos et al., 2019), or both roles (Anyan and Hjemdal, 2016; Ma et al., 2019) of resilience in the relation between stress and psychiatric symptoms. The mediating role of resilience between stress and anxiety symptoms has been proven, but the moderating role of

resilience is uncertain. For example, Ma et al. (2019) found that resilience was both a mediator and a modifier of the association between stress and prenatal anxiety. Anyan and Hjemdal (2016) found that resilience partially mediated the relation between stress and symptoms of anxiety. However, it did not moderate the influence of stress on symptoms of anxiety.

The compensatory model of resilience (Zimmerman et al., 1998; Zimmerman and Brenner, 2010) holds that the direct effects of resilience counterbalance the direct negative effects of risk factors such as stress, which suggests a mediating role of resilience between stress and anxiety. Empirical studies have indicated that individuals respond to different life experiences with varying degrees of resilience (Waller, 2001). Stress can have an adverse impact on an individual's resilience (Bonanno and Mancini, 2008), and more experience with adversities is associated with lower resilience among pregnant and postpartum women (Harville et al., 2010). Meanwhile, a meta-analysis revealed that resilience is negatively associated with psychiatric symptoms (e.g., anxiety; Hu et al., 2015). Based on the compensatory model of resilience and the empirical evidence linking stress, resilience, and anxiety symptoms, this study concentrates on the mediating role of resilience between the perceived stress and symptoms of anxiety (i.e., how does the perceived stress result in symptoms of anxiety *via* resilience?) among pregnant women during the COVID-19 pandemic. Pregnant women with high resilience showed lower levels of psychological distress during the COVID-19 pandemic (Chasson et al., 2020). However, whether group differences in perceived stress profiles on pregnant women's anxiety during the COVID-19 pandemic were mediated by resilience has not yet been specifically investigated.

The present study aimed to identify integrative stress profiles consisting of two perceived stress dimensions and to explore the relationship among stress profiles, resilience, and anxiety of pregnant Chinese women using LPA during the COVID-19 pandemic. We hypothesized that (1) there may be perceived stress profiles reflecting different combinations of HEL and SEL. We employed an exploratory approach and therefore made no hypothesis about the number of perceived stress profiles. (2) There were significant differences in anxiety and resilience among the different stress profiles. Profiles with lower HEL have lower levels of anxiety and higher levels of resilience. (3) Resilience would mediate the effect of stress profile differences on anxiety. That is, the differences in anxiety between a profile with lower HEL and other profiles could be explained by the former group's higher resilience.

METHODS

Participants and Procedures

This study is part of a WeChat psychological crisis intervention program initiated by the Institute of Psychology, Chinese Academy of Sciences, that aimed to help pregnant Chinese women cope with stress during the COVID-19 pandemic. Pregnant women who attended regular examinations at medical institutions in Wuhan, Beijing, Lanzhou, and other cities of China were recruited to scan the QR code generated by an online survey platform to complete the survey. The inclusion criteria were at all stages of pregnancy, more than 18 years old, being able to read and write in Chinese and no infection with COVID-19. Pregnant women with a history of mental illness were excluded from the study ($n = 7$). Pregnant women participated voluntarily in this study and provided an informed consent between February 28, 2020 and April 26, 2020. Ethics approval for the study was obtained from the Institutional Review Board of Institute of Psychology, Chinese Academy of Sciences.

Measurements

Perceived Stress

A 10-item Perceived Stress Scale (PSS-10) was used to assess persons' perceptions of situations in their life in terms of uncontrollability, unpredictability, and overload (Cohen et al., 1983; Cohen and Williamson, 1988). It was divided into two dimensions: HEL (items 1, 2, 3, 6, 9, and 10) and SEL (items 4, 5, 7, and 8, reverse scoring) (Leung et al., 2010; Taylor, 2015). The items were rated on a five-point Likert scale from 0 ("never") to 4 ("very often"). Higher scores on these two dimensions indicated a higher negative emotion perception and a stronger sense of an inability to cope with stress. This scale has been validated among pregnant women (Monique et al., 2010). In this study, the Cronbach's α was 0.85.

Resilience

A 10-item Connor-Davidson resilience scale (CD-RISC) was applied to assess the adaptability to stress (Connor and Davidson, 2003; Campbell-Sills and Stein, 2007). The 10-item CD-RISC is a unidimensional scale rated on a five-point Likert scale ranging from 0 ("not true at all") to 4 ("true nearly all of the time"). The 10-item CD-RISC has been validated among pregnant women (Levey et al., 2019). In this study, the Cronbach's α was 0.96.

Anxiety

A seven-item Generalized Anxiety Disorder scale (GAD-7) was used to measure the severity of anxiety symptoms, with a four-point Likert scale response ranging from 0 ("almost never") to 3 ("almost always"). GAD-7 was initially developed for screening the generalized anxiety disorder (GAD) and assessing the severity of symptoms in a primary care patient sample (Spitzer et al., 2006). It has also been validated or used for assessing anxiety symptoms in the general population (Löwe et al., 2008; Solomou and Constantinidou, 2020), patients with cancer (Lundt and Jentschke, 2019), and pregnant women (e.g., Barthel et al., 2014; Rosenthal et al., 2015). Internal consistency was obtained as satisfactory in this study (Cronbach's $\alpha = 0.92$).

Statistical Analysis

SPSS 25.0 and Mplus 7.0 were used in the analyses. First, descriptive statistics and Pearson correlation analysis for all of the variables were applied. Second, LPA was utilized to identify latent stress profiles according to HEL and SEL. The one- to six-class groups were applied and compared based on a set of fit statistics. A good model fit is indicated by (1) lower comparative values of the Akaike information criteria (AIC), the Bayesian information (BIC), and the adjusted BIC (ABIC) values, as well as higher

values of entropy with numbers closer to 1; (2) a significant Lo-Mendell-Rubin likelihood ratio test (LMR LR) and the Vuong-Lo-Mendell-Rubin test (VLMR). Third, after determining the best class solution, univariate ANOVAs and *post-hoc* tests were applied to compare the differences among the stress profiles with respect to the two stress dimensions and resilience and anxiety.

Following Hayes and Preacher (2014), a multicategorical mediating model was constructed through structural equation modeling (SEM) to investigate whether the differences among the perceived stress profiles (multicategorical variables) on anxiety (latent variable, the measured indicators were seven items of GAD-7) could be explained by resilience (latent variable, the measured indicators were five parcels of items of CD-RISC). The criteria for good model fit indices for SEM were as follows: $\chi^2/df \leq 5.000$, comparative fit index (CFI), Tucker–Lewis index (TLI) ≥ 0.900, standardized root mean square residual (SRMR) ≤ 0.080, and root mean square error of approximation (RMSEA) ≤ 0.080 (Kline, 2011; Hoyle, 2012).

RESULTS

Sample Description

The final participants included 2,116 pregnant women whose average age was 30.24 years old (SD = 3.97, range = 19–47 years). Among the participants, 22.7% were in the first trimester, 23.8% in the second trimester, and 53.5% in the third trimester. The majority of participants were married (98.2%) and of Han nationality (95.8%). In terms of geography, 38.5% were from Beijing, 32.7% were from Hubei (among them, 99.1% were from Wuhan), 25.6% were from Gansu, 2.4% were from Hebei, and 0.8% were from the other provinces in China. Regarding their education levels, 11% had completed graduate studies or above, 44.1% had completed university, 28.7% had completed junior college, and 16.2% had completed senior high school or less. In terms of economic status, 12.6% of the participants' annual family income exceeded 300,000 RMB, and 31.24% of the participants' annual family income was <80,000 RMB. A total of 17.63% of the sample reported to have pregnancy complications.

TABLE 1 | Descriptive statistics and correlation matrix of all variables.

	M	*SD*	1	2	3
1 HEL	1.104	0.820	–		
2 SEL	1.752	1.131	−0.274***	–	
3 Resilience	2.989	0.790	−0.299***	−0.266***	–
4 Anxiety	0.350	0.472	0.581***	0.010	−0.371***

*HEL, perceived helplessness; SEL, perceived self-efficacy. ***$p < 0.001$.*

Descriptive Statistics

Means, SDs, and correlations for all of the variables are presented in **Table 1**. The results showed that anxiety was positively associated with HEL ($p < 0.001$) but not related to SEL ($p > 0.05$). Resilience was negatively associated with HEL, SEL, and anxiety ($p < 0.001$).

Perceived Stress Profiles

The fit indices of the six LPA models are reported in **Table 2**. The four-profile model had lower AIC, BIC, and ABIC values than the three-profile model and had significant values of p for LMR LR and VLMR. The five-profile model had significant values of p for LMR LR and VLMR, and lower AIC, BIC, and ABIC values than the four-profile model, but the downtrend of AIC, BIC, and ABIC became slow, and the entropy was less than that of the four-profile model. In addition, considering the simplicity and relative distinguishability of the model, we chose the four-profile solution as the final model.

Figure 1 and **Table 3** summarize the characteristics of the four stress profiles identified using standardized scores. The profiles differed from one another with respect to the two perceived stress dimensions, characterized by low HEL/low SEL, high HEL/moderate SEL, low HEL/high SEL, and very high HEL/low SEL. We labeled them as adaptive (33.7%), resistant (44.6%), insensitive (19.1%), and sensitive (2.6%).

Profile Differences in Resilience and Anxiety

The differences in resilience and anxiety among the four profiles were examined by using ANOVAs. The adaptive profile had the highest resilience. The insensitive and sensitive profile had middle-level resilience. The resistant profile had the lowest resilience. The profiles also differed overall in terms of anxiety. The sensitive profile had the highest anxiety. The resistant profile had middle-level anxiety. The adaptive and insensitive profiles had the least amount of anxiety (**Table 3**).

TABLE 2 | Model fit indices for one to six profile solutions of perceived stress.

Model	AIC	BIC	ABIC	Entropy	LMR LR (*p*)	VLMR (*p*)
1-profile	12015.895	12038.524	12025.816			
2-profile	11232.247	11271.848	11249.608	0.899	0.000	0.000
3-profile	10945.377	11001.950	10970.179	0.720	0.000	0.000
4-profile	**10622.749**	**10696.293**	**10654.991**	**0.824**	**0.000**	**0.000**
5-profile	10550.852	10641.369	10590.535	0.815	0.029	0.033
6-profile	10430.187	10537.675	10477.310	0.809	0.050	0.055

AIC, Akaike information criterion; BIC, Bayesian information criterion; ABIC, Adjusted BIC; LMR LR, Lo-Mendell-Rubin likelihood ratio test; VLMR, Vuong-Lo-Mendell-Rubin test. Indices of the best-fitting model are in boldface.

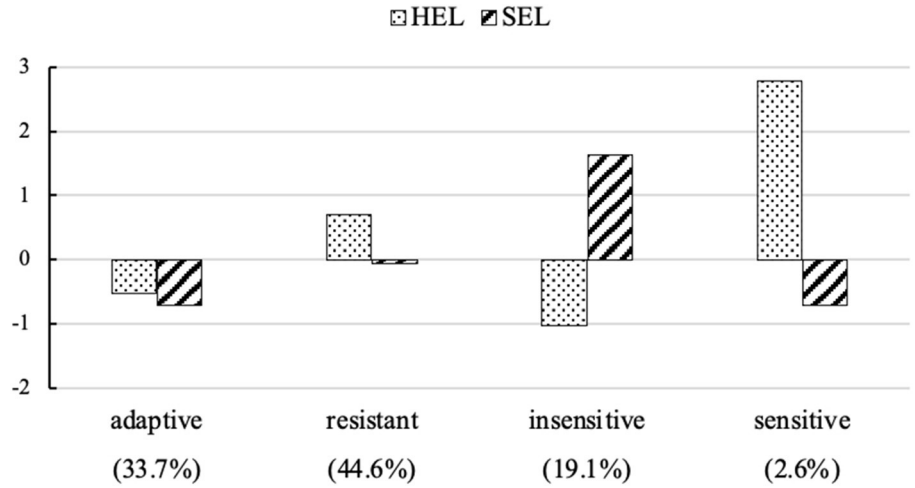


FIGURE 1 | The four perceived stress profiles and relative size of the profiles. HEL, perceived helplessness; SEL, perceived self-efficacy. Profile indicator variables were standardized values.

TABLE 3 | The dimensions of perceived stress, resilience, and anxiety for four perceived stress profiles.

	Adaptive	Resistant	Insensitive	Sensitive	F (*p*)	Effect size
HEL	-0.608_c	0.732_b	1.015_d	2.808_a	2301.299***	0.766
SEL	0.764_c	0.076_b	1.629_a	0.758_c	1821.654***	0.721
Resilience	3.371_a	2.721_c	2.946_b	2.942_b	106.232***	0.131
Anxiety	0.142_c	0.565_b	0.143_c	0.886_a	208.621***	0.229

*The dimensions of perceived stress are presented as standardized z-scores. Values with different subscripts in the same row represent significantly different values based on Tukey's honest significant difference (HSD) tests for HEL, SEL, resilience, and anxiety. HEL, perceived helplessness; SEL, perceived self-efficacy. ***$p < 0.001$.*

Mediated Effects of Resilience

Three dummy variables (D1, D2, and D3) were created by using indicator coding to represent the four stress profiles. The resistant profile served as a reference group and was assigned a score of "0" across all variables. The adaptive, insensitive, and sensitive profiles were coded as "100," "010," and "001," respectively. Adding the pregnant women's age, gestational age, number of births, and physical disease as covariates, these dummy variables were then entered into the SEM to test whether the differences in anxiety between the adaptive/insensitive/sensitive and resistant profiles were due to the differences in resilience and resilience's subsequent effect on anxiety. Compared with the resistant profile, the relative direct and indirect effects for the other profiles were calculated. The significance of each relative indirect path was tested by using the bootstrapping method (1,000 samples). The mediation model was fitted ideally with $\chi^2/df = 4.16$, CFI = 0.985, TLI = 0.980, RMSEA = 0.039 [0.035, 0.042], SRMR = 0.019.

According to Hayes and Preacher (2014), a1, a2, and a3 and c1', c2', and c3' correspond to the differences in the adaptive, insensitive, and sensitive profiles for resilience and anxiety, respectively, relative to the resistant profile. b quantifies the effect of resilience on anxiety (**Figure 2**). The bootstrap CI indicated a significant relative indirect effect of D1 and D2 on anxiety *via* resilience (for D1, $\beta = -0.10$, $E = 0.01$, 99% CI [−0.13, −0.08]; for D2, $\beta = -0.03$, $E = 0.01$, 99% CI [−0.05, −0.01]), while the relative direct effect of D1 and D2 on anxiety was significant (for D1, $\beta = -0.32$, $E = 0.02$, 99% CI [−0.38, −0.28]; for D2, $\beta = -0.33$, $E = 0.02$, 99% CI [−0.38, −0.28]). The results suggested that compared with the resistant profile, the adaptive profile and insensitive profile led to significantly lower levels of anxiety *via* higher levels of resilience. The examination of the proportion of relative mediation effects showed that 23.6% (adaptive profile) and 7.3% (insensitive profile) of the relative total effect on anxiety were mediated by resilience. Meanwhile, the CIs spanned zero, indicating that the relative indirect effects of D3 (the sensitive profile, relative to the resistant profile) on anxiety *via* resilience were not significant. The relative direct effect of D3 on anxiety was significant ($\beta = 0.12$, $E = 0.04$, 99% CI [0.03, 0.23]).

DISCUSSION

We found that the perceived stress among pregnant women during the COVID-19 pandemic could be classified into four profiles: adaptive (low HEL/low SEL), resistant (high HEL/moderate SEL), insensitive (low HEL/high SEL), and

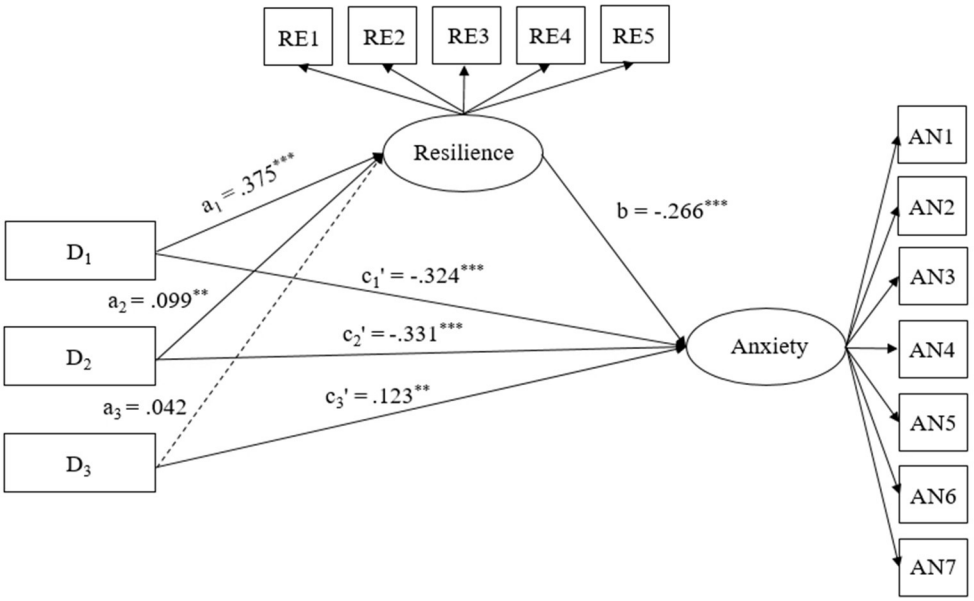


FIGURE 2 | Model of the mediation role of resilience in association between perceived stress profiles and anxiety. D_1, D_2, and D_3 were dummy variables to represent the perceived stress profiles. The resistant profile served as the reference group and were assigned a score of "0" across the three variables. The adaptive, insensitive, and sensitive profiles were assigned with respective scores of "100," "010," and "001" across D_1, D_2, and D_3. RE1-RE5 = five parcels of resilience; AN1-AN7 = seven items of anxiety. $^{***}p < 0.001$.

sensitive (very high HEL/low SEL), which differed from one another in terms of anxiety and resilience. The differences in the pregnant women's anxiety between the adaptive/insensitive and resistant stress profiles could be explained by the former groups' higher resilience.

The resistant stress profile occurs most frequently among pregnant women. This finding is partly in accordance with some previous research findings. For example, Lee et al. (2006) reported that pregnant women in Hong Kong, China, tended to display obvious stress responses during the 2003 SARS outbreak period, such as overestimation of the risk of infection. Meanwhile, they showed a coping ability by adopting behavioral strategies to mitigate their risk. The adaptive stress profile is similar to the "low stress" profile described by Berlin et al. (2012) and the "ordinary" profile described by Liao et al. (2018). Pregnant women in this group felt less distress and had a better sense of coping even during the COVID-19 pandemic. The opposite features existed in the insensitive and sensitive profiles. However, the number of pregnant women in both groups was relatively small.

In general, the pregnant women with a sensitive profile had the highest levels of anxiety, followed by the pregnant women with a resistant profile, an insensitive profile, and an adaptive profile. This suggested that a higher HEL is associated with an increased risk of anxiety. This finding is partly in line with a previous study; that is, only HEL is related to psychiatric symptoms between HEL and SEL for women (Martin et al., 1995) and for men (Hewitt et al., 1992). Anxiety symptoms are characterized precisely by excessive negative emotion according to the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; DSM-5; American Psychiatric Association, 2013). Therefore, pregnant women may respond with anxiety symptoms to their perception of distress. As expected, there was no association between SEL and anxiety in this study. This is consistent with a previous study showing that efficacy expectations (a perceived ability to cope with the situation) did not significantly predict anxiety (Dowd et al., 1985). One explanation for this finding might be that the relation between coping and anxiety is conditional. It would be affected by some moderators (Li and Miller, 2017), which requires additional research to achieve a better understanding.

An important finding of this research was that the effects of the differences between adaptive/insensitive and resistant profiles on anxiety were partially mediated by resilience. Compared with the resistant stress profile, the adaptive and insensitive stress profile led to significantly lower levels of anxiety *via* higher levels of resilience, which is also partly consistent with past dimension-approach research results (Anyan and Hjemdal, 2016; Ma et al., 2019) and supported by the compensatory model of resilience (Zimmerman et al., 1998). Compared with pregnant women in the resistant profile, pregnant women in the adaptive profile can better adapt to changes in the environment and their social life and have perceptions of fewer negative affective reactions and a high coping ability and self-efficacy. These factors may give pregnant women the resources to cope with stressors under many situations and develop resilience (Galatzer-Levy et al., 2013; Sagone and Caroli, 2013; Schwarzer and Warner, 2013). Pregnant women with an insensitive profile had lower perceptions of

distress and coping ability, which may protect them from consuming too many available resources to deal with negative emotions, conducive to maintaining resiliency (Galatzer-Levy et al., 2013). Meanwhile, based on the compensatory model of resilience (Zimmerman et al., 1998) and empirical findings (e.g., Hjemdal et al., 2011), resilience can directly decrease the risk of anxiety. Therefore, compared to the resistant profile, the higher resilience of the adaptive profile and insensitive profile directly predicted lower levels of anxiety.

The study found that although women with a sensitive profile had a higher level of anxiety than women with a resistant profile, resilience did not mediate the effect of the difference on anxiety between the sensitive stress profile and the resistant stress profile. One possible reason may be that the sensitive profile had a very high HEL, which can directly lead to anxiety and need not be mediated by resilience. A possible effect of heightened stress sensitivity on affective disorder onset and susceptibility has been supported by previous studies (Bale, 2006). Another possible explanation is that there may be other mediators that explain the differences in anxiety between the sensitive and resistant profiles that were not considered in this study. However, this explanation is speculative. Additional studies are needed to verify the current findings.

To our knowledge, this is the first study to apply LPA to identify the patterns of pregnant women's perceived stress during the COVID-19 pandemic and to examine the effect of resilience on the association between the perceived stress profiles and anxiety from a person-centered approach. However, this study has some limitations that need to be addressed. First, this was a cross-sectional study, and there was an absence of a pre-pandemic control group, which prevented us from reaching any causal conclusions about the association of perceived stress with anxiety. Future research should conduct longitudinal studies to identify causal relationships. Second, a self-reported data collection method might affect the validity of the data. Future research should combine multiple methods, such as brain imaging and molecular biological techniques, to collect data. Meanwhile, qualitative interviews or focused group discussions could have added more value to the study by exploring the causes of pregnant women's anxiety and how they cope with it. Third, although our study was based on two important dimensions of perceived stress, it might not fully encompass the stress that the pregnant women experienced. Fourth, GAD-7 was originally designed for screening for GAD and assessing the severity of symptoms in a clinical sample (Spitzer et al., 2006) although it has also been confirmed or used to assess anxiety symptoms among pregnant women (e.g., Barthel et al., 2014; Rosenthal et al., 2015). Comparisons with previous studies should be made with caution because different studies may assess different aspects of anxiety and its severity.

Despite the limitations, our findings might have important implications for medical staff to develop more effective crisis intervention programs to alleviate pregnant women's anxiety during a period of crisis. Pregnant women with different HEL/SEL patterns might have different levels of anxiety, which suggests differentiated clinical psychological nursing and interventions to balance the needs of all pregnant women. We encourage future anxiety interventions of pregnant women aimed at managing stress from a specific person-centered mode. Pregnant women in the adaptive group have low levels of HEL and SEL, which can help them deal with crises. For these pregnant women, additional psychological interventions are not needed. For pregnant women in the insensitive group, the main goal is to increase their perceptions of coping ability, i.e., general self-efficacy, through health education emphasizing high performance accomplishments, vicarious experiences, verbal persuasion, etc. (Bandura, 1977). Pregnant women in the resistant group and sensitive group should be the focus of crisis intervention. The primary goal is to relieve their high HEL, such as being instructed to use various positive emotion regulation strategies (e.g., Garnefski et al., 2002) and through cognitive interventions (e.g., Zemestani and Fazeli Nikoo, 2020). Meanwhile, pregnant women with adaptive and insensitive patterns could experience decreases in anxiety *via* resilience. Thus, our results offer a reasonable basis for further developing resilience-specific crisis interventions that would be more targeted and thus increase their effectiveness. For example, it could help pregnant women to develop meaningful connections with family or friends and perceive increased social support to improve their resilience and reduce their anxiety.

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 of Institute of Psychology, Chinese Academy of Sciences. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

ZLu, FS, and ZLi: study design, critical revision of the manuscript, and approval of the final version for publication. ZLu, YS, JY, and YZ: analysis and interpretation of data. ZLu and YS: drafting of the manuscript. All authors contributed to the article and approved the submitted version.

FUNDING

This research was supported by the Shenzhen-Hongkong Institute of Brain Science-Shenzhen Fundamental Research Institutions (NYKFKT2020002).

ACKNOWLEDGMENTS

We thank Wei Qian and Yongjie Zhou for their outstanding work in organizing data collection and writing review and editing. We are also grateful to all the other colleagues who contributed to data collection and writing review.

REFERENCES

American Psychiatric Association (2013). *Diagnostic and Statistical Manual of Mental Disorders.* (5th ed.). Washington, DC: American Psychiatric Association. doi: 10.1176/appi.books.9780890425596

Anyan, F., and Hjemdal, O. (2016). Adolescent stress and symptoms of anxiety and depression: resilience explains and differentiates the relationships. *J. Affective Disord.* 203, 213–220. doi: 10.1016/j.jad.2016.05.031

Bale, T. L. (2006). Stress sensitivity and the development of affective disorders. *Horm. Behav.* 50, 529–533. doi: 10.1016/j.yhbeh.2006.06.033

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychol. Rev.* 84, 191–215. doi: 10.1037/0033-295X.84.2.191

Barthel, D., Barkmann, C., Ehrhardt, S., and Bindt, C. (2014). Psychometric properties of the 7-item Generalized Anxiety Disorder scale in antepartum women from Ghana and Côte d'Ivoire. *J. Affective Disord.* 169, 203–211. doi: 10.1016/j.jad.2014.08.004

Berlin, K. S., Rabideau, E. M., and Hains, A. A. (2012). Empirically derived patterns of perceived stress among youth with type 1 diabetes and relationships to metabolic control. *J. Pediatr. Psychol.* 37, 990–998. doi: 10.1093/jpepsy/jss080

Berthelot, N., Lemieux, R., Garon-Bissonnette, J., Drouin-Maziade, C., Martel, É., and Maziade, M. (2020). Uptrend in distress and psychiatric symptomatology in pregnant women during the COVID-19 pandemic. *Acta Obstetricia et Gynecol. Scand.* 99, 848–855. doi: 10.1111/aogs.13925

Bonanno, G. A., and Mancini, A. D. (2008). The human capacity to thrive in the face of potential trauma. *Pediatrics* 121, 369–375. dio:10.1542/peds.2007-1648

Campbell-Sills, L., and Stein, M. B. (2007). Psychometric analysis and refinement of the connor–davidson resilience scale (CD-RISC): validation of a 10-item measure of resilience. *J. Trauma. Stress.* 20, 1019–1028. doi: 10.1002/jts.20271

Chasson, M., Taubman-Ben-Ari, O., and Abu-Sharkia, S. (2020). Jewish and arab pregnant women's psychological distress during the covid-19 pandemic: the contribution of personal resources. *Ethnic Health.* 12, 1–13. doi: 10.1080/13557858.2020.1815000

Cohen, S., Kamarck, T., and Mermelstein, R. (1983). A global measure of perceived stress. *J. Health. Soc. Behav.* 24, 385–396. doi: 10.2307/2136404

Cohen, S., and Williamson, G. M. (1988). "Perceived stress in a probability sample of the United States," in *The Social Psychology of Health: Claremont Symposium on Applied Social Psychology,* eds S. Spacapan and S. Oskamp (Newbury Park, CA: Sage), 31–67.

Connor, K. M., and Davidson, J. R. T. (2003). Development of a new resilience scale: the Connor-Davidson Resilience Scale (CD-RISC). *Depress. Anxiety.* 18, 76–82. doi: 10.1002/da.10113

Ding, W., Lu, J., Zhou, Y., Wei, W., Zhou, Z., and Chen, M. (2021). Knowledge, attitudes, practices, and influencing factors of anxiety among pregnant women in Wuhan during the outbreak of COVID-19: a cross-sectional study. *BMC Pregnancy Childb.* 21:80. doi: 10.1186/s12884-021-03561-7

Dowd, E. T., Claiborn, C. D., and Milne, C. R. (1985). Anxiety, attributional style, and perceived coping ability. *Cognitive Ther. Res.* 9, 575–582. doi: 10.1007/BF01173010

Fernández, R. S., Crivelli, L., Guimet, N. M., Allegri, R. F., and Pedreira, M. E. (2020). Psychological distress associated with covid-19 quarantine: latent profile analysis, outcome prediction and mediation analysis. *J. Affective Disord.* 277, 75–84. doi: 10.1016/j.jad.2020.07.133

Fletcher, D., and Sarkar, M. (2013). Psychological resilience: a review and critique of definitions, concepts, and theory. *Eur. Psychol.* 18, 12–23. doi: 10.1027/1016-9040/a000124

Galatzer-Levy, I. R., Brown, A. D., Henn-Haase, C., Metzler, T. J., Neylan, T. C., and Marmar, C. R. (2013). Positive and negative emotion prospectively predict trajectories of resilience and distress among high-exposure police officers. *Emotion.* 13, 545–553. doi: 10.1037/a0031314

Garnefski, N., Van Den Kommer, T., Kraaij, V., Teerds, J., Legerstee, J., and Onstein, E. (2002). The relationship between cognitive emotion regulation strategies and emotional problems: comparison between a clinical and a non-clinical sample. *Eur. J. Personality.* 16, 403–420. doi: 10.1002/per.458

Hamzehgardeshi, Z., Omidvar, S., Amoli, A. A., and Firouzbakht, M. (2021). Pregnancy-related anxiety and its associated factors during COVID-19 pandemic in Iranian pregnant women: a web-based cross-sectional study, *BMC Pregnancy Childb.* 21:208. doi: 10.1186/s12884-021-03694-9

Harville, E. W., Xiong, X., Buekens, P., Pridjian, G., and Elkind-Hirsch, K. (2010). Resilience after hurricane Katrina among pregnant and postpartum women. *Women Health Iss.* 20, 20–27. doi: 10.1016/j.whi.2009.10.002

Hasanjanzadeh, P., and Faramarzi, M. (2017). Relationship between maternal general and specific-pregnancy stress, anxiety, and depression symptoms and pregnancy outcome. *J. Clin. Diagn. Res.* 11, VC04–VC07. doi: 10.7860/JCDR/2017/24352.9616

Hayes, A. F., and Preacher, K. J. (2014). Statistical mediation analysis with a multicategorical independent variable. *Brit. J. Math. Stat. Psy.* 67, 451–470. doi: 10.1111/bmsp.12028

Hewitt, P. L., Flett, G. L., and Mosher, S. W. (1992). the perceived stress scale: factor structure and relation to depression symptoms in a psychiatric sample. *J. Psychopathol. Behav.* 14, 247–257. doi: 10.1007/BF00962631

Hjemdal, O., Vogel, P. A., Solem, S., Hagen, K., and Stiles, T. C. (2011). The relationship between resilience and levels of anxiety, depression, and obsessive-compulsive symptoms in adolescents. *Clin. Psychol. Psychot.* 18, 314–321. doi: 10.1002/cpp.719

Hoyle, R. H. (2012). "Model specification in structural equation modeling," in *Handbook of Structural Equation Modeling*, eds R. H. Hoyle and R. H. Hoyle (New York, NY: Guilford Press), 126–144.

Hu, T., Zhang, D., and Wang, J. (2015). A meta-analysis of the trait resilience and mental health. *Pers Individ Dif.* 76:18–27. doi: 10.1016/j.paid.2014.11.039

Jiang, H., Jin, L., Qian, X., Xiong, X., La, X., Chen, W., et al. (2021). Maternal mental health status and approaches for accessing antenatal care information during the COVID-19 epidemic in China: cross-sectional study. *J. Med. Internet Res.* 23:e18722. doi: 10.2196/18722

Kline, R. B. (2011). *Principles and Practice of Structural Equation Modeling (3rd ed.)*. New York, NY: Guilford Press.

Langford, D. J., Cooper, B., Paul, S., Humphreys, J., Hammer, M. J., Levine, J., et al. (2019). Distinct stress profiles among oncology patients undergoing chemotherapy. *J. Pain Symptom Manage.* 59, 646–657. doi: 10.1016/j.jpainsymman.2019.10.025

Lee, D. T. S., Sahota, D., Leung, T. N., Yip, A. S. K., Lee, F. F. Y., and Chung, T. K. H. (2006). Psychological responses of pregnant women to an infectious outbreak: a case-control study of the 2003 SARS outbreak in Hong Kong. *J. Psychosom. Res.* 61, 707–713. doi: 10.1016/j.jpsychores.2006.08.005

Leung, D. Y. P., Lam, T., and Chan, S. S. C. (2010). Three versions of Perceived Stress Scale: validation in a sample of Chinese cardiac patients who smoke. *BMC Public Health* 10, 513–519. doi: 10.1186/1471-2458-10-513

Levey, E. J., Rondon, M. B., Sanchez, S., Williams, M. A., and Gelaye, B. (2019). Psychometric properties of the Spanish version of the 10-item Connor Davidson Resilience Scale (CD-RISC) among adolescent mothers in Peru. *J. Child Adolescent Trauma* 14, 29–40. doi: 10.1007/s40653-019-00295-9

Li, W. W., and Miller, D. J. (2017). The impact of coping and resilience on anxiety among older Australians. *Aust. J, Psychol.* 69, 263–272. doi: 10.1111/ajpy.12152

Liao, P., Chen, S., and Lin, S. S. J. (2018). Latent profiles of stress and their relationships with depression and problematic Internet use among college freshmen. *Scand. J. Psychol.* 59, 621–630. doi: 10.1111/sjop.12489

Löwe, B., Decker, O., Müller, S., Brähler, E., Schellberg, D., Herzog, W., et al. (2008). Validation and standardization of the Generalized Anxiety Disorder Screener (GAD-7) in the general population. *Med. Care.* 46, 266–274. doi: 10.1097/MLR.0b013e318160d093

Lundt, A., and Jentschke, E. (2019). Long-term changes of symptoms of anxiety, sepression, and fatigue in cancer patients 6 months after the end of Yoga therapy. *Integr. Cancer Ther.* 18, 1534735418822096. doi: 10.1177/1534735418822096

Luthar, S. S., Cicchetti, D., and Becker, B. (2000). The construct of resilience: a critical evaluation and guidelines for future work. *Child Dev.* 71, 543–562. doi: 10.1111/1467-8624.00164

Ma, X., Wang, Y., Hu, H., Tao, X. G., Zhang, Y., and Shi, H. (2019). The impact of resilience on prenatal anxiety and depression among pregnant women in shanghai. *J. Affective Disord.* 250, 57–64. doi: 10.1016/j.jad.2019.02.058

Martin, R. A., Kazarian, S. S., and Breiter, H. J. (1995). Perceived stress, life events, dysfunctional attitudes, and depression in adolescent psychiatric inpatients. *J. Psychopathol. Behav.* 17, 81–95. doi: 10.1007/BF02229205

Monique, C., Hibah, O., Georges, N., and Ziyad, M. (2010). Validation of the Arabic version of the Cohen perceived stress scale (PSS-10)

among pregnant and postpartum women. *BMC Psychiatry*. 10:111. doi: 10.1186/1471-244X-10-111

Preis, H., Mahaffey, B., Heiselman, C., and Lobel, M. (2020a). Pandemic-related pregnancy stress and anxiety among women pregnant during the COVID-19 pandemic. *Am. J. Obstet. Gynecol.* 100155. doi: 10.1016/j.ajogmf.2020.100155

Preis, H., Mahaffey, B., Heiselman, C., and Lobel, M. (2020b). Vulnerability and resilience to pandemic-related stress among U.S. women pregnant at the start of the COVID-19 pandemic. *Soc. Sci. Med.* 266:113348. doi: 10.1016/j.socscimed.2020.113348

Romero-Gonzalez, B., Puertas-Gonzalez, J. A., Marino-Narvaez, C., and Peralta-Ramirez, M. I. (2021). Confinement variables by COVID-19 predictors of anxious and depressive symptoms in pregnant women. *Med. Clin.* 156, 172–176. doi: 10.1016/j.medcle.2020.10.010

Rosenthal, L., Earnshaw, V., Lewis, T. T., Reid, A. E., Lewis, J. B., Stasko, E. C., et al. (2015). Changes in experiences with discrimination across pregnancy and postpartum: Age differences and consequences for mental health. *Am. J. Public Health*. 105, 686–693. doi: 10.2105/AJPH.2014.301906

Rutter, M. (1985). Resilience in the face of adversity: protective factors and resistance to psychiatric disorder. *Br. J. Psychiatry*. 147:598–611. doi: 10.1192/bjp.147.6.598

Saadati, N., Afshari, P., Boostani, H., Beheshtinasab, M., Abedi, P., and Maraghi, E. (2021). Health anxiety and related factors among pregnant women during the COVID-19 pandemic: a cross-sectional study from Iran. *BMC Psychiatry*. 21:95. doi: 10.1186/s12888-021-03092-7

Sagone, E., and Caroli, M. E. D. (2013). Relationships between resilience, self-efficacy, and thinking styles in Italian middle adolescents. *Pro-Soc. Behav. Sci.* 92, 838–845. doi: 10.1016/j.sbspro.2013.08.763

Schwarzer, R., and Warner, L. M. (2013). "Perceived self-efficacy and its relationship to resilience," in *Resilience in Children, Adolescents, and Adults: Translating Research Into Practice*, eds A. Prince-Embury and D. H. Saklofske (New York, NY: The Springer Series on Human Exceptionality, Springer), 139–150.

Selye, H. (1950). Stress and the general adaptation syndrome. *Br. Med. J.* 1, 1383–1392. doi: 10.1136/bmj.1.4667.1383

Solomou, I., and Constantinidou, F. (2020). Prevalence and predictors of anxiety and depression symptoms during the COVID-19 pandemic and compliance with precautionary measures: age and sex matter. *Int. J. Environ. Res. Public Health*. 17:4924. doi: 10.3390/ijerph17144924

Spitzer, R. L., Kroenke, K., Williams, J. B. W., and Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder. *Arch. Intern. Med.* 166:1092. doi: 10.1001/archinte.166.10.1092

Stein, A., Pearson, R. M., Goodman, S. H., Rapa, E., Rahman, A., McCallum, M., et al. (2014). Effects of perinatal mental disorders on the fetus and child. *Lancet* 384, 1800–1819. doi: 10.1016/S0140-6736(14)61277-0

Tam, C. C., Benotsch, E. G., and Weinstein, T. L. (2020). Resilience and psychiatric symptoms as mediators between perceived stress and non-medical use of prescription drugs among college students. *Am. J. Drug Alcohol Ab.* 46, 120–130. doi: 10.1080/00952990.2019.1653315

Taylor, J. M. (2015). Psychometric analysis of the Ten-Item Perceived Stress Scale. *Psychol. Assess.* 27, 90–101. doi: 10.1037/a0038100

Tsourtos, G., Ward, P. R., Miller, E. R., Hill, K., Barton, C., Wilson, C. J., et al. (2019). Does resilience moderate the relationship between stress and smoking status? *Subst. Use Misuse* 54, 412–425. doi: 10.1080/10826084.2018.1501066

Vollrath, M. E., Sengpiel, V., Landolt, M. A., Jacobsson, B., and Latal, B. (2016). Is maternal trait anxiety a risk factor for late preterm and early term deliveries? *BMC Pregnancy Childbirth*. 16:286. doi: 10.1186/s12884-016-1070-1

Waller, M. A. (2001). Resilience in ecosystemic context: evolution of the concept. *Am. J. Orthopsychiat.* 71, 290–297. doi: 10.1037/0002-9432.71.3.290

Wu, Y., Zhang, C., Liu, H., Duan, C., Li, C., Fan, J., et al. (2020). Perinatal depressive and anxiety symptoms of pregnant women during the coronavirus disease 2019 outbreak in China. *Am. J. Obstetr. Gynecol.* 223, 240.e1–240.e9. doi: 10.1016/j.ajog.2020.05.009

Yan, H., Ding, Y., and Guo, W. (2020). Mental health of pregnant and postpartum women during the coronavirus disease 2019 pandemic: a systematic review and meta-analysis. *Front. Psychol.* 11:617001. doi: 10.3389/fpsyg.2020.617001

Zemestani, M., and Fazeli Nikoo, Z. (2020). Effectiveness of mindfulness-based cognitive therapy for comorbid depression and anxiety in pregnancy: a randomized controlled trial. *Arch. Women Ment. Hlth.* 23, 207–214. doi: 10.1007/s00737-019-00962-8

Zimmerman, M. A., and Brenner, A. B. (2010). "Resilience in adolescence: overcoming neighborhood disadvantage," in *Handbook of Adult Resilience*, eds J. W. Reich, A. J. Zautra, and J. S. Hall (New York, NY: The Guilford Press), 283–308.

Zimmerman, M. A., Steinman, K. J., and Rowe, K. J. (1998). "Violence among urban African American adolescents: the protective effects of parental support," in *Addressing Community Problems: Psychological Research and Interventions*, eds X. B. Arriaga and S. Oskamp (Newbury Park, CA: Sage Publications, Inc), 78–103.

Zubin, J., and Spring, B. (1977). Vulnerability-a new view of schizophrenia. *J. Abnorm. Psychol.* 86, 103–126. doi: 10.1037/0021-843X.86.2.103

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 30 July 2021
doi: 10.3389/fpsyg.2021.678369

Distress, Appraisal, and Coping Among the Frontline Healthcare Provider Redeployed to the Epicenter in China During COVID-19 Pandemic

Zhongliang Ji[1†], *Wei Han*[1*], *Zhe Deng*[2*] and *Kailin Lu*[3†]

[1] Department of Emergency Medicine, Shenzhen University General Hospital, Shenzhen, China, [2] Department of Emergency Medicine, the First Affiliated Hospital of Shenzhen University, Health Science Center, Shenzhen Second People's Hospital, Shenzhen, China, [3] Shenzhen Hospital, University of Hong Kong, Shenzhen, China

OPEN ACCESS

Edited by:
Yi-Yuan Tang,
Texas Tech University, United States

Reviewed by:
Eleni Petkari,
Universidad Internacional De La Rioja, Spain
Ernest Marek Tyburski,
University of Social Sciences and Humanities, Poland

***Correspondence:**
Wei Han
robert.vince@163.com
Zhe Deng
23221064@qq.com

[†]These authors have contributed equally to this work

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: 09 March 2021
Accepted: 30 June 2021
Published: 30 July 2021

Citation:
Ji Z, Han W, Deng Z and Lu K (2021) Distress, Appraisal, and Coping Among the Frontline Healthcare Provider Redeployed to the Epicenter in China During COVID-19 Pandemic. Front. Psychol. 12:678369. doi: 10.3389/fpsyg.2021.678369

Objective: The central issue of this research is to evaluate the extent of cognitive appraisal and coping processes within the pandemic encounter and determines their influence on frontline healthcare providers who had been dispatched to the coronavirus disease 2019 (COVID-19) epicenter (HPDE) distress symptoms.

Materials and methods: An electronic survey of the HPDE and frontline healthcare providers who worked in their original medical facility (HPOF) was conducted from March 1 to 15, 2020. Two variables, appraisal (measured with an 18-item questionnaire) and coping (measured The Brief Cope questionnaire), were used in the analysis to explain distress symptoms (Impact of Event Scale-Revised).

Results: A total of 723 eligible respondents completed the survey with a response rate of 57.3% (351 HPDE and 372 HPOF). The mean IES-R scores of HPDE respondents were 26.47 ± 11.7. Of HPDE respondents, 246 (70.09%) reported distress symptoms (score 9–88). The scores of intrusion, avoidance, and hyperarousal for HPDE were 10.28 ± 4.7, 8.97 ± 4.3, and 7.20 ± 3.2, respectively. The respondents had higher scores in overall distress and three subscales than HPOF. Appraisal and coping variables explained 77% of the distress variance. Five appraisal variables (health of self, health of family/others, virus spread, vulnerability or loss of control, and general health) were positively associated with distress symptoms. Four coping variables (active coping, positive reframing, self-distraction, and behavioral disengagement) were negatively associated with distress level, whereas self-blame was positively associated with distress symptoms. Regarding the appraisal, the scores of HPDE were significantly higher than HPOF (all p-values $<$ 0.05), whereas being isolated was not significantly different between HDPE nurses and HPOF nurses. HPDE was significantly more likely to use humor, emotional support, instrumental support, self-distractions, venting, substance use, denial, behavioral disengagement, and self-blame ($P < 0.05$), whereas HPOF was significantly more likely to use active coping and acceptance ($P < 0.05$). HPDE doctors were significantly more likely than nurses to use active coping and acceptance ($P < 0.05$), whereas HPDE nurses were significantly more likely to use emotional support and use self-blame ($P < 0.05$).

Conclusion: Frontline healthcare providers who had been dispatched to the COVID-19 epicenter respondents had a higher distress level. Therefore, we should provide proactive psychological support based on specific appraisal and coping variables.

Keywords: COVID-19, distress, healthcare provider, appraisal, coping

INTRODUCTION

Coronavirus disease 2019 (COVID-19) emerged in China in December 2019 and rapidly led to a significant global health crisis (Phelan et al., 2020). Globally, as of May 11, 2021, there have been over 5.5 million confirmed cases and over 90,000 deaths (WHO, 2021). Previous studies revealed a profound and wide range of psychological distress among healthcare workers during the 2003 SARS outbreak (Wang et al., 2005). The COVID-19 pandemic has also generated widespread public panic and psychological distress among the general population and medical staff (Holmes et al., 2020; Lai et al., 2020; Fukase et al., 2021). A recent study showed that COVID-19 confirmed patients had a 33.62% incidence of neurological or psychiatric sequelae in the following six months, in which 12.84% had received their first such diagnosis (Taquet et al., 2021). In addition, frontline healthcare staff exposed to COVID-19 were at higher risk of occupational stress and psychological symptoms (Manh Than et al., 2020; Feingold et al., 2021). Some reports revealed that the increasing number of COVID-19 patients and suspected cases, exhaustion, isolation, and lack of proper psychological support could increase the emotional burden and cause high levels of distress among health workers (Bao et al., 2020; Chew et al., 2020; Holmes et al., 2020; Wang et al., 2020).

Since January 23, 2020, many frontline healthcare providers who had been dispatched to the COVID-19 epicenter (HPDE) were redeployed to Wuhan and Hubei province, where the medical system was on edge because of the severe COVID-19 epidemic (Yang et al., 2021); however, research about distress among HPDE is still rarely reported. In addition, HPDE had to work in an unfamiliar environment far away from their families and original clinical facilities, which could increase their distress levels compared with those who worked in their original medical facilities. So, it is essential to compare HPDE and frontline healthcare providers who worked in their original medical facility (HPOF) when evaluating the psychological distress of HPDE. Until we fully understand HPDE distress symptoms within the context of the COVID-19 pandemic, accurate intervention for HPDE distress symptoms cannot be properly provided. This has become a matter of urgency, as many countries are suffering second or third waves of the COVID-19 epidemic, and much medical staff needs to be redeployed (Fukase et al., 2021).

The cognitive processes of health providers who were experiencing psychological distress caused by COVID-19 have led to the current situation of evaluation (appraisal) and management (coping) (Lazarus and Folkman, 1984). Appraisal and coping are critical pathways to mitigate HPDE distress levels based on the clinical psychological model of S. Folkman (Folkman et al., 1986). That said, what are the predictor variables of appraisal and coping that can affect HPDE distress levels and what are the different effects of these predictors on HPDE and HPOF? These questions remain uncertain. So, we aimed to evaluate the extent of cognitive appraisal and coping processes within the pandemic encounter and determine their influence on HPDE distress symptoms compared with HPOF.

MATERIALS AND METHODS

Setting and Participants

The study was a cross-sectional survey using an anonymous online questionnaire "questionnaire star." Questionnaire star is an online crowdsourcing platform of China, like Amazon Mechanical Turk (Wu et al., 2018). Questionnaires access were made using Q.R. codes, and then, it was circulated to all participants *via* WeChat accounts. The participants could fill and upload the questionnaire in the WeChat app. A contact person in each medical facility was responsible for the distribution of the questionnaires. Data were collected from May 1 to May 15, 2020. The inclusion criteria were those frontline medical providers involved in managing, transferring, and caring for COVID-19 patients and willing to participate in this study. The questionnaire for HPDE had to be finished in 1 week after they arrived at their destinations. The questionnaire was in Chinese, and the return was also anonymous.

This study was approved by the hospital ethics committee.

Measure

The level of distress symptoms was measured by the Impact of Event Scale-Revised (IES-R; range, 0–88). The IES-R has been well-validated to assess the extent of psychological impact after exposure to stressful circumstances in the Chinese population (Zhang et al., 2014). Items are rated on a 5-point scale ranging from 0 ("not at all") to 4 ("extremely"). The total scores of IES-R were interpreted as normal (0–8), mild (9–25), moderate (26–43), and severe (44–88), and subscale scores can also be calculated for the intrusion, avoidance, and hyperarousal subscales (Tan et al., 2021).

Appraisals were assessed by a 19-item questionnaire which proved to be validated in a previous study on the 2003 SARS outbreak among health care workers (Wang et al., 2005). A 4-point Likert-type scale was used to rate the compatibility of each item with a current appraisal of participants (0 = cannot completely describe my situation, 1 = cannot describe my situation, 2 = can describe my situation, and 3 = can completely describe my situation). All items were grouped into six subscales (the health of self, the health of family/others, virus spread, vulnerability/loss of control, changes in work, and general health). The score of each subscale was obtained by the mean

of items scores of its subgroup. Thus, the subscale scores were identified as the current appraisal rate of participants for these six subscales.

Coping was measured using the Brief Cope questionnaire (Kato, 2015). All 28 coping methods of the questionnaire were grouped into 14 subscales (acceptance, active coping, positive reframing, planning, using emotional support, humor, using instrumental support, venting, self-distraction, religion, self-blame, denial, behavioral disengagement, and substance use). Each subscale owns two coping methods. How each item was adopted was rated by a 4-point Likert-type scale (1 = I have not been doing this at all, 2 = I have been doing this a little bit, 3 = I have been doing this a medium amount, and 4 = I have been doing this a lot). The score of each subscale was obtained by the mean of items scores of its subgroup. Thus, the subscale scores were identified as the rate of adoption of the participant for these 14 subscales.

Statistical Analysis

Statistical analyses were performed using Excel (Microsoft, Redmond, WA, U.S.A.) and Spss 23.0. Descriptive data were tested by Chi-Square (χ^2) test between groups. The reliability of the instruments of the study was evaluated using Cronbach's α coefficients. The normal distribution of the variables was tested by the Kolmogorov-Smirnov test. Normal measurement data were shown as mean and SD. The Student's t-test was used to determine whether the HPDE and HPDF or different occupations differed within each of the three sets of predictors (IES-R, appraisal, and coping). For qualitative data, the χ^2 test was used to compare the grades of IES-R in response to HPDE and HPOF groups. Multivariable linear regression with IES-R score as a dependent variable evaluates the association between HPDE distress level with appraisal and coping variables after adjusting for confounders, including age, gender, marriage, and occupation. All the tests were two-tailed, with a significance of $p < 0.05$.

RESULTS

A total of 1,262 medical staff [631 (50.0%) HPDE and 631 (50.0%) HPOF] were invited to participate in this study. In the end, 723 eligible respondents completed the survey with a response rate of 62.3%. Of all respondents, 351 (48.55%) participants were HPDE staff, and 372 (51.45%) participants were HPOF staff. In addition, 449 (62.10%) were female and 274 (37.90%) were male. Most participants were aged between 30 and 45 years [397 (54.91%)] and were married with children [503 (69.57%)]. About 314 (43.43%) participants were nurses, and 409 (56.57%) participants were doctors. There was no significant difference in characteristics between the two groups (**Table 1**).

The mean IES-R scores of HPDE respondents were 26.47 ± 11.7. Of HPDE respondents, 199 (56.70%) reported mild distress symptoms (score 9–25), 34 (9.69%) reported moderate distress symptoms (scores 26–43), and 13 (3.70%) reported severe distress symptoms (score 44–88). The scores of intrusion, avoidance, and hyperarousal for HPDE were 10.28 ± 4.7, 8.97 ± 4.3, and 7.20 ± 3.2, respectively. The HPDE had higher scores in overall distress and three subscales (intrusion, avoidance, and hyperarousal) than HPOF. The distress scores of nurses were significantly higher than the distress scores of doctors ($P < 0.05$). The nurse from HPDE had higher distress scores than the doctor from HPOF ($P < 0.05$). The effect size for overall distress and the three subscales between the HPDE and HPOF was 0.78, 0.65, 0.63, and 0.98 (Cohen's d) (**Table 2**).

The scores of HPDE were significantly higher than the scores of HPOF (all p-values < 0.05) regarding the appraisal. The effect size for all appraisal variables between HPDE and HPOF was larger than 0.5 except for being isolated (0.17) and general health (0.43). There was a significant difference in appraisal between HDPE nurses and HPOF nurses, except being isolated. The effect size of the health of self between different occupations of HPDE was larger than 0.2, the rest effect size of appraisal variables was under 0.2 (**Table 3**).

Frontline healthcare providers who had been dispatched to the COVID-19 epicenter were significantly more likely to use humor, emotional support, instrumental support, self-distractions, venting, substance use, denial, behavioral disengagement, and self-blame ($P < 0.05$). Whereas, HPOF was significantly more likely to active coping and acceptance ($P < 0.05$). The effect size of self-distractions between different occupations of HPDE was larger than 0.5 (0.55), whereas active coping, humor, emotional support, instrumental support, venting, denial, behavioral disengagement, and self-blame were in the 0.2–0.5 and religion was under 0.2.

Frontline healthcare providers who had been dispatched to the COVID-19 epicenter doctors were significantly more likely than nurses to use active coping and planning ($P < 0.05$), whereas HPDE nurses were significantly more likely to use emotional support, venting, denial, and self-distractions ($P < 0.05$). The effect size of the above variables was 0.2–0.5 except venting (0.2) (**Table 4**).

The health of self, the health of family/others, and virus spread were positively associated with HPDE level, whereas the health of self, virus spread, and being isolated were positively associated with HPOF distress level. Three coping variables (active coping, positive reframing, and emotional support) were negatively associated with the HPDE distress level, whereas only active coping was negatively associated with HPOF distress. Five coping variables (acceptance, venting, self-blame, denial, and substance abuse) were positively associated with the HPDE distress level, whereas acceptance, venting, and denial were positively associated with the HPOF distress level (**Table 5**).

DISCUSSION

In this study, nearly 60% of participants experienced psychological distress. We found that HPDE participants suffered more distress symptoms than HPOF. The result was consistent with one previous study (Lai et al., 2020). This study found that Wuhan and Hubei province healthcare workers were at especially higher risk for distress symptoms compared with others; however, the studies of health providers in this research did not consist only of HPDE but also those whose original

TABLE 1 | Characteristics of respondents.

Characteristics	HPDE *N* (%)	HPOF (*N* = 372)	χ^2	Overall *p*-value
Sex	2.753	0.097		
Men	116 (33.05%)	145 (38.98%)		
Women	235 (62.95%)	227 (61.02%)		
Ages (years)	6.694	0.082		
Below 29	145 (41.31%)	150 (40.32)		
30–45	173 (49.29%)	166 (44.62)		
46–59	33 (9.40%)	54 (14.52)		
60 and above	0 (0%)	2 (0.54%)		
Years of service	5.417	0.067		
0–4	49 (13.96%)	51 (13.71%)		
5–9	112 (31.91%)	91 (24.66%)		
10 and over	190 (54.13%)	230 (61.83%)		
Marriage status	5.090	0.165		
Unmarried	42 (11.97%)	49 (13.17%)		
Married without Child	33 (9.40%)	19 (5.11%)		
Married with Children	272 (77.49%)	299 (80.38%)		
Divorced or be widowed	4 (1.14%)	5 (1.34%)		
Occupation			1.910	0.167
Doctor	165 (47.01%)	194 (52.15%)		
Nurse	186 (52.99%)	178 (47.85%)		

HPDE, frontline healthcare providers who had been dispatched to the epicenter of coronavirus disease 2019 (COVID-19) in China; HPOF, frontline healthcare providers in the original medical facility.
P < 0.05 was considered statistically significant.

TABLE 2 | Impact Event Scale-Revised.

Variable	HPDE	HPOF	Statistics	Effect size	*p*-value
IES-R	26.47 ± 11.7	18.14 ± 10.6	10.049	0.78[c]	0.00*
Normal	109	191	41.77[b]	0.24[d]	0.00*
Mild	155	128			
Moderate	34	32			
Severe	13	21			
Subgroup					
Intrusion	10.28 ± 4,7	7.37 ± 4.2	8.774[a]	0.65[c]	0.00*
Avoidance	8.97 ± 4.3	6.39 ± 3.9	8.456[a]	0.63[c]	0.00*
Hyperarousal	7.20 ± 3.2	4.38 ± 2.6	13.128[a]	0.98[c]	0.00*

HPDE, frontline healthcare providers who had been dispatched to the epicenter of COVID-19 in China; HPOF, frontline healthcare providers in the original medical facility.
[a] χ^2*-value.*
[b] *t-value.*
[c] *Cohen's d.*
[d] *Cramer's V.*
[*] *P < 0.05 was considered statistically significant.*

working facilities were located in Wuhan and Hubei province. As they were working in an unfamiliar environment and far away from their families and original clinical facilities, HPDE had to face the stress of local health workers, an unfamiliar medical specialty, and being away from their families. We infer that the severity of HPDE distress symptoms was neglected before and was also underestimated. Furthermore, the magnitude of the effects of the HPDE on three subscales was not the same. The hyperarousal effect was greater than the other two variables, possibly because HPDE also lacked sufficient knowledge about the virus at the beginning of the pandemic, especially when entering unfamiliar environments. That is why many HPDE suffered more hyperarousal symptoms.

Studies have shown that job-related distress of healthcare workers was mainly associated with their health and the fear of infecting their families, social isolation, uncertainty, reluctance to work, and other appraisals (Barello et al., 2020). In this study, with regards to their distress symptoms, HPDE was mainly

TABLE 3 | Appraisal.

Variable	Working Position					Occupation of HPDE				
	HPDE	HPOF	Cohen's d	*t*-value	*p*-value	Doctor	Nurse	Cohen's d	*t*-value	*p*-value
Health of self	2.73 ± 0.5	2.26 ± 0.5	0.87	11.71	0.00*	2.64 ± 0.5	2.80 ± 0.5	0.22	−2.94	0.00*
Health of family/others	2.92 ± 0. 6	2.47 ± 0.6	0.79	10.67	0.00*	2.85 ± 0.6	2.99 ± 0.6	0.17	−2.34	0.00*
Virus spread	3.01 ± 0.6	2.54 ± 0.6	0.80	10.72	0.00*	2.93 ± 0.6	3.00 ± 0.5	0.18	−2.46	0.00*
Vulnerability orloss of control	2.64 ± 0.6	2.26 ± 0.6	0.63	8.48	0.00*	2.61 ± 0.5	2.67 ± 0.6	0.07	−0.92	0.00*
Changes in work	2.41 ± 0.6	1.98 ± 0.6	0.68	9.22	0.00*	2.30 ± 0.6	2.51 ± 0.7	0.25	−3.32	0.00*
Being isolated	2.30 ± 0.7	2.19 ± 0.7	0.17	2.34	0.02*	2.26 ± 0.7	2.34 ± 0.7	0.10	−1.30	0.19

*HPDE, frontline healthcare providers who had been dispatched to the epicenter of COVID-19 in China; HPOF, frontline healthcare providers in the original medical facility. Scores ranged from 0 to 3 of the first six dimensions, the score of general health ranged from 1 to 4. Scores were shown as Mean ± SD. *P < 0.05 was considered statistically significant. Reliabilities (Cronbach's α) for the above six dimensions were 0.83, 0.82, 0.83, 0.85, 0.83, and 0.85.*

TABLE 4 | Coping.

Variable	Working place					0ccupation Of HPDE				
	HPDE	HPOF	Cohen's d	*t*- value	*p*-value	Doctor	Nurse	Cohen's d	*t*- value	*p*-value
Acceptance	3.49 ± 0.6	3.60 ± 0.5	0.19	−2.49	0.01*	3.57 ± 0.5	3.42 ± 0.6	0.17	2.28	0.23
Active coping	3.57 ± 0.6	3.71 ± 0.6	0.25	−3.31	0.00*	3.67 ± 0.6	3.48 ± 0.7	0.30	3.95	0.00*
Positive reframing	3.27 ± 0.7	3.32 ± 0.7	0.07	−0.88	0.38	3.29 ± 0.7	3.26 ± 0.7	0.02	−0.30	0.77
Planning	3.23 ± 0.7	3.30 ± 0.8	0.10	−1.40	0.16	3.35 ± 0.7	3.11 ± 0.77	0.32	4.36	0.00*
emotional support	1.35 ± 0.6	1.20 ± 0.5	0.32	4.29	0.00*	1.25 ± 0.6	1.44 ± 0.7	0.31	−4.15	0.00*
Humor	1.67 ± 0.74	1.43 ± 0.7	0.35	4.68	0.00*	1.74 ± 0.8	1.61 ± 0.7	0.12	1.55	0.12
instrumental support	2.44 ± 0.8	2.30 ± 0.8	0.17	2.33	0.02*	2.41 ± 0.8	2.48 ± 0.8	0.20	−2.70	0.01
Venting	2.25 ± 0.8	1.92 ± 0.7	0.44	5.90	0.00*	2.22 ± 0.8	2.28 ± 0.8	0.02	−0.32	0.00*
Self-distraction	2.87 ± 1.0	2.30 ± 1.1	0.55	7.45	0.00*	2.76 ± 1.0	2.97 ± 1.0	0.41	−5.49	0.00*
Religion	1.67 ± 0.6	1.58 ± 0.6	0.16	2.18	0.03*	1.67 ± 0.7	1.67 ± 0.6	0.13	−1.70	0.10
Self-blame	1.71 ± 0.7	1.57 ± 0.6	0.22	2.90	0.00*	1.61 ± 0.7	1.82 ± 0.8	0.14	1.86	0.06
Denial	2.43 ± 0.9	2.15 ± 0.9	0.32	4.29	0.00*	2.36 ± 1.0	2.48 ± 0.9	0.29	−3.95	0.00*
Behavioral disengagement	1.22 ± 0.5	1.11 ± 0.4	0.26	3.43	0.00*	1.18 ± 0.5	1.25 ± 0.5	0.13	−1.34	0.18
Substance use	1.29 ± 0.6	1.16 ± 0.4	0.25	3.35	0.00*	1.34 ± 0.7	1.26 ± 0.6	0.13	1.24	0.22

HPDE, frontline healthcare providers who had been dispatched to the epicenter of COVID-19 in China; HPOF, frontline healthcare providers in the original medical facility. Scores ranged from 1 to 4. Scores were shown as Mean ± SD.
**P < 0.05 was considered statistically significant.*
Reliabilities (Cronbach's α) for the above 14 dimensions were (0.73, 0.73, 0.73, 0.73, 0.70, 0.73,0.69,0.70,0.72,0.72,0.72,0.73,0.73, and 0.73).

concerned with the health of self and family/others and virus spread, whereas health of self, virus spread, and being isolated was the concerns of HPOF. These results were consistent with the previous study, revealing that health and safety were the main concerns of the staff among the various appraisals related to the epidemic outbreak (Khalid et al., 2016). There were greater concerns of all six appraisals among HPDE than HPOF, which was also evident for worse distress symptoms of HPDE.

However, HPDE was more concerned about the health of family/others than being isolated, whereas HPOF was more concerned about being isolated (**Table 5**). The underlying cause may be that while providing medical assistance in Hubei province, most healthcare HPDE stayed together when working or resting; however, they also had no contact with their families. This feature of HPDE could decrease the worry of being an isolated factor and increase families/others. HPDE nurses were more worried in all six appraisals than doctors in the HPDE subgroup, indicating that nurses were suffering more distress than doctors (Folkman, 1986; Mosheva et al., 2020). This was also consistent with the IES-R scores. Therefore, more assistance should be provided to HPDE nurses to alleviate their distress symptoms.

Overall, coping might adversely affect distress symptoms (Mosheva et al., 2020); however, not all the coping variables are negatively correlated with HPDE distress. Previous studies revealed that planful problem-solving coping was negatively correlated with symptoms, whereas confrontive coping was positively correlated (Folkman, 1986). In this study, HPDE adopted more planful problem-solving copings and less confrontive coping than HPOF (**Table 4**). HPDE was supposed to have fewer distress symptoms compared with HPOF based on the above coping theory; however, HPDE had higher distress scores in this study. The reason is that HPDE encountered more stress and lacked sufficient approaches to problem-solving

TABLE 5 | Association between IES-R scores with appraisal and coping variables, in multivariable linear regression analysis with IES-R as dependent variable ($N = 723$).

Adjust	HPDE		HPOF	
Predictor variable	**β (95%CI)**	***p*-value**	**β (95%CI)**	***p*-value**
Appraisal				
Health of self	1.82 (0.26, 3.37)	0.02*	1.20 (−0.11, 2.51)	0.07
Health of family/others	2.43 (0.48, 4.38)	0.02*	1.58 (−0.39, 3.56)	0.12
Virus spread	3.92 (1.49, 6.34)	0.00*	4.85 (1.70, 8.00)	0.00*
Vulnerability or loss of control	0.28 (−1.49, 2.06)	0.76	0.24 (−1.24, 1.73)	0.75
Changes in work	1.15 (−0.08, 2.39)	0.07	1.00 (−0.06, 2.06)	0.07
Being isolated	0.73 (−1.72, 3.19)	0.56	2.65 (0.34, 4.95)	0.02*
Coping				
Acceptance	2.13 (0.04, 4.22)	0.04*	1.63 (0.39, 2.87)	0.01*
Active coping	−2.28 (−3.63, −0.93)	0.00*	−1.58 (−3.08, −0.08)	0.04*
Positive reframing	−2.08 (−3.45, −0.71)	0.00*	−1.49 (−3.00, 0.02)	0.05
Planning	0.28 (−1.49, 2.06)	0.76	0.24 (−1.24, 1.73)	0.75
emotional support	−1.16 (−2.27, −0.05)	0.04*	−0.07 (−2.10, 1.95)	0.94
Humor	0.28 (−1.64, 2.20)	0.77	−0.02 (−1.62, 1.58)	0.98
instrumental support	1.23 (−1.60, 4.07)	0.39	0.05 (−1.98, 2.09)	0.96
Venting	3.55 (2.06, 5.04)	0.00*	2.39 (0.87, 3.92)	0.00*
Self-distraction	−0.71 (−2.77, 1.35)	0.50	1.24 (−0.64, 3.11)	0.20
Religion	0.85 (−1.10, 2.80)	0.40	−0.66 (−3.19, 1.88)	0.61
Self-blame	2.97 (1.26, 4.68)	0.00*	1.66 (−0.13, 3.46)	0.07
Denial	2.24 (0.25, 4.23)	0.03*	2.20 (−0.09, 4.50)	0.06
Behavioral disengagement	−0.18 (−2.36, 2.00)	0.87	0.86 (−0.97, 2.69)	0.36
Substance use	2.43 (0.48, 4.38)	0.02*	1.58 (−0.39, 3.56)	0.12

HDPE, frontline healthcare providers who had been dispatched to the epicenter of COVID-19 in China; β, standardized β coefficient; CI, confidence interval.
Adjust the model for age, sex, marriage, and occupation.
**P < 0.05 was considered statistically significant.*

coping. Active coping and planning were adopted more by HPDE doctors. On the contrary, self-blame, venting, denial, and emotional were more adopted by HPDE nurses, which revealed that HPDE nurses used more confrontive coping than HPDE doctors and consequently had higher distress levels. The cause might be that the duties of the doctors were to provide treatment based on updated medical information, so they had better access to the latest COVID-19 information.

Among the coping strategies, positive reframing, emotional support, self-blame, and substance abuse could influence HDPE distress symptoms positively or negatively, whereas active coping, acceptance, and venting could influence both HDPE and HPOF. A possible interpretation of this finding is that HPDE needs more assistance to relieve their distress symptoms, and such assistance would be of more benefit to their distress symptoms as the β value of the above coping variables was larger in HPDE groups than in the HPOF groups. Thus, theoretically, more distress symptoms will be relieved in HPDE when one specific coping strategy is improved.

Many studies have reported that positive coping or other practices could relieve the psychological impact (Zaçe et al., 2021). The same finding was noticed in this study, improving active coping skills and other planful problem-solving coping support measures and decreasing the self-blame influence of distress symptoms on HPDE will be useful; however, HPDE nurses need more support to manage these confrontive coping influences.

This study has several strengths. First, it is a comprehensive study of cognitive appraisal and the coping processes encountered during the pandemic, and it analyzes their influence on distress symptoms among HPDE, who have been mostly neglected. Second, the survey began during the peak of the COVID-19 outbreak in China. So, the timing of this study allowed healthcare providers to describe their acute distress symptoms and current appraisal and coping mechanisms; however, this study still has several limitations. First, the surveys for the HPDE and HPOF groups were not conducted at the same time. Therefore, the impact of COVID-19 on each group may differ. Second, the questionnaire used to measure the appraisal had not been fully validated, as it was only used in the SARS epidemic in 2003. Finally, there could be a potential reporting bias since medical staff might under-report their distress levels during the global pandemic.

CONCLUSION

We believe that COVID-19 provoked a high level of distress among HPDE. Furthermore, the relations between appraisal variables and planful problem-solving coping were positively

correlated with distress levels among HPDE, whereas confrontive coping was negatively correlated. Therefore, we should plan ahead of a medical assistance mission to provide proactive psychological support to frontline medical staff, based on the nature of the mission and specific appraisal and coping variables.

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 Shenzhen University General Hospital. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

ZJ and KL drafted the manuscript. ZJ collected the epidemiological and clinical data. KL is responsible for summarizing all clinical data. ZD and WH revised the final manuscript. All authors contributed to the article and approved the submitted version.

FUNDING

This research was funded by the Sanming Project of Medicine in Shenzhen (No: SZSM201911007).

REFERENCES

Bao, Y., Sun, Y., Meng, S., Shi, J., and Lu, L. J. L. (2020). 2019-nCoV epidemic: address mental health care to empower society. *Lancet* 395, e37–e38. doi: 10.1016/S0140-6736(20)30309-3

Barello, S., Falcó-Pegueroles, A., Rosa, D., Tolotti, A., Graffigna, G., and Bonetti, L. (2020). The psychosocial impact of flu influenza pandemics on healthcare workers and lessons learnt for the COVID-19 emergency: a rapid review. *Int. J. Public Health* 65, 1205–1216. doi: 10.1007/s00038-020-01463-7

Chew, N., Ngiam, J., Tan, B., Tham, S., Tan, C., Jing, M., et al. (2020). Asian-Pacific perspective on the psychological well-being of healthcare workers during the evolution of the COVID-19 pandemic. *BJPsych Open* 6:e116. doi: 10.1192/bjo.2020.98

Feingold, J., Peccoralo, H. L., Chan, C. C., Kaplan, C. A., Kaye-Kauderer, H., Charney, D., et al. (2021). Psychological impact of the COVID-19 pandemic on frontline health care workers during the pandemic surge in New York City. *Chronic Stress* 5:2470547020977891. doi: 10.1177/24705470209 77891

Folkman, S., Lazarus, R. S., Gruen, R. J., and Delongis, A. J. J. o.P.S. (1986). Appraisal, coping, health status, and psychological symptoms. *Psychology* 50, 571–579. doi: 10.1037/0022-3514.50.3.571

Folkman, S. J. J. o. P. (1986). Dynamics of a stressful encounter: cognitive appraisal, coping, and encounter outcomes. *Psychology* 50, 992–1003. doi: 10.1037/0022-3514.50.5.992

Fukase, Y., Ichikura, K., Murase, H., and Tagaya, H. J. B. p. (2021). Depression, risk factors and coping strategies in the context of social dislocations resulting from the second wave of COVID-19 in Japan. *BMC Psychiatry* 21:33. doi: 10.1186/s12888-021-03047-y

Holmes, E., O'Connor, A. R. C., Perry, V., Tracey, H., Wessely, I., Arseneault, S., et al. (2020). Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science. *Lancet Psychiatry* 7, 547–560. doi: 10.1016/S2215-0366(20)30168-1

Kato, T. (2015). Frequently used coping scales: a meta-analysis. *Stress Health J. Int. Soc. Investig. Stress* 31, 315–323. doi: 10.1002/smi. 2557

Khalid, I., Khalid, T. J., Qabajah, M. R., Barnard, A. G., and Qushmaq, I. A. (2016). Healthcare workers emotions, perceived stressors and coping strategies during a MERS-CoV outbreak. *Clin. Med. Res.* 14, 7–14. doi: 10.3121/cmr.2016. 1303

Lai, J., Ma, S., Wang, Y., Cai, Z., Hu, J., Wei, N., et al. (2020). Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. *J. Am. Med. Assoc. Netw. Open* 3:e203976. doi: 10.1001/jamanetworkopen.2020.3976

Lazarus, R.S., and Folkman, S. (1984). *Research and Therapy, Stress, Appraisal, and Coping*. New York, NY: Springer, 445.

Manh Than, H., Minh Nong, V., Trung Nguyen, C., Phu Dong, K., Ngo, H. T., Thu Doan, T., et al. (2020). Mental health and health-related quality-of-life outcomes among frontline health workers during the peak of COVID-19 outbreak in Vietnam: a cross-sectional study. *Risk Manag. Healthcare Pol.* 13, 2927–2936. doi: 10.2147/RMHP.S28 0749

Mosheva, M., Hertz-Palmor, N., Dorman Ilan, S., Matalon, N., Pessach, I., Afek, A., et al. (2020). Anxiety, pandemic-related stress and resilience among physicians during the COVID-19 pandemic. *Depress Anxiety* 37, 965–971. doi: 10.1002/da.2 3085

Phelan, A., Katz, R., and Gostin, L. J. J. (2020). The novel coronavirus originating in Wuhan, China: challenges for global health governance. *J. Am. Med. Assoic.* 323, 709–710. doi: 10.1001/jama.2020.1097

Tan, Y. Q., Wang, Z., Yap, Q. V., Chan, Y. H., Ho, R. C., Hamid, A., et al. (2021). Psychological health of surgeons in a time of COVID-19: a global survey. *Ann. Surg.* 2021:4775. doi: 10.1097/SLA.000000000000 4775

Taquet, M., Geddes, J., Husain, R., Luciano, M. S., and Harrison, P. J. (2021). 6-month neurological and psychiatric outcomes in 236,379 survivors of COVID-19: a retrospective cohort study using electronic health records. *Lancet Psychiatry* 8, 416–427. doi: 10.1016/S2215-0366(21)00084-5

Wang, S., Wen, X., Dong, Y., Liu, B., and Cui, M. (2020). Psychological influence of coronovirus disease 2019 (COVID-19) pandemic on the general public, medical workers, and patients with mental disorders and its countermeasures. *Psychosomatics* 61, 616–624. doi: 10.1016/j.psym.2020. 05.005

Wang, T. W., Yau, J. K. Y., Chan, C. L. W., Kwong, R. S. Y., Ho, S. M. Y., Lau, C. C., et al. (2005). The psychological impact of severe acute respiratory syndrome outbreak on healthcare workers in emergency departments and how they cope. *J. Eur. J. Emerg. Med.* 12, 13–18. doi: 10.1097/00063110-200502000-0 0005

WHO (2021). *Coronavirus Disease (COVID-19) Situation Report – Data as received by WHO from national authorities, as of 10am C.E.T. May 9*. doi: 10.46945/bpj.10.1.03.01

Wu, S. J., Bai, X., and Fiske, S. T. J. J. o.C. C.P. (2018). Admired rich or resented rich? How two cultures vary in envy. *J. Cross Cult. Psychol.* 49, 1114–1143. doi: 10.1177/002202211877 4943

Yang, G., Li, C., Zhu, X., Yan, J., and Liu, J. (2021). Prevalence of and risk factors associated with sleep disturbances among HPCD exposed to COVID-19 in China. *Sleep Med.* 80, 16–22. doi: 10.1016/j.sleep.2020.1 2.034

Zaçe, D., Hoxhaj, I., Orfino, A., Viteritti, A. M., Janiri, L., and Di Pietro, M. L. (2021). Interventions to address mental health issues in

healthcare workers during infectious disease outbreaks: a systematic review. *J. Psychiatric Res.* 136, 319–333. doi: 10.1016/j.jpsychires.2021.02.019

Zhang, M. W., Ho, C., Fang, P., Lu, Y., and Ho, R. C. (2014). Usage of social media and smartphone application in assessment of physical and psychological well-being of individuals in times of a major air pollution crisis. *JMIR mHealth uHealth* 2:e16. doi: 10.2196/mhealth.br2827

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's Note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

frontiers in Psychology

ORIGINAL RESEARCH
published: 05 August 2021
doi: 10.3389/fpsyg.2021.669833

Depression, Anxiety, and Suicidal Ideation in Chinese University Students During the COVID-19 Pandemic

Shuang-Jiang Zhou[1†], Lei-Lei Wang[1†], Meng Qi[2], Xing-Jie Yang[1], Lan Gao[1], Suo-Yuan Zhang[1], Li-Gang Zhang[1], Rui Yang[3] and Jing-Xu Chen[1]*

[1] Beijing HuiLongGuan Hospital, Peking University HuiLongGuan Clinical Medical School, Beijing, China, [2] Department of Psychology, Chengde Medical University, Chengde, China, [3] Beijing Anding Hospital, Capital Medical University, Beijing, China

OPEN ACCESS

Edited by:
Jason H. Huang,
Baylor Scott and White Health,
United States

Reviewed by:
Mario Miniati,
University of Pisa, Italy
Hongyu Xu,
Virginia Commonwealth University,
United States

***Correspondence:**
Jing-Xu Chen
chenjx1110@163.com

[†] These authors have contributed equally to this work and share first authorship

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: 23 February 2021
Accepted: 19 July 2021
Published: 05 August 2021

Citation:
Zhou S-J, Wang L-L, Qi M, Yang X-J, Gao L, Zhang S-Y, Zhang L-G, Yang R and Chen J-X (2021) Depression, Anxiety, and Suicidal Ideation in Chinese University Students During the COVID-19 Pandemic. Front. Psychol. 12:669833. doi: 10.3389/fpsyg.2021.669833

Coronavirus disease-2019 (COVID-19) pandemic has seriously threatened the global public health security and caused a series of mental health problem. Current research focuses mainly on mental health status and related factors in the COVID-19 pandemic among Chinese university students. Data from 11133 participants was obtained through an online survey. The Patient Health Question-9 (PHQ-9) was used to assess depressive symptoms, the Social Support Rate Scale (SSRS) was used to assess social support. We also used 7-item Generalized Anxiety Disorder Scale (GAD-7) to assess anxiety symptoms. Totally, 37.0% of the subjects were experiencing depressive symptoms, 24.9% anxiety symptoms, 20.9% comorbid depressive and anxiety symptoms, and 7.3% suicidal ideation. Multivariable logistic regression analysis revealed an increased presence of mental health problems in female students, graduate students, and those with personal COVID-19 exposure. Awareness of COVID-19, living with family were protective factors that reduced anxiety and depression symptoms. In addition, male, personal COVID-19 exposure, depressive and anxiety symptoms were risk factors for suicidal ideation. Social support, COVID-19 preventive and control measures, prediction of COVID-19 trends, living with family and graduate students are protective factors for reducing suicidal ideation.

Keywords: COVID-19, depressive symptoms, anxiety symptoms, suicidal ideation, social support

INTRODUCTION

Coronavirus disease-2019 (COVID-19) is an acute respiratory infection disease caused by severe respiratory syndrome coronavirus 2 (SARS-CoV-2). It is characterized by developing rapidly, widespread, and strong infectivity, and lack of specific treatment (Chan et al., 2020). The global COVID-19 epidemic is now nearly 1 year, with the coming of autumn and winter, COVID-19 is now worsening again in many countries. The COVID-19 epidemic has also caused many mental health problems (Bao et al., 2020). Since the COVID-19 outbreak, studies have shown that a high percentage of children, adolescents, and adults have psychological problems, such as suicidal tendencies, sleep disruption, anxiety, depression, and behavioral problems (Altena et al., 2020; Li et al., 2020; Liu et al., 2020; Purtle, 2020; Yang et al., 2020; Zhou et al., 2020). Some experts especially

highlighted the urgency and importance of evaluating and managing mental health problems during the COVID-19 pandemic (Chenneville and Schwartz-Mette, 2020; Lai et al., 2020; Wang Y. et al., 2020). Social support is a resource in social relationships that may buffer or mitigate the effects of life events and other stressors (Kessler et al., 1985). Studies have shown that social support is associated with suicidal thoughts, anxiety, and depressive symptoms (Amit et al., 2020). High levels of social support can reduce suicidal ideation (Bi et al., 2020).

University students undergo a critical transition as they become independent and responsible for their own health during university years (Kim et al., 2018), and experience higher psychological stress levels (e.g., academic pressure, living conditions, financial situation) than their peers in the general population (Auerbach et al., 2018; Recabarren et al., 2019). University life is the peak period for the first onset of common mental disorders such as anxiety, depression and insomnia (Auerbach et al., 2018). This has brought a lot of troubles to university students, seriously affecting their social functions, study and life (Beiter et al., 2015; Scanlan and Hazelton, 2019; Jenkins et al., 2020). In addition, suicidal ideation are also common among university students (Lew et al., 2020). The anxiety and depression symptoms in college students are related to stress factors such as earthquakes, floods and epidemics (Huang et al., 2003; Li et al., 2003, 2011). University students' mental health problems have increased significantly during the outbreak of infectious diseases such as influenza A (H1N1) (Kanadiya and Sallar, 2011; Main et al., 2011).

During the outbreak of COVID-19, university students' education, including university studies and internship, was completed halted, which implies long hours at home and can lead to disordered rhythms of life and irregular sleep patterns. Moreover, the pandemic has brought the risk of infection and death. These may be traumatic experiences and have a psychological impact on this population. There have been no studies on anxiety, depressive symptoms, suicidal thoughts and social support among college students in China.

Since Chinese university students have been exposed to a persistent source of distress during the public health emergency, it is imperative to evaluate and respond to their mental health issues. But there have been no studies on anxiety, depressive symptoms, suicidal thoughts and social support among college students in China. For this purpose, the prevalence and potential factors contributing to depressive and anxiety symptoms, suicidal ideation, social supporting were detected.

MATERIALS AND METHODS

Participants

This research was a cross-sectional study, students were invited to complete a battery of online questionnaires through the Wenjuanxing platform from March 1 to 15, 2020. Inclusion criteria were full-time university students, including undergraduate and graduate students, living in mainland China, equal to or greater than 18 years of age. Participants who failed to complete the questionnaire were excluded from the study. Students signed online informed consent before participating in the study. The study was also approved by the Ethics Committee of Beijing Huilongguan Hospital.

Procedure

Sociodemographic Factors

Demographic information, including gender, region, grade, and whether living with family were collected.

Assessment of COVID-19 Exposure and Awareness of COVID-19

Individual COVID-19 exposure was defined as a person who has been diagnosed with COVID-19, or a person who has a history of close contact with a COVID-19 patient in a mandatory isolation or medical observation. We used a self-made questionnaire to investigate university students' awareness of COVID-19. The questionnaire consisted of three main questions. The first question is about whether the subject is familiar with COVID-19. We asked the subject whether he/she has taken preventive and control measures to prevent COVID-19 infection for the second question. The final question asked the subject about his/her attitude toward the prediction of COVID-19 trends. The score for all the questions were ranged from 1 to 5.

Assessment of Depressive Symptoms

We used the Chinese version of the 9-item Patient Health Questionnaire (PHQ-9) to assess the severity depressive symptoms (Spitzer et al., 1999). The questionnaire consists of 9 items, For each item, the answer consists of four choices: Not at all, several days, more than a week, and almost every day. The corresponding score is 0, 1, 2, and 3. The symptom severity is determined by the total score, with 5–9 being mild, 10–14 being moderate, 15–19 being moderately severe, and 20–27 being severe.

Assessment of Anxiety Symptoms

We used Chinese version of the 7-item Generalized Anxiety Scale (GAD-7) to assess participants' anxiety symptoms (Spitzer et al., 2006), with symptom prevalence on a scale from 0 (not at all) to 3 (nearly every day). The symptom severity is determined by the total score, with 5–9 being mild, 10–14 being moderate, and 15–21 being severe.

Assessment of Suicidal Ideation

Suicidal ideation among college students was assessed by single item (item 9) of PHQ-9, which asked participants how often they thought they would be better off dead. Suicidal ideation is divided into four grades: From 0 (not at all) to 3 (nearly every day). The higher the level, the more serious the suicidal ideation.

Assessment of Social Support

The social support scale developed by Xiao Shuiyuan was used to evaluate the social support of college students. There are 10 items in this scale, including subjective support, objective support and utilization of support. A higher score indicates a higher level of social support or utilization. Previous studies have shown that the social support scale has good reliability and validity (Shuiyuan, 1987).

Data Analysis

We used SPSS 24.0 for data analysis. We use percentages to show the proportion of depression symptoms, anxiety symptoms, suicidal ideation. The chi-square test was used to analyze the categorical variables. Logistic regression was used to explore the predictors of depressive or anxiety symptoms, and suicidal ideation. The level of significance was set at $p < 0.05$ (two-sided).

We used the Process macro program in SPSS to conduct the mediation effect analysis. In the mediating effect model, whether there is COVID-19 exposure is an independent variable, suicide concept is a dependent variable, subjective support and objective support are mediators. The results of the mediation analysis are presented in the form of plots. We used bootstrap to test the mediating effect. The sample size was set to 5,000, and the 95% confidence interval of indirect effect did not include zero, indicating that the mediating effect was significant.

RESULTS

A total of 11,372 participants completed the online questionnaires. After removing those answering less than 3 min or living abroad, 11,133 participants (18–35 years old, median = 21) from 31 provincial-level regions of mainland China, except Macau and Hong Kong, were involved in the current study, giving a response prevalence of 97.9%. **Table 1** shows that 62.3% of the participants were female, 56.4% were urban residents, 90.3% were graduate students, 95.5% were living with their families, and 7.2% had exposure to COVID-19.

A total of 37.0% participants experienced mild to severe depressive symptoms, 24.9% experienced mild to severe anxiety symptoms, and the comorbidity prevalence of depressive and anxiety symptoms was 20.9%. Moreover, 7.3% of the students had suicidal ideation. The distribution of age among the three groups: With and without symptoms of depression, with and without symptoms of anxiety, with and without suicidal thoughts was non-normal ($P < 0.001$ for all Kolmogorov-Smirnova tests), so the Non-parametric Mann-Whitney test was used to compare the ages of all three groups. But only the group with anxiety symptoms was older than those without anxiety symptoms group ($P < 0.001$). As shown in **Table 1**, there were no differences in depressive and anxiety symptoms, suicidal ideation among university students between different regions. The proportion of depressive symptoms and anxiety symptoms among female students was higher than male students (38.9 vs. 33.9%; 26.1 vs. 22.8%). But the proportion of suicidal ideation for male students was higher than female students (8.1 vs. 6.8%). Depressive and anxiety symptoms were more likely to occur in graduate students than in undergraduates (41.2 vs. 36.5%; 29.6 vs. 24.3%), but there was no difference between undergraduate and graduate students for suicidal ideation. The differences in depressive and anxiety symptoms, suicidal ideation between students living with and without their families were statistically significant (53.3 vs. 36.2%; 42.6 vs. 24.0%; 19.6 vs. 6.7%). Students with COVID-19 exposure reported more depressive and anxiety symptoms, suicidal ideation than those without COVID-19 exposure (46.1 vs. 36.3%; 34.0 vs. 24.1%; 10.5 vs. 7.0%).

As shown in **Table 2**, The higher scores of COVID-19 awareness, preventive and control measures, and COVID-19 trend prediction scores, the lower proportion of anxiety symptoms, depression symptoms, and suicidal ideation.

Table 3 multivariable logistic regression showed that there was an increased presence of depressive and anxiety symptoms in female students (OR_D = 1.24, 95% CI: 1.14–1.34; OR_A = 1.21, 95% CI: 1.11–1.33), graduate students (OR_D = 1.14, 95% CI: 1.00–1.30; OR_A = 1.18, 95% CI: 1.02–1.346), and those with COVID-19 exposure (OR_D = 1.42, 95% CI: 1.22–1.65; OR_A = 1.51, 95% CI: 1.29–1.76). We found that college students living with their parents (OR_D = 0.52, 95% CI: 0.44–0.63; OR_A = 0.46, 95% CI: 0.38–0.55), being familiar with COVID-19 (OR_D = 0.85, 95% CI: 0.81–0.89; OR_A = 0.92, 95% CI: 0.87–0.97), actively taking preventive and control measures (OR_D = 0.88, 95% CI: 0.84–0.92; OR_A = 0.87, 95% CI: 0.83–0.91), and being optimistic about projections of COVID-19 trends (OR_D = 0.71, 95% CI: 0.67–0.74; OR_A = 0.67, 95% CI: 0.63–0.70) were protective factors for depressive symptoms and anxiety symptoms. As for suicidal ideation, multivariable logistic regression showed that depressive (OR = 10.62, 95% CI: 7.84–14.38) and anxiety symptoms (OR = 5.56, 95% CI: 4.53–6.81) were risk factors. And female students (OR = 0.72, 95% CI: 0.61–0.84), graduate students (OR = 0.74, 95% CI: 0.57–0.97), living with family (OR = 0.48, 95% CI: 0.37–0.64), preventive and control measures (OR = 0.86, 95% CI: 0.75–0.91), and projections of COVID-19 trends (OR = 0.83, 95% CI: 0.60–0.71).

Linear regression showed that COVID-19 exposure was negatively correlated with subjective support, objective support, and suicidal thoughts. There was also a negative correlation between subjective support, objective support, and suicidal thoughts. Based on the regression results, we established a mediating effect model. As shown in **Figures 1**, **2** (models 1 and 2), the indirect effects between COVID-19 exposure and suicidal ideation through objective support, subjective support were significant, suggesting that models 1 and 2 were full mediation models.

DISCUSSION

Emotional problems are the most common psychological symptoms in university students (Auerbach et al., 2016), which may further increase during public health emergencies (Cao et al., 2020). This survey indicated the following main findings. Firstly, among university students in mainland China during the COVID-19 pandemic, 37.0% experienced depressive symptoms, 24.9% experienced anxiety symptoms, and 20.9% experienced comorbidity depressive and anxiety symptoms. Secondly, female gender, being a graduate, and personal COVID-19 exposure were independent risk factors and living with family was an independent protective factor for developing depressive and anxiety symptoms. Thirdly, awareness of COVID-19 is an important factor in reducing anxiety and depression symptoms, and suicide ideation.

In general, the prevalence of depressive and anxiety symptoms demonstrated in this study is clearly much higher than that

TABLE 1 | Socio-demographic characteristics and association with depressive and anxiety symptoms.

Variables	n	%	Depressive symptoms			Anxiety symptoms			Suicidal ideation		
			N	%	*P*	n	%	*P*	n	%	*p*
Gender					<0.001			<0.001			0.007
Male	4,195	37.7	1,424	33.9		956	22.8		341	8.1	
Female	6,938	62.3	2,695	38.8		1,811	26.1		469	6.8	
Region					0.165			0.866			0.080
Urban resident	6,284	56.4	2,360	37.6		1,558	24.8		481	7.7	
Rural resident	4,849	43.6	1,759	36.3		1,209	24.9		329	6.8	
Grade					0.003			<0.001			0.958
Undergraduates	10,053	90.3	3,674	36.5		2,477	24.3		731	7.3	
Graduate students	1,080	9.7	445	41.2		320	29.6		79	7.3	
Living with family					<0.001			<0.001			<0.001
Yes	10,628	95.5	3,850	36.2		2,552	24.0		711	6.7	
No	505	4.5	269	53.3		215	42.6		99	19.6	
COVID-19 exposure					<0.001			<0.001			<0.001
Yes	801	7.2	369	46.1		272	34.0		84	10.5	
No	10,332	82.8	3,750	36.3		2,495	24.1		726	7.0	
Total	11,133	100	4,119	37.0		2,767	24.9		810	7.3	

TABLE 2 | The relationship between COVID-19 awareness and depressive and anxiety symptoms.

Variables	n	%	Depressive symptoms			Anxiety symptoms			Suicidal ideation		
			n	%	*P*	n	%	*P*	n	%	*P*
COVID-19 knowledge					<0.001			<0.001			<0.001
Very unfamiliar	128	1.1	66	51.6		45	35.2		23	18.0	
Unfamiliar	1,606	14.4	674	42.0		440	27.4		132	8.2	
Medium level	4,713	42.3	1,836	39.0		1,203	25.5		361	7.7	
Familiar	3,777	33.9	1,290	34.2		908	24.0		226	6.0	
Very familiar	909	8.2	253	27.8		171	18.8		68	7.5	
Preventive and control measures					<0.001			<0.001			<0.001
Very inconsistent	202	1.8	68	33.7		53	26.2		22	10.9	
Inconsistent	462	4.1	196	42.4		462	27.1		42	9.1	
Neutral	899	8.1	409	45.5		304	33.8		103	11.5	
Consistent	5,909	53.1	2,300	38.9		2,536	26.0		449	7.6	
Very consistent	3,661	32.9	1,146	31.3		749	20.5		194	5.3	
Projections of COVID-19 trend					<0.001			<0.001			<0.001
Very pessimistic	99	0.9	49	49.5		42	42.4		19	19.2	
Pessimistic	734	6.6	397	54.1		306	41.7		101	13.8	
Neutral	2,660	23.9	1,162	43.7		823	30.9		266	10.0	
Optimistic	6,434	57.8	2,209	34.3		1,410	21.9		373	5.8	
Very optimistic	1,206	10.8	302	25.0		186	15.4		51	4.2	

in most previous studies during non-pandemic periods. For example, a meta-analysis, involving 39 studies with 32694 Chinese university students, indicated that the prevalence of depressive symptoms was 23.8% (95% CI: 19.9–28.5%) (Lei et al., 2016). Studies have shown that about 10% of undergraduate and graduate students report significant anxiety symptoms during their school years (Eisenberg et al., 2013; Auerbach et al., 2016). However, a relatively high prevalence of depressive and anxiety symptoms has also been observed in individual studies (Othman et al., 2019). On further analysis of the severity of mental health problems, it was found that mild depressive and anxiety symptoms were most common. In addition to anxiety and depression symptoms, college students' suicidal ideation during the COVID-19 epidemic should also be concerned. Studies have shown that during the COVID-19 epidemic, the public has a high rate of suicidal ideation due to factors such as unemployment, home isolation, anxiety, depression, and insomnia symptoms (Bryan et al., 2020; Kawohl and Nordt, 2020; Li et al., 2020). But there have been no studies of college students. So it is worth mentioning that, even though only 7.3% students had suicide ideation, more attention should be paid to students with these characteristics.

TABLE 3 | Sociodemographic characteristics and COVID-19 awareness correlates with depressive and anxiety symptoms.

Variables	Depressive symptoms			Anxiety symptoms			Suicidal ideation		
	OR	95%CI	*P*	OR	95%CI	*P*	OR	95%CI	*P*
Gender									
Male	1			1			1		
Female	1.24	1.14–1.34	<0.001	1.21	1.11–1.33	<0.001	0.72	0.61–0.84	<0.001
Grade									
Undergraduate	1			1			1		
Graduate	1.14	1.00–1.30	0.051	1.18	1.02–1.36	0.025	0.74	0.57–0.97	0.028
Living with family									
No	1			1			1		
Yes	0.52	0.44–0.63	<0.001	0.46	0.38–0.55	<0.001	0.48	0.37–0.64	<0.001
COVID-19 exposure									
No	1			1			1		
Yes	1.42	1.22–1.65	<0.001	1.51	1.29–1.76	<0.001	1.17	0.89–1.52	0.262
Awareness of COVID-19									
COVID-19 knowledge	0.85	0.81–0.89	<0.001	0.92	0.87–0.97	0.001	1.00	0.91–1.09	0.937
Preventive and control measures	0.88	0.84–0.92	<0.001	0.87	0.83–0.91	<0.001	0.86	0.75–0.91	0.001
Projections of COVID-19 trend	0.71	0.67–0.74	<0.001	0.67	0.63–0.70	<0.001	0.83	0.60–0.71	<0.001
Depressive symptoms									
No	–			–			1		
Yes	–			–			10.62	7.84–14.38	<0.001
Anxiety symptoms									
No	–			–			1		
Yes	–			–			5.56	4.53–6.81	<0.001

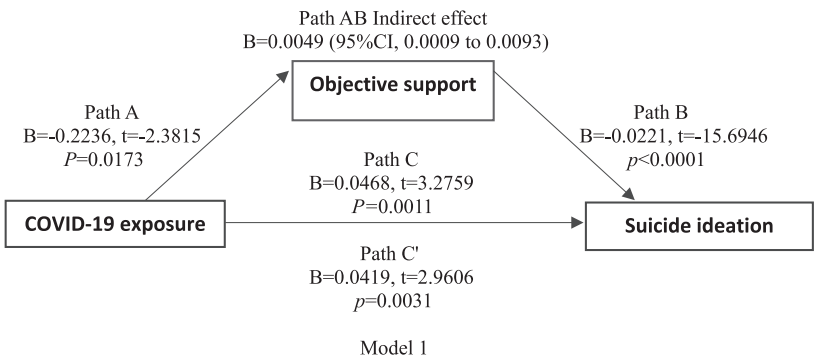


FIGURE 1 | Model 1 shoes path diagram of the mediation model (X = COVID-19 exposure; Y = suicidal ideation). Path C represent the variance in COVID-19 exposure associated with suicidal ideation. Path C' represent the association between COVID-19 exposure and suicidal ideation after taking into account objective support. Path AB is the mediation effect and is significant at $P < 0.05$.

There is now sufficient evidence to state that the female gender is a reliable risk factor for depressive and anxiety symptoms (Gater et al., 1998; Othman et al., 2019; Jenkins et al., 2020; Zhou et al., 2020). But our study found female students is a protect factor for suicidal ideation, which is consistent with previous research on factors influencing suicidal ideation among Chinese college students, it may be related to the great pressure placed on male college students by Chinese society (Lllhm, 2006). Graduate students, in contrast to undergraduate ones, have more negative emotions. This might be explained by more profound stresses regarding economic, marital, academic, interpersonal, and employment concerns as results of the pandemic. Although graduate students had more negative emotions, they had less suicidal ideation than undergraduates, this is not consistent with previous studies. Studies have shown that in the student population, for those older than 25 years old, the suicide rate of students is significantly higher than that of students younger than 25 years old. In the group of students aged 20–24, suicide rate of graduate students is higher than that of undergraduate students (Silverman et al., 1997; Hamilton and Schweitzer, 2000). In the present study, students living with family are related to lower risk of mental health problems, lower percentage of suicidal ideation. Some authors have demonstrated that family support, especially parental support, is very important and could effectively buffer

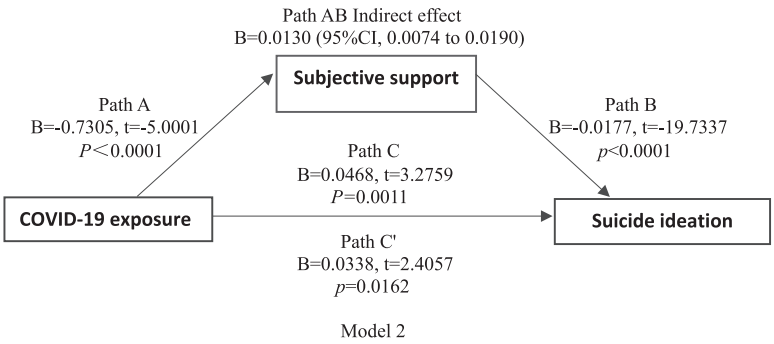


FIGURE 2 | Model 2 shoes path diagram of the mediation model (X = COVID-19 exposure; Y = suicidal ideation). Path C represent the variance in COVID-19 exposure associated with suicidal ideation. Path C' represent the association between COVID-19 exposure and suicidal ideation after taking into account subjective support. Path AB is the mediation effect and is significant at $P < 0.05$.

the effects of high stress on anxiety symptoms and depressive symptoms, it also reduces suicidal ideation (Crockett et al., 2007; Gariepy et al., 2016; van Harmelen et al., 2016; Pruitt et al., 2020). Conversely, emotional loneliness caused by family disconnection is an important factor leading to mental health problems (Fernandez-Rouco et al., 2019). As predicted, COVID-19 exposure is closely related to bad moods. Individuals who were quarantined, irrespective of their wishes, suffered from isolation and directly faced the problems of infection, medical treatment, and even death (Elizarraras-Rivas et al., 2010; Oboho et al., 2015). But we also found that objective support, subjective support, was the intermediary between COVID-19 exposure and suicidal ideation. Previous studies have also shown that high levels of social support are protective factors for suicidal ideation (Hirsch and Barton, 2011; Parker et al., 2021). Therefore, providing social support to college students during the COVID-19 epidemic, especially for college students exposed to COVID-19, can reduce suicidal ideation.

Good awareness regarding infectious diseases may assist in the prevention of psychological problems (Khan et al., 2015). More accurate COVID-19 knowledge can reduce negative attitudes, potentially dangerous practices, fear and panic during the epidemic (Ren et al., 2020). Our findings supported this view and revealed COVID-19 awareness as an independent protective factor for mental health among university students. Of course, it is important to provide timely, specific and accurate health information about COVID-19 (Wang C. et al., 2020). Since the early stage of the COVID-19 pandemic, the Chinese government has provided essential COVID-19 knowledge to the public every day, through media campaigns via television, radio, WeChat, Tik Tok, and newspapers. However, it was found that only 42.1% students were familiar and 15.5% were unfamiliar with COVID-19 knowledge. Therefore, public health policy makers and health workers should attach importance to COVID-19 prevention training and health education for university students.

Based on the pandemic characteristics of COVID-19, the Chinese government and public authorities made efforts to facilitate the implementation of pandemic prevention measures. The practices were very cautious in the Chinese population: Decreased unnecessary outings, avoiding crowded places, wearing masks when going outside, and washing hands frequently (Zhong et al., 2020). Our study results were in agreement with a previous study, which suggested that precautionary measures could reduce the levels of anxiety and depression symptoms and psychological impact of the outbreak (Leung et al., 2003; Wang C. et al., 2020; Xiang et al., 2020).

During this survey period, the number of reported infection cases nationwide began to decline slightly, but the pandemic was spreading rapidly around the world and some imported cases occurred. Therefore, the public was urged to take more stringent preventive and control measures. Almost all students continued to stop their university studies and practice, and their range of activities was greatly restricted, which caused great inconvenience in their lives. Long-term self-isolation can make people bored and prone to focus too much on negative pandemic information, which also increases the risk of mental health problems (Gostic et al., 2020). However, our finding that the majority of students had an optimistic attitude about overcoming this crisis was unexpected. The most likely explanations for this situation are the openness and transparency of data, the effective and standardized implementation of preventive and control work in China (China, 2020). The optimistic attitude toward the prospects of COVID-19 could reduce depressive and anxiety symptoms, since risk perception has a greater correlation with mental health (Liao et al., 2014). However, recently, there has been a rebound of COVID-19 epidemic abroad, and many schools are facing another shutdown and class closure. The worsening COVID-19 epidemic may cause psychological problems among college students again. Therefore, our research also has certain guiding significance to alleviate the psychological problems of college students.

The key strengths of this study included the wide-ranging demographics and the largest sample studied to date. In addition, it was the first study to investigate the prevalence of anxiety, depression symptoms and suicidal ideation among university students and its influence during the COVID-19 epidemic. However, there are also some limitations to this study. First, the study adopted the method of convenience sampling to recruit subjects, which may lead to a lack of sample representativeness and an imbalance of the sample distribution. Second, we used

the self-assessment questionnaire to assess the symptoms of anxiety and depression, so that reporting bias may exist when compared with the professional assessment. Third, all the data were collected in a cross-sectional survey, and therefore, causal relationships could not be established. Finally, the item 9 of PHQ-9 was mainly used for the evaluation of suicidal ideation. No professional questionnaire is used for the evaluation of suicidal ideation, which may not be systematic and detailed enough.

CONCLUSION

In conclusion, the mental health status of university students has been affected during the COVID-19 pandemic, with a high prevalence of depressive symptoms, anxiety symptoms, and suicidal ideation. The female gender, graduates, living with family, personal COVID-19 exposure and awareness of COVID-19 were related factors for depressive and anxiety symptoms. In addition, our study showed that anxiety and depression symptoms are important risk factors for suicidal ideation. We also found that social support mediated between exposure and suicidal ideation. Providing adequate social support to university students may reduce suicide. While paying attention to the anxiety and depression symptoms of university students, we should also pay attention to the students' suicidal ideation, and focus on the intervention of students with suicidal ideation.

DATA AVAILABILITY STATEMENT

The data that supports the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

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

AUTHOR CONTRIBUTIONS

S-JZ and X-JY completed the design of the questionnaire. MQ was responsible for the examination of the contents of the questionnaire. LG, S-YZ, and L-GZ were responsible for the distribution and recovery of the questionnaire. L-LW and J-XC completed the statistical analyses. RY and J-XC received funding support for the research. S-JZ and MQ jointly completed the first draft of this manuscript. J-XC designed the whole study, provided guidance and reviewed and submitted the article. All authors have read and agreed with the published version of the manuscript.

FUNDING

This work was supported by the Beijing Municipal Administration of Hospitals Clinical Medicine Development of Special Funding (XMLX201806), the Capital Foundation of Medicine Research and Development (2018-3-2132), and the Special Foundation of Beijing Municipal Science and Technology Commission (Z171100001017001).

ACKNOWLEDGMENTS

We thank all of subjects who participated in this study. We would like to thank Editage (www.editage.cn) for English language editing.

REFERENCES

Altena, E., Baglioni, C., Espie, C. A., Ellis, J., Gavriloff, D., Holzinger, B., et al. (2020). Dealing with sleep problems during home confinement due to the COVID-19 outbreak: practical recommendations from a task force of the European CBT-I Academy. *J. Sleep Res.* 29:e13052. doi: 10.1111/jsr.13052

Amit, N., Ismail, R., Zumrah, A., Mohd Nizah, M., Tengku Muda, T., Tat Meng, E., et al. (2020). Relationship between debt and depression, anxiety, stress, or suicide ideation in asia: a systematic review. *Front. Psychol.* 11:1336. doi: 10.3389/fpsyg.2020.01336

Auerbach, R. P., Alonso, J., Axinn, W. G., Cuijpers, P., Ebert, D. D., Green, J. G., et al. (2016). Mental disorders among college students in the World Health Organization World Mental Health Surveys. *Psychol. Med.* 46, 2955–2970. doi: 10.1017/S0033291716001665

Auerbach, R. P., Mortier, P., Bruffaerts, R., Alonso, J., Benjet, C., Cuijpers, P., et al. (2018). WHO World Mental Health Surveys International College Student Project: prevalence and distribution of mental disorders. *J. Abnorm. Psychol.* 127, 623–638. doi: 10.1037/abn0000362

Bao, Y., Sun, Y., Meng, S., Shi, J., and Lu, L. (2020). 2019-nCoV epidemic: address mental health care to empower society. *Lancet* 395, e37–e38. doi: 10.1016/S0140-6736(20)30309-3

Beiter, R., Nash, R., McCrady, M., Rhoades, D., Linscomb, M., Clarahan, M., et al. (2015). The prevalence and correlates of depression, anxiety, and stress in a sample of college students. *J. Affect. Disord.* 173, 90–96. doi: 10.1016/j.jad.2014.10.054

Bi, F., Luo, D., Huang, Y., Chen, X., Zhang, D., and Xiao, S. (2020). The relationship between social support and suicidal ideation among newly diagnosed people living with HIV: the mediating role of HIV-related stress. *Psychol. Health Med.* 26, 724–734. doi: 10.1080/13548506.2020.1761987

Bryan, C. J., Bryan, A. O., and Baker, J. C. (2020). Associations among state-level physical distancing measures and suicidal thoughts and behaviors among U.S. adults during the early COVID-19 pandemic. *Suicide Life Threat. Behav.* 50, 1223–1229. doi: 10.1111/sltb.12653

Cao, W., Fang, Z., Hou, G., Han, M., Xu, X., Dong, J., et al. (2020). The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry Res.* 287:112934. doi: 10.1016/j.psychres.2020.112934

Chan, J., Yuan, S., Kok, K., To, K., Chu, H., Yang, J., et al. (2020). A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. *Lancet* 395, 514–523. doi: 10.1016/s0140-6736(20)30154-9

Chenneville, T., and Schwartz-Mette, R. (2020). Ethical considerations for psychologists in the time of COVID-19. *Am. Psychol.* 75, 644–654. doi: 10.1037/amp0000661

China, N. H. C. (2020). *Technical Guide for Prevention and Control of New Coronavirus Infection in Medical Institutions*, 2nd Edn. Available online at:

http://www.nhc.gov.cn/jkj/s3577/202001/c67cfe29ecf1470e8c7fc47d3b751e88.shtml (accessed January 22, 2020).

Crockett, L. J., Iturbide, M. I., Torres Stone, R. A., McGinley, M., Raffaelli, M., and Carlo, G. (2007). Acculturative stress, social support, and coping: relations to psychological adjustment among Mexican American college students. *Cultur. Divers. Ethnic. Minor. Psychol.* 13, 347–355. doi: 10.1037/1099-9809.13.4.347

Eisenberg, D., Hunt, J., and Speer, N. (2013). Mental health in American colleges and universities: variation across student subgroups and across campuses. *J. Nerv. Ment. Dis.* 201, 60–67. doi: 10.1097/NMD.0b013e31827ab077

Elizarraras-Rivas, J., Vargas-Mendoza, J. E., Mayoral-Garcia, M., Matadamas-Zarate, C., Elizarraras-Cruz, A., Taylor, M., et al. (2010). Psychological response of family members of patients hospitalised for influenza A/H1N1 in Oaxaca, Mexico. *BMC Psychiatry* 10:104. doi: 10.1186/1471-244X-10-104

Fernandez-Rouco, N., Carcedo, R. J., Lopez, F., and Orgaz, M. B. (2019). Mental health and proximal stressors in transgender men and women. *J. Clin. Med.* 8:413. doi: 10.3390/jcm8030413

Gariepy, G., Honkaniemi, H., and Quesnel-Vallee, A. (2016). Social support and protection from depression: systematic review of current findings in Western countries. *Br. J. Psychiatry* 209, 284–293. doi: 10.1192/bjp.bp.115.169094

Gater, R., Tansella, M., Korten, A., Tiemens, B. G., Mavreas, V. G., and Olatawura, M. O. (1998). Sex differences in the prevalence and detection of depressive and anxiety disorders in general health care settings: report from the World Health Organization Collaborative Study on Psychological Problems in General Health Care. *Arch. Gen. Psychiatry* 55, 405–413. doi: 10.1001/archpsyc.55.5.405

Gostic, K., Gomez, A. C., Mummah, R. O., Kucharski, A. J., and Lloyd-Smith, J. O. (2020). Estimated effectiveness of symptom and risk screening to prevent the spread of COVID-19. *eLife* 9:e55570. doi: 10.7554/eLife.55570

Hamilton, T. K., and Schweitzer, R. D. (2000). The cost of being perfect: perfectionism and suicide ideation in university students. *Aust. N. Z. J. Psychiatry* 34, 829–835. doi: 10.1080/j.1440-1614.2000.00801.x

Hirsch, J. K., and Barton, A. L. (2011). Positive social support, negative social exchanges, and suicidal behavior in college students. *J. Am. Coll. Health* 59, 393–398. doi: 10.1080/07448481.2010.515635

Huang, Y. Q., Dang, W. M., and Liu, Z. R. (2003). Psychosocial aspects in three universities during sars epidemic in beijing. *Chinese Ment. Health J.* 17, 521–523.

Jenkins, P. E., Ducker, I., Gooding, R., James, M., and Rutter-Eley, E. (2020). Anxiety and depression in a sample of UK college students: a study of prevalence, comorbidity, and quality of life. *J. Am. Coll. Health* [Epub ahead of print]. doi: 10.1080/07448481.2019.1709474

Kanadiya, M. K., and Sallar, A. M. (2011). Preventive behaviors, beliefs, and anxieties in relation to the swine flu outbreak among college students aged 18-24 years. *Z. Gesundh. Wiss.* 19, 139–145. doi: 10.1007/s10389-010-0373-3

Kawohl, W., and Nordt, C. (2020). COVID-19, unemployment, and suicide. *Lancet Psychiatry* 7, 389–390. doi: 10.1016/s2215-0366(20)30141-3

Kessler, R., Price, R., and Wortman, C. (1985). Social factors in psychopathology: stress, social support, and coping processes. *Annu. Rev. Psychol.* 36, 531–572. doi: 10.1146/annurev.ps.36.020185.002531

Khan, A., Farooqui, A., Guan, Y., and Kelvin, D. J. (2015). Lessons to learn from MERS-CoV outbreak in South Korea. *J. Infect. Dev. Countr.* 9, 543–546. doi: 10.3855/jidc.7278

Kim, S., Sinn, D., and Syn, S. Y. (2018). Analysis of college students' personal health information activities: online survey. *J. Med. Internet Res.* 20:e132. doi: 10.2196/jmir.9391

Lllhm, L. (2006). *A Survey on University Students' Suicidal Ideation and the Influence Factors*. Kirkland, WA: Northwest University.

Lai, J., Ma, S., Wang, Y., Cai, Z., Hu, J., Wei, N., et al. (2020). Factors Associated With Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease 2019. *JAMA Netw. Open* 3:e203976. doi: 10.1001/jamanetworkopen.2020.3976

Lei, X. Y., Xiao, L. M., Liu, Y. N., and Li, Y. M. (2016). Prevalence of depression among chinese university students: a meta-analysis. *PLoS One* 11:e0153454. doi: 10.1371/journal.pone.0153454

Leung, G. M., Lam, T. H., Ho, L. M., Ho, S. Y., Chan, B. H., Wong, I. O., et al. (2003). The impact of community psychological responses on outbreak control for severe acute respiratory syndrome in Hong Kong. *J. Epidemiol. Community Health* 57, 857–863. doi: 10.1136/jech.57.11.857

Lew, B., Osman, A., Huen, J. M. Y., Siau, C. S., Talib, M. A., Cunxian, J., et al. (2020). A comparison between American and Chinese college students on suicide-related behavior parameters. *Int. J. Clin. Health Psychol.* 20, 108–117. doi: 10.1016/j.ijchp.2020.03.005

Li, D. J., Ko, N. Y., Chen, Y. L., Wang, P. W., Chang, Y. P., Yen, C. F., et al. (2020). COVID-19-related factors associated with sleep disturbance and suicidal thoughts among the taiwanese public: a facebook survey. *Int. J. Environ. Res. Public Health* 17:4479. doi: 10.3390/ijerph17124479

Li, J., Lin, J., and Wang, X. (2003). Effects of catastrophic flood on mental health of students whose families were in disaster-afflicted areas. *Chinese J. Sch. Health* 24, 456–457.

Li, X., Shi, J. L., Xiong, W., Mu, Y. G., and Wei, X. (2011). Study on mental status for the nursing freshmen in a medical college after wenchuan earthquake. *China J. Health Psychol.* 19, 233–235.

Liao, Q., Cowling, B. J., Lam, W. W., Ng, D. M., and Fielding, R. (2014). Anxiety, worry and cognitive risk estimate in relation to protective behaviors during the 2009 influenza A/H1N1 pandemic in Hong Kong: ten cross-sectional surveys. *BMC Infect. Dis.* 14:169. doi: 10.1186/1471-2334-14-169

Liu, J. J., Bao, Y., Huang, X., Shi, J., and Lu, L. (2020). Mental health considerations for children quarantined because of COVID-19. *Lancet Child Adolesc. Health* 4, 347–349. doi: 10.1016/S2352-4642(20)30096-1

Main, A., Zhou, Q., Ma, Y., Luecken, L. J., and Liu, X. (2011). Relations of SARS-related stressors and coping to Chinese college students' psychological adjustment during the 2003 Beijing SARS epidemic. *J. Couns. Psychol.* 58, 410–423. doi: 10.1037/a0023632

Oboho, I. K., Tomczyk, S. M., Al-Asmari, A. M., Banjar, A. A., Al-Mugti, H., Aloraini, M. S., et al. (2015). 2014 MERS-CoV outbreak in Jeddah–a link to health care facilities. *N. Engl. J. Med.* 372, 846–854. doi: 10.1056/NEJMoa1408636

Othman, N., Ahmad, F., El Morr, C., and Ritvo, P. (2019). Perceived impact of contextual determinants on depression, anxiety and stress: a survey with university students. *Int. J. Ment. Health Syst.* 13:17. doi: 10.1186/s13033-019-0275-x

Parker, M., Duran, B., Rhew, I., Magarati, M., Larimer, M., and Donovan, D. (2021). Risk and Protective Factors Associated with Moderate and Acute Suicidal Ideation among a National Sample of Tribal College and University Students 2015-2016. *J. Rural Health* 37, 545–553. doi: 10.1111/jrh.12510

Pruitt, L. D., McIntosh, L. S., and Reger, G. (2020). Suicide safety planning during a pandemic: the implications of COVID-19 on coping with a crisis. *Suicide Life Threat. Behav.* 50, 741–749. doi: 10.1111/sltb.12641

Purtle, J. (2020). COVID-19 and mental health equity in the United States. *Soc. Psychiatry Psychiatr. Epidemiol.* 55, 969–971. doi: 10.1007/s00127-020-01896-8

Recabarren, R. E., Gaillard, C., Guillod, M., and Martin-Soelch, C. (2019). Short-term effects of a multidimensional stress prevention program on quality of life, well-being and psychological resources. A randomized controlled trial. *Front. Psychiatry* 10:88. doi: 10.3389/fpsyt.2019.00088

Ren, S. Y., Gao, R. D., and Chen, Y. L. (2020). Fear can be more harmful than the severe acute respiratory syndrome coronavirus 2 in controlling the corona virus disease 2019 epidemic. *World J. Clin. Cases* 8, 652–657. doi: 10.12998/wjcc.v8.i4.652

Scanlan, J. N., and Hazelton, T. (2019). Relationships between job satisfaction, burnout, professional identity and meaningfulness of work activities for occupational therapists working in mental health. *Aust. Occup. Ther. J.* 66, 581–590. doi: 10.1111/1440-1630.12596

Shuiyuan, X. (1987). The influence of social support on physical and mental health. *Chinese Ment. Health J.* 1, 183–187.

Silverman, M. M., Meyer, P. M., Sloane, F., Raffel, M., and Pratt, D. M. (1997). The Big Ten Student Suicide Study: a 10-year study of suicides on midwestern university campuses. *Suicide Life Threat. Behav.* 27, 285–303.

Spitzer, R. L., Kroenke, K., and Williams, J. B. (1999). Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. Primary Care Evaluation of Mental Disorders. Patient Health Questionnaire. *JAMA* 282, 1737–1744. doi: 10.1001/jama.282.18.1737

Spitzer, R. L., Kroenke, K., Williams, J. B., and Lowe, B. (2006). A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch. Intern. Med.* 166, 1092–1097. doi: 10.1001/archinte.166.10.1092

van Harmelen, A. L., Gibson, J. L., St Clair, M. C., Owens, M., Brodbeck, J., Dunn, V., et al. (2016). Friendships and family support reduce subsequent depressive symptoms in at-risk adolescents. *PLoS One* 11:e0153715. doi: 10.1371/journal.pone.0153715

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., et al. (2020). Immediate psychological responses and associated factors during the initial stage of the 2019 Coronavirus Disease (COVID-19) epidemic among the general population in China. *Int. J. Environ. Res. Public Health* 17:1729. doi: 10.3390/ijerph17051729

Wang, Y., Zhao, X., Feng, Q., Liu, L., Yao, Y., and Shi, J. (2020). Psychological assistance during the coronavirus disease 2019 outbreak in China. *J. Health Psychol.* 25, 733–737. doi: 10.1177/1359105320919177

Xiang, Y. T., Yang, Y., Li, W., Zhang, L., Zhang, Q., Cheung, T., et al. (2020). Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. *Lancet Psychiatry* 7, 228–229. doi: 10.1016/S2215-0366(20)30046-8

Yang, Y., Li, W., Zhang, Q., Zhang, L., Cheung, T., and Xiang, Y. T. (2020). Mental health services for older adults in China during the COVID-19 outbreak. *Lancet Psychiatry* 7:e19. doi: 10.1016/S2215-0366(20)30079-1

Zhong, B. L., Luo, W., Li, H. M., Zhang, Q. Q., Liu, X. G., Li, W. T., et al. (2020). Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. *Int. J. Biol. Sci.* 16, 1745–1752. doi: 10.7150/ijbs.45221

Zhou, S. J., Zhang, L. G., Wang, L. L., Guo, Z. C., Wang, J. Q., Chen, J. C., et al. (2020). Prevalence and socio-demographic correlates of psychological health problems in Chinese adolescents during the outbreak of COVID-19. *Eur. Child Adolesc. Psychiatry* 29, 749–758. doi: 10.1007/s00787-020-01541-4

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 13 September 2021
doi: 10.3389/fpsyg.2021.693396

COVID-19-Related Daily Stress Processes in College-Aged Adults: Examining the Role of Depressive Symptom Severity

*Jody L. Greaney[1], Ashley M. Darling[1], Jennifer R. Turner[2], Erika F. H. Saunders[3], David M. Almeida[4,5] and Jacqueline Mogle[2]**

[1]Department of Kinesiology, The University of Texas at Arlington, Arlington, TX, United States, [2]Edna Bennett Pierce Prevention Research Center, The Pennsylvania State University, University Park, PA, United States, [3]Department of Psychiatry, Penn State College of Medicine, Hershey, PA, United States, [4]Department of Human Development and Family Studies, The Pennsylvania State University, University Park, PA, United States, [5]Center for Healthy Aging, The Pennsylvania State University, University Park, PA, United States

OPEN ACCESS

Edited by:
Jason H. Huang, Baylor Scott and White Health, United States

Reviewed by:
Chiara Meneghetti, University of Padua, Italy
Shen Li, Tianjin Medical University, China
Jasmina Burdzovic Andreas, Norwegian Institute of Public Health (NIPH), Norway

***Correspondence:**
Jacqueline Mogle
jam935@psu.edu

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *12 April 2021*
Accepted: *11 August 2021*
Published: *13 September 2021*

Citation:
Greaney JL, Darling AM, Turner JR, Saunders EFH, Almeida DM and Mogle J (2021) COVID-19-Related Daily Stress Processes in College-Aged Adults: Examining the Role of Depressive Symptom Severity. Front. Psychol. 12:693396. doi: 10.3389/fpsyg.2021.693396

Exposure to daily stressors specific to the COVID-19 pandemic (e.g., threat of infection) is associated with emotional distress, heightened stress reactivity, and increased depressive symptomology. Herein, we examined whether current depressive symptomology modulates the association between COVID-19-related daily stressor exposure and negative affective reactivity in young, otherwise healthy, college-aged adults. Fifty-eight adults (21 men; 22 ± 3 years) completed a daily web-based interview for eight consecutive days to assess COVID-19-related daily stress exposure and emotional responsiveness (September–November 2020). Depressive symptom severity was assessed using the Patient Health Questionnaire-9 (PHQ-9), and a score of ≥10 (range: 0–27) was used to define adults with a depressive episode ($n = 20$). Participants reported at least one COVID-19-related stressor on 35.8% of interview days. Depressive symptomology did not predict the likelihood of exposure to a COVID-19-related stressor ($p = 0.46$; OR = 1.52; 95% CI: 0.492–4.718). However, negative affect (NA) was greater on days with an exposure to any COVID-19-specific daily stressor in adults with moderate-to-severe depressive symptoms ($b = 0.28$, SE = 0.093, $p = 0.003$) but not in those without ($b = 0.009$, SE = 0.074, $p = 0.90$), such that negative affective reactivity to COVID-19-related stressors was amplified in adults with a current depressive episode ($p = 0.019$). Depressive symptomology did not moderate positive affective reactivity ($p = 0.686$). Taken together, these data suggest that exposure to daily stressors related to COVID-19 further worsens NA in adults with a current depressive episode, potentially rendering them more susceptible to adverse mental health outcomes during the pandemic.

Keywords: depression, daily stress, negative affect, mood, COVID-19 pandemic

INTRODUCTION

The global COVID-19 pandemic has profoundly impacted nearly all aspects of daily life. Beyond the direct threat of infection for physical health, the implementation of numerous lifestyle measures to slow disease spread (e.g., quarantine, lockdown, physical distancing, etc.) has had far-reaching psychological, social, and economic effects (Nicola et al., 2020; Pan et al., 2021). Although, the global pandemic is a novel "once-in-a-generation" *chronic* stressor, the unprecedented curbs on social interaction and the ensuing social isolation are significant sources of *daily* stress unique to the circumstances surrounding COVID-19 (Brooks et al., 2020; Taylor et al., 2020). These naturalistic events or hassles that arise from day-to-day living during the pandemic, examples of which include fears of infection and survival, financial insecurity, resource scarcity, and tension, boredom, and frustration among families in lockdown together, activate stress-responsive neurocircuitry and thereby have immediate consequences for psychological and physiological function (Almeida et al., 2009; Stawski et al., 2013; Greaney et al., 2019).

There is marked heterogeneity in the subjective appraisal of daily stressors (Stawski et al., 2008, 2013), and mounting evidence suggests that emotional responsiveness to daily stressors is even more predictive of long-term disease risk than daily stressor exposure by and of itself (Sin et al., 2016; Chiang et al., 2018; Leger et al., 2018). Importantly, chronic life stress (e.g., living through a pandemic) necessarily also contextualizes and influences the processing of everyday daily stress, contributing to heightened stress-related negative affective reactivity (Stawski et al., 2008; Sliwinski et al., 2009). To probe this link for COVID-19, previous investigators conducted a 28-day daily diary study assessing stress and emotions in community-dwelling adults (age range: 26–89 years) immediately following government lockdown orders in April 2020 (Nelson and Bergeman, 2020). Greater daily worry related to the pandemic exacerbated affective reactivity to daily stressors, an effect that was more pronounced in young compared to older adults (Nelson and Bergeman, 2020). These data suggest that young college-aged adults may be particularly vulnerable to increased daily stress amidst the COVID-19 pandemic (McGinty et al., 2020; Nelson and Bergeman, 2020; Nwachukwu et al., 2020; Klaiber et al., 2021), perhaps owing to their stronger need for social interaction, employment uncertainty, and/or the additional stressors related to online learning, including unstable internet connectivity, additional financial burdens, and difficulty focusing.

In addition to the striking increases in the prevalence of mental health illness during the COVID-19 pandemic (Holmes et al., 2020; Pierce et al., 2020; Vindegaard and Benros, 2020), it appears that the psychological and emotional sequela of pandemic-related stress may be even further amplified in adults with underlying psychiatric comorbidities, particularly depressive disorders (Yao et al., 2020; Pan et al., 2021). Indeed, increases in pandemic-related stressors predicted increases in emotional distress and depressive symptomology, even when controlling for baseline depression (Duan et al., 2020; Shanahan et al., 2020; Zheng et al., 2021). In response to daily stress exposure, young otherwise healthy adults with major depressive disorder report greater increases in negative emotions (Bylsma et al., 2011; Booij et al., 2018). However, whether depressive symptomology similarly modulates negative affective reactivity to the unique daily stressors specific to COVID-19 in young college-aged adults remains unclear.

Given the long-term physiological and psychological consequences of increased exposure and negative affective reactivity to daily stressors (Sin et al., 2016; Chiang et al., 2018; Leger et al., 2018) and, separately, depression (Cuijpers and Smit, 2002; Lett et al., 2004; Whiteford et al., 2013; Gilsanz et al., 2015), a better understanding of the inter-relations between COVID-19-related daily stress processes and depressive symptom severity may provide insight into effective strategies to prevent or mitigate untoward health outcomes stemming from the pandemic. Because policies related to containment of the COVID-19 virus severely limit stress mitigation approaches that rely on group gatherings and increased community support to promote resilience, this line of inquiry has clear public health relevance. Therefore, as a necessary first step, the aim of this small pilot study was to examine exposure and affective reactivity to daily stressors during the pandemic in college-aged adults with a broad range of depressive symptom severity. We tested the novel hypothesis that negative affective reactivity [i.e., the association between COVID-19-related daily stress exposure and negative affect (NA)] would be stronger in adults with moderate-to-severe depressive symptoms compared to those without.

MATERIALS AND METHODS

All experimental procedures and protocols were approved by the Institutional Review Board at the University of Texas at Arlington (2020-0912). The investigation was conducted in accordance with the Declaration of Helsinki. The nature, risks, and benefits of all study procedures were explained to participants, and their verbal informed consent was obtained voluntarily prior to participation. Due to the ongoing pandemic-related restrictions to in-person research, contact with participants was limited to online participation.

Participants

College-aged adults were recruited from The University of Texas at Arlington and surrounding community using common means of study advertisement (e.g., posting recruitment fliers, social media, etc.), and a total of 64 were enrolled. Thereafter, participants completed a web-based version of the Daily Inventory of Stressful Events (DISE) interview, adapted to include stressors related to COVID-19, for eight consecutive days, as is standard for this type of study (Almeida et al., 2009; Klaiber et al., 2021). Participants received text message and email reminders every evening at 5 pm local time with the link to DISE interview. Of those enrolled, 58 participants (91%) completed at least one daily diary. In total, participants completed 7.6 ± 1.1 diaries, with most completing all eight ($n = 47$; 81%) and only two participants completing fewer than 6 days. Data were collected

from September 8, 2020 until November 11, 2020, with some participants completing the study before others.

Assessment of Daily Stress

The DISE interview assesses multiple components of daily stressor exposure using stem questions, followed by open-ended probes, asking whether any of seven types of naturally-occurring stressors occurred in the previous 24 h: argument, argument avoidance, stressful event at work or school, stressful event at home, stressful event related to racial/ethnic/sexual discrimination, network stress (i.e., stressful even that happened to a close friend or relative), or any other stressful event (Almeida et al., 2002). The DISE captures specific events that occurred the immediate 24 h preceding each daily assessment and, therefore, is focused on the types of daily hassles that result from everyday life (as listed above), as well as experiences that may stem from chronic stress occurring over much longer durations (e.g., living in poverty, being in an abusive relationship, etc.). Obtaining daily stressor information over this short-time frame helps in alleviating concerns regarding ecological validity and retrospective memory distortions that can occur over longer periods of time (Almeida et al., 2002). A dichotomous variable was created to indicate the occurrence of any stressor that day (1 = *yes*, 0 = *no*) and the total number of stressors was calculated for each day.

Assessment of COVID-19-Related Daily Stress

The DISE was expanded to also include daily stressors specifically related to the circumstances surrounding the COVID-19 pandemic. Items from other publicly available surveys on the impacts of COVID-19 were adapted for daily administration and responding (Nelson and Bergeman, 2020; Klaiber et al., 2021). These items asked whether participants experienced any of the following COVID-19-related daily stressors: financial problems, unable to spend time with others, challenges at home, trouble obtaining supplies, distressing news reports, experience of physical symptoms of COVID-19, difficulty completing work or school requirements, and greater work or home responsibilities compared to before the COVID-19 pandemic. As above, a dichotomous variable was created to indicate the occurrence of any COVID-19-related stressor that day (1 = *yes*, 0 = *no*) and the total number of COVID-19-related stressors was calculated for each day.

Assessment of Positive and Negative Affect

To assess daily affect, participants rated the frequency of 13 positive (in good spirits, cheerful, extremely happy, calm and peaceful, satisfied, full of life, close to others, like you belong, enthusiastic, attentive, proud, active, and confident) and 14 negative (restless or fidgety, nervous, worthless, so sad nothing could cheer you up, everything was an effort, hopeless, lonely, afraid, jittery, irritable, ashamed, upset, angry, and frustrated) emotions using a five-point scale (0 = *none of the time*, 1 = *a little of the time*, 2 = *some of the time*, 3 = *most of the time*, and 4 = *all of the time*; Mroczek and Kolarz, 1998; Kessler et al., 2002). Reliability for the positive affect items was 0.97 and for the negative affect items was 0.93. The emotion item ratings were averaged to obtain daily positive and negative affect scores and scores were aggregated for the eight interview days. Daily positive affect was 1.89 ± 0.93 (range 0–4) and daily negative affect was 0.63 ± 0.49 (range 0–3.5).

Assessment of Depressive Symptom Severity

On the first day of the DISE interview, depressive symptom severity was assessed using the Patient Health Questionnaire-9 (PHQ-9), which provides a valid and sensitive index of symptomology based on the diagnostic criteria for DSM-5 depressive disorders (Spitzer et al., 1999; Kroenke et al., 2001). The PHQ-9 rates the frequency of the nine clinical symptoms of depression in the past 7 days on a four-point Likert scale (0 = *not at all*, 1 = *several days*, 2 = *more than half of the days*, and 3 = *nearly every day*). Response options are used to calculate a total score (maximum = 27) and symptom severity is quantified as none (0–4), mild (5–9), moderate (10–14), moderately severe (15–19), or severe (20–27). In addition to grading depressive symptom severity, the PHQ-9 can also be used to establish a depressive episode diagnosis (Kroenke et al., 2001). Because the present data were collected entirely remotely without participants visiting the laboratory, the presence of depressive symptoms of at least moderate severity (i.e., a PHQ-9 score of ≥10) was used to define the group of adults with a depressive episode. A PHQ-9 score of ≥10 has a sensitivity of 88% and a specificity of 88% for a diagnosis of major depression (Kroenke et al., 2001). The group of non-depressed adults had PHQ-9 score of <10. Importantly, PHQ-9 scores <10 very seldomly occur in major depression (Kroenke et al., 2001). These cut-off values were selected because, in the absence of a diagnostic interview or clinical diagnosis, symptom severity scores in the moderate to moderate-to-severe range are more likely to be indicative of a depressive episode (Spitzer et al., 1999; Kroenke et al., 2001, 2010).

Data Analytical and Statistical Approach

Data were examined in a series of steps. First, we computed all summary scores and calculated descriptive statistics for all participants and days. We then examined descriptive statistics to determine the frequency of COVID-19-related stressors, other daily stressful events, and their daily co-occurrence. Multilevel modeling was used for all analyses, as is appropriate when data are nested as with the current daily diaries (days at level 1 nested in persons at level 2) and allows for the estimation of within-person relations among the variables of interest, as well as how person-level variables (e.g., depression symptom severity) modify those relations (Hox et al., 2017). In the current study, we first examined whether a depressive disorder predicted the likelihood of reporting daily and COVID-19-related stressors. Because of the binary and count outcomes, these were fit as generalized multilevel model with a binomial or Poisson distribution, respectively (log link; SAS PROC GLIMMIX). Next,

TABLE 1 | Descriptive characteristics.

	All participants	(–) Depressive episode	(+) Depressive episode
n	58	38	20
Age (years)	22 ± 3	23 ± 3	22 ± 2
Sex (% women)	68	68	70
Student (%)	89	89	90
Hispanic/Latinx (%)	22	19	30
Race (%)			
White	38	46	25
Black or African American	8	11	5
Asian	33	27	45
Native Hawaiian or Other Pacific Islander	8	8	10
American Indian/Alaska Native	0	0	0
More than one race	13	8	15

Data are mean ± SD.

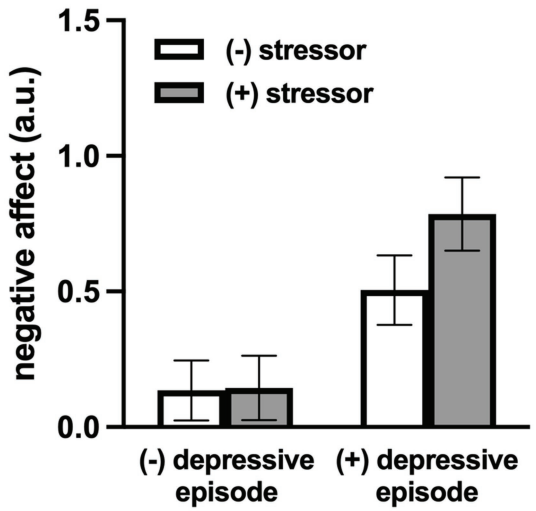


FIGURE 1 | Model-estimated negative affect for individuals with and without a depressive episode, on stressor and non-stressor days. The magnitude of the increase in negative affect on days with an exposure to a daily stressor was greater in adults with a depressive episode ($p = 0.02$). Data are mean ± SE.

we examined the relations of COVID-19-related stressors and daily affect, after accounting for other types of daily stressors (SAS PROC MIXED). Finally, we included depressive disorder status (as described above) as a moderator to determine whether individuals with greater symptom severity were more reactive to COVID-19-related stressors compared to those without.

All models report unstandardized coefficients. For continuous variables, the coefficients indicate the amount of change in the outcome (e.g., negative affect) for a one-unit change in the predictor variable. For categorical variables (e.g., sex or stressor exposure), the coefficient represents the difference between groups at level 2 or types of days at level 1 (e.g., stressor vs. non-stressor days). Significant interaction effects were probed using simple slopes analysis to generate estimated slopes for each group. All models included the average total number of daily stressors and COVID-19-related stressors to control for differences between individuals on exposure to stress across the diary period. Models included student status, sex, race/ethnicity, and age (grand mean centered) as covariates based on our previous work examining affective reactivity (Stawski et al., 2008; Piazza et al., 2013). Given the design of this initial pilot study and the small analytical sample size, we had 80% power to detect a small-to-medium Cohen's f (0.22). Data are reported as mean ± SD and significance was set at $p < 0.05$.

RESULTS

A total analytical sample of 58 adults (18 men; 22 ± 3 years) and 442 days of data were available. Participants were racially diverse (38% white; 33% Asian; 8% Native American/Hawaiian; 8% Black; and 13% multi-racial) and 22% identified as Hispanic/Latinx (**Table 1**). Most participants were currently enrolled in classes (89%), while the remaining 11% were community-dwelling young adults (**Table 1**). Most participants were not living in on-campus university housing (84%). Exposure to daily stressors was reported on approximately half of the interview days ($n_{days} = 220$, 49.8%). Further, participants reported a COVID-19-related stressor on approximately one-third of interview days ($n_{days} = 158$, 35.8%), indicating overlap between other forms of daily stressors and COVID-19-specific stressors. Both types of stressors events were reported on 24% of days. The most common COVID-19-related stressor was distressing newscast exposure ($n_{days} = 72$; 16%). Of the total analytical sample, 20 (34%; $n = 14$ female) reported a PHQ-9 score of ≥10 (18 ± 2), indicating the presence of a depressive episode (Spitzer et al., 1999; Kroenke et al., 2001, 2010). Non-depressed adults reported a PHQ-9 of 4 ± 3.0. The presence of a depressive episode did not predict the likelihood of any stressor exposure ($p = 0.26$; OR = 1.53, 95% CI: 0.726–3.235) or the total number of daily stressors ($p = 0.142$; OR = 1.31, 95% CI: 0.912–1.875). Similarly, a depressive episode was not a significant predictor of either the likelihood of stressor exposure ($p = 0.46$; OR = 1.52; 95% CI: 0.492–4.718) or the total number of COVID-19-related stressors ($p = 0.44$; OR = 1.317; 95% CI: 0.647–2.680).

Days with a daily stressor exposure were characterized by greater negative affect and lower positive affect (**Table 2**; both $p < 0.01$) compared to stressor-free days. Adults with a depressive episode reported greater negative affect on days with an exposure to any daily stressor ($b = 0.70$, SE = 0.077, $p < 0.01$) compared to individuals without ($b = 0.33$, SE = 0.063, $p < 0.01$). Further, the daily stress-related increase in negative affect was greater in adults with a depressive episode (**Figure 1**; $p < 0.01$). Exposure to a daily stressor was associated with lower positive affect in both adults with ($b = -0.42$, SE = 0.010, $p < 0.01$) and without a depressive episode ($b = -0.37$, SE = 0.08, $p < 0.01$); this relation was not different between groups ($p = 0.68$). Data were consistent when analyzing the total number of daily stressors.

TABLE 2 | Daily stressor exposure, affective response, and depressive symptomology.

	Negative affect						Positive affect					
	Model 1			Model 2			Model 1			Model 2		
Variable	Estimate	SE	*p*	Estimate	SE	*p*	Estimate	SE	*p*	Estimate	SE	*p*
Intercept	0.044	0.12	0.728	0.141	0.13	0.267	2.376	0.24	<0.01	2.362	0.25	<0.01
Daily stressor (ref = "no stressor")	0.478	0.05	<0.01	0.326	0.06	<0.01	−0.391	0.06	<0.01	−0.370	0.09	<0.01
Daily stressor × Depressive episode	–	–	–	0.378	0.10	<0.01	–	–	–	−0.052	0.13	0.686
Average number of daily stressors	0.039	0.21	0.855	0.112	0.21	0.592	−0.650	0.41	0.116	−0.660	0.41	0.112
Depressive episode (ref = "no")	0.479	0.12	<0.01	0.276	0.13	0.033	−0.797	0.23	<0.01	−0.769	0.24	0.002
Student status (ref = "yes")	−0.122	0.19	0.521	−0.153	0.19	0.415	0.842	0.37	0.028	0.846	0.37	0.028
Sex (ref = "male")	0.251	0.12	0.042	0.231	0.12	0.058	−0.185	0.24	0.438	−0.183	0.24	0.446
Ethnicity (ref = "white")	0.067	0.12	0.587	0.054	0.12	0.658	0.077	0.24	0.751	0.079	0.24	0.746
Age	−0.002	0.02	0.912	−0.002	0.02	0.908	−0.010	0.04	0.790	−0.010	0.04	0.791

Multilevel models included a random intercept. Coefficients are unstandardized. For continuous variables, coefficients reflect the change in the outcome for a one unit change in the predictor. For categorical variables, coefficients reflect the difference between the reference group and the remaining category. Model 1 includes the main effects of all variables; Model 2 includes the interaction between a depressive episode and daily stressors to test for group differences.

FIGURE 2 | Model-estimated negative affect (NA) for individuals with and without a depressive episode, on COVID-19-specific stressor and non-COVID-19-specific-stressor days. NA was greater on days with an exposure to a COVID-19-specific daily stressor in adults with a depressive episode but not in those without. Data are mean ± SE.

Exposure to COVID-19-specific daily stressors also appeared to be associated with negative affect, though this did not reach statistical significance (**Table 3**; $p = 0.062$). COVID-19-related daily stressors were not related to positive affect (**Table 3**; $p = 0.764$). Consistent with the aforementioned emotional response to non-COVID-19-related daily stress, adults with a depressive episode also had greater negative affect on days with exposure to any COVID-19-specific stressor ($b = 0.281$, SE = 0.093, $p = 0.003$), whereas individuals without did not ($b = 0.009$, SE = 0.074, $p = 0.90$), such that negative affective reactivity to daily COVID-19-related stressors was amplified in adults with a depressive episode (**Figure 2**; $p = 0.019$). There were no associations between COVID-19-related stressor exposure and positive affect in either group, nor were there any differences in this response between groups (**Table 3**; $p = 0.673$). Similar results were obtained when examining the total number of COVID-19-related stressors.

DISCUSSION

The primary novel finding of this small pilot study is that although neither exposure to, nor the total number of, COVID-19-related daily stressors were different between adults with and without a depressive disorder, both the likelihood of exposure and the cumulative total of exposures were associated with increased negative affective reactivity in adults with depression. The presence of a depressive disorder did not moderate positive affect. Taken together, these data suggest that daily stressors related to COVID-19 further worsen negative affect in adults with a depressive disorder. These findings add to the rapidly growing body of literature demonstrating that people with existing mental health illness are far more vulnerable to daily stress related to the COVID-19 pandemic.

TABLE 3 | COVID-19-specific daily stressor exposure, affective response, and depressive symptomology.

	Negative affect						Positive affect					
	Model 1			Model 2			Model 1			Model 2		
Variable	**Estimate**	**SE**	***p***	**Estimate**	**SE**	***p***	**Estimate**	**SE**	***p***	**Estimate**	**SE**	***p***
Intercept	0.015	0.13	0.907	0.063	0.13	0.621	2.410	0.25	<0.01	2.340	0.25	<0.01
COVID-19-related daily stressor (ref = "no stressor")	0.112	0.06	0.062	0.009	0.07	0.900	−0.023	0.08	0.764	0.001	0.10	0.988
COVID-19-related daily stressor × Depressive episode	–	–	–	0.272	0.12	0.012	–	–	–	−0.065	0.15	0.673
Average number of COVID-19-related daily stressors	0.029	0.21	0.892	0.022	0.21	0.919	0.431	0.41	0.300	0.433	0.41	0.298
Other daily stressors	0.470	0.05	<0.01	0.465	0.05	<0.01	−0.390	0.06	<0.01	−0.389	0.06	<0.01
Average number of other daily stressors	−0.033	0.24	0.892	−0.008	0.24	0.974	−0.882	0.47	0.064	−0.888	0.47	0.063
Depressive episode (ref = "no")	0.477	0.12	<0.01	0.370	0.12	0.004	−0.803	0.23	<0.01	−0.777	0.24	0.002
Student status (ref = "yes")	−0.145	0.19	0.455	−0.153	0.19	0.422	0.775	0.38	0.046	0.777	0.38	0.046
Sex (ref = "male")	0.232	0.12	0.068	0.229	0.12	0.066	−0.240	0.24	0.328	−0.239	0.24	0.330
Ethnicity (ref = "white")	0.092	0.13	0.478	0.069	0.13	0.585	0.148	0.25	0.558	0.154	0.25	0.545
Age	−0.003	0.02	0.887	−0.001	0.02	0.954	−0.012	0.04	0.745	−0.012	0.04	0.738

Multilevel models included a random intercept. Coefficients are unstandardized. For continuous variables, coefficients reflect the change in the outcome for a one unit change in the predictor. For categorical variables, coefficients reflect the difference between the reference group and the remaining category. Model 1 includes the main effects of all variables; Model 2 includes the interaction between depressive episode and COVID-19-related daily stressors to test for group differences.

Daily stressors, the common – albeit minor – naturalistic events or hassles that arise from day-to-day living, have both immediate and long-term consequences for psychological and physiological function (Almeida et al., 2009; Stawski et al., 2013; Greaney et al., 2019, 2020). In this regard, heightened negative affective reactivity to daily stressors is a powerful predictor of future depression (Charles et al., 2013), lending support to the concept that a sensitized emotional response to daily stress exposure may contribute to the susceptibility to mental health disorders (Caspi et al., 2010). Although, daily stress is uniquely predictive of emotional health and well-being (Twisk et al., 1999; Piazza et al., 2013; Stawski et al., 2013; Leger et al., 2018), chronic life stress necessarily influences the affective response to a daily stressor exposure (Stawski et al., 2008; Sliwinski et al., 2009). Interestingly, it is increasingly evident that the chronic stress of the ongoing global pandemic is also a significant source of novel daily stressors unique to the circumstances surrounding COVID-19 (Nelson and Bergeman, 2020; Klaiber et al., 2021; Sin et al., 2021; Zheng et al., 2021). Indeed, emerging data suggest that increased COVID-19-related daily stress (e.g., concern for one's health, social isolation financial insecurity, etc.) is associated with increased emotional distress and depressive symptoms (Duan et al., 2020; Shanahan et al., 2020; Zheng et al., 2021). This effect appears even more pronounced in adults with pre-existing depressive symptomology (Zheng et al., 2021), suggesting an important link between COVID-19-related daily stress, affective responsiveness, and symptoms of depression.

To begin to probe these inter-relations in more detail, this small proof-of-concept study was designed to determine whether moderate-to-severe depressive symptomology modulates the affective response to COVID-19-related daily stressors. Broadly consistent with, and an important extension of, the available literature (Duan et al., 2020; Nelson and Bergeman, 2020; Shanahan et al., 2020; Zheng et al., 2021), the primary novel finding of the present study is that the presence of a depressive episode synergistically magnified the detrimental emotional consequences of a COVID-19-related daily stressor exposure (e.g., hearing distressing news reports). Based on the evidence that negative affective reactivity to daily stress is exacerbated by greater pandemic-related worry (Nelson and Bergeman, 2020), it was somewhat surprising that there was no effect of COVID-19-specific daily stress on negative affect in adults without depression. This is especially notable considering that we did, in fact, detect and confirm the expected association between "traditional" non-COVID-19-related daily stressors and negative affect (Bylsma et al., 2011; Booij et al., 2018). The reason(s) for this discrepancy is not entirely clear. Certainly, the lack of consensus in the literature on the specific daily stressors that constitute a COVID-19-related stress has not yet been definitively established, as this is a rapidly evolving area of research (Klaiber et al., 2021). Another possibility is that non-depressed adults may be better equipped to adapt and cope with pandemic-related stress (Hill et al., 2021; Killgore et al., 2020). Although, these possibilities clearly require more targeted investigation, based on the

present findings, it appears that current symptoms of depression may be necessary to fully unmask the association between COVID-19-related daily stress and negative affective reactivity.

In contrast, depressive symptomology did not moderate the association between COVID-19-related daily stress and positive affect, though positive affect was reduced in adults with a depressive disorder compared to those without. This finding was somewhat surprising given that susceptibility to reduced positive emotions in the context daily stress appears to increase the risk for poor mental health outcomes, including anxiety and depressive disorders (Rackoff and Newman, 2020). Interestingly, the buffering capacity of positive affect to protect against heightened negative affective reactivity appears diminished when individuals are exposed to a COVID-19-specific stress (Nelson and Bergeman, 2020). Because adults with depression have less capacity for positive affect (Heller et al., 2009), this in turn may mechanistically contribute to amplified negative affective reactivity in the face of pandemic-related daily stress exposure. This causal mechanism of stress susceptibility merits additional study.

Age is a primary risk factor for severe illness and increased mortality risk stemming from COVID-19 infection (Zhou et al., 2020). However, studies have, perhaps surprisingly, consistently reported that older adults are less emotionally reactive to daily stress during the pandemic than young adults (Carstensen et al., 2020; Nelson and Bergeman, 2020; Novotny et al., 2020; Bruine de Bruin, 2021). As a result, there is an emerging body of research that has explored the potential factors contributing to increased mental distress in young adults during COVID-19 (Gao et al., 2020; Zheng et al., 2021). In this regard, and consistent with the data demonstrating that pre-menopausal women are more than twice as likely to develop depression and suffer greater depressive symptom severity (Kessler et al., 2003), the COVID-19 pandemic has had a more severe impact on the mental health of women (Luo et al., 2020; Novotny et al., 2020). Moreover, there is evidence that women are more emotionally reactive to daily stressor exposure than men, potentially contributing to increased risk of poor mental health outcomes (Almeida and Kessler, 1998). As such, we performed exploratory analyses to begin to examine whether greater COVID-19-related daily stress-induced increases in negative affect in young women mechanistically contribute to the aforementioned prevalence of depression during the pandemic in this cohort; however, these results did not reach statistical significance. However, given the small sample size of this initial study, future targeted investigations of the potential influence of sex on negative affective stress reactivity, in young adults both with and without depression, are warranted. Further, numerous stress-related behaviors (e.g., substance/tobacco use, sleep disturbances, unhealthy eating, etc.) have a bi-directional relation with depression (Musselman et al., 1998) and thus, in a feedforward manner may further exacerbate the severity of emotional responsiveness to stress exposure in adults with depressive symptoms. Consideration of these additional risk factors will be critical for future prospective studies designed to better understand the mechanistic underpinnings of daily stress reactivity and depression as the COVID-19 pandemic persists.

Limitations

There are inherent limitations to this initial feasibility study that warrant consideration. First, the study included a relatively small sample size, which may limit data interpretation. However, sensitivity power analyses indicate a small-to-medium effect (Cohen's $f = 0.22$), providing preliminary support for the concept that depressive symptomology influences daily stress processes as they relate to the COVID-19 pandemic. Second, ~90% of the analytical sample were students. As such, the current findings may differ for young adults who are not currently enrolled in a higher education program, as well as for middle-aged and older adults. Third, it is not possible to discern the directionality of depressive symptomology and daily stress processes in the current study, owing to the lack of comparable data prior to the onset of the COVID-19 pandemic. Finally, because data were collected, while severe restrictions to in-person, laboratory-based human subjects research were in place, a formal clinical diagnosis of major depressive disorder was not feasible. Instead, participants were characterized based on depressive symptomology. Whether the magnitude of the increase in negative affect on days with an exposure to any daily stressor is related to the degree of depressive symptom severity should be considered in future investigations. Nevertheless, the results of this small, initial study provide novel insight to the role of depressive symptomology on daily stress processes during the COVID-19 pandemic in young adults, which likely has important implications for long-term health and well-being.

Perspectives

Although, the specific COVID-19-related daily stressors have continued to evolve as the pandemic has persisted (e.g., a shift from quarantine and isolation-related stressors to those related to the lifting of emergency directives to vaccination-specific stressors and the emergence of SARS-CoV-2 variants), the current findings nevertheless add to the growing body of literature highlighting an amplification of the emotional response to stressor exposure during the pandemic, a link that may be driven by concurrent depression (Yao et al., 2020; Pan et al., 2021; Zheng et al., 2021). In addition to its inextricable link to the disease process of depression itself, stress system dysfunction is directly linked the initiation and progression of pathophysiological alterations that substantially increase cardiovascular disease risk and mortality (Dimsdale, 2008). In this regard, our laboratory recently demonstrated that daily stressor exposure was associated with greater impairments in vascular function in young otherwise healthy adults with depression (Greaney et al., 2019). Whether this link is also evident for COVID-19-related daily stress – and whether strategies to promote stress resistance and resilience during the pandemic, particularly in adults with depression – may mitigate or prevent untoward cardiovascular outcomes is an exciting avenue for future research.

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 at the University of Texas at Arlington (2020-0912). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

JG, ES, DA, and JM contributed to conception and design of the study. JG, AD, and JM collected the data. JG, AD, JT, and JM analyzed the data and performed statistical analysis. JG, AD, JT, ES, DA, and JM interpreted the data. JG drafted the manuscript. All authors contributed to the article and approved the submitted version.

FUNDING

This work was supported by National Institutes of Health (NIH) awards HL133414 (JG), MH123928 (JG), and AG062605 (JM and JT).

ACKNOWLEDGMENTS

We greatly appreciate the effort expended by the participants.

REFERENCES

Almeida, D. M., and Kessler, R. C. (1998). Everyday stressors and gender differences in daily distress. *J. Pers. Soc. Psychol.* 75, 670–680. doi: 10.1037/0022-3514.75.3.670

Almeida, D. M., Mcgonagle, K., and King, H. (2009). Assessing daily stress processes in social surveys by combining stressor exposure and salivary cortisol. *Biodemography Soc. Biol.* 55, 219–237. doi: 10.1080/19485560903382338

Almeida, D. M., Wethington, E., and Kessler, R. C. (2002). The daily inventory of stressful events: an interview-based approach for measuring daily stressors. *Assessment* 9, 41–55. doi: 10.1177/1073191102091006

Booij, S. H., Snippe, E., Jeronimus, B. F., Wichers, M., and Wigman, J. T. W. (2018). Affective reactivity to daily life stress: relationship to positive psychotic and depressive symptoms in a general population sample. *J. Affect. Disord.* 225, 474–481. doi: 10.1016/j.jad.2017.08.051

Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., et al. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *Lancet* 395, 912–920. doi: 10.1016/S0140-6736(20)30460-8

Bruine de Bruin, W. (2021). Age differences in COVID-19 risk perceptions and mental health: evidence from a national U.S. survey conducted in March 2020. *J. Gerontol. B Psychol. Sci. Soc. Sci.* 76, e24–e29. doi: 10.1093/geronb/gbaa074

Bylsma, L. M., Taylor-Clift, A., and Rottenberg, J. (2011). Emotional reactivity to daily events in major and minor depression. *J. Abnorm. Psychol.* 120, 155–167. doi: 10.1037/a0021662

Carstensen, L. L., Shavit, Y. Z., and Barnes, J. T. (2020). Age advantages in emotional experience persist even under threat from the COVID-19 pandemic. *Psychol. Sci.* 31, 1374–1385. doi: 10.1177/0956797620967261

Caspi, A., Hariri, A. R., Holmes, A., Uher, R., and Moffitt, T. E. (2010). Genetic sensitivity to the environment: the case of the serotonin transporter gene and its implications for studying complex diseases and traits. *Am. J. Psychiatry* 167, 509–527. doi: 10.1176/appi.ajp.2010.09101452

Charles, S. T., Piazza, J. R., Mogle, J., Sliwinski, M. J., and Almeida, D. M. (2013). The wear and tear of daily stressors on mental health. *Psychol. Sci.* 24, 733–741. doi: 10.1177/0956797612462222

Chiang, J. J., Turiano, N. A., Mroczek, D. K., and Miller, G. E. (2018). Affective reactivity to daily stress and 20-year mortality risk in adults with chronic illness: findings from the National Study of daily experiences. *Health Psychol.* 37, 170–178. doi: 10.1037/hea0000567

Cuijpers, P., and Smit, F. (2002). Excess mortality in depression: a meta-analysis of community studies. *J. Affect. Disord.* 72, 227–236. doi: 10.1016/S0165-0327(01)00413-X

Dimsdale, J. E. (2008). Psychological stress and cardiovascular disease. *J. Am. Coll. Cardiol.* 51, 1237–1246. doi: 10.1016/j.jacc.2007.12.024

Duan, H., Yan, L., Ding, X., Gan, Y., Kohn, N., and Wu, J. (2020). Impact of the COVID-19 pandemic on mental health in the general Chinese population: changes, predictors and psychosocial correlates. *Psychiatry Res.* 293:113396. doi: 10.1016/j.psychres.2020.113396

Gao, J., Zheng, P., Jia, Y., Chen, H., Mao, Y., Chen, S., et al. (2020). Mental health problems and social media exposure during COVID-19 outbreak. *PLoS One* 15:e0231924. doi: 10.1371/journal.pone.0238327

Gilsanz, P., Walter, S., Tchetgen Tchetgen, E. J., Patton, K. K., Moon, J. R., Capistrant, B. D., et al. (2015). Changes in depressive symptoms and incidence of first stroke among middle-aged and older US adults. *J. Am. Heart Assoc.* 4:e001923. doi: 10.1161/JAHA.115.001923

Greaney, J. L., Koffer, R. E., Saunders, E. F. H., Almeida, D. M., and Alexander, L. M. (2019). Self-reported everyday psychosocial stressors are associated with greater impairments in endothelial function in young adults with major depressive disorder. *J. Am. Heart Assoc.* 8:e010825. doi: 10.1161/JAHA.118.010825

Greaney, J. L., Surachman, A., Saunders, E. F. H., Alexander, L. M., and Almeida, D. M. (2020). Greater daily psychosocial stress exposure is associated with increased norepinephrine-induced vasoconstriction in young adults. *J. Am. Heart Assoc.* 9:e015697. doi: 10.1161/JAHA.119.015697

Heller, A. S., Johnstone, T., Shackman, A. J., Light, S. N., Peterson, M. J., Kolden, G. G., et al. (2009). Reduced capacity to sustain positive emotion in major depression reflects diminished maintenance of fronto-striatal brain activation. *Proc. Natl. Acad. Sci. U. S. A.* 106, 22445–22450. doi: 10.1073/pnas.0910651106

Hill, P. L., Klaiber, P., Burrow, A. L., Delongis, A., and Sin, N. L. (2021). Purposefulness and daily life in a pandemic: predicting daily affect and physical symptoms during the first weeks of the COVID-19 response. *Psychol. Health.* 1–17. doi: 10.1080/08870446.2021.1914838

Holmes, E. A., O'connor, R. C., Perry, V. H., Tracey, I., Wessely, S., Arseneault, L., et al. (2020). Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science. *Lancet Psychiatry* 7, 547–560. doi: 10.1016/S2215-0366(20)30168-1

Hox, J. J., Moerbeek, M., and Van De Schoot, R. (2017). *Multilevel Analysis: Techniques and Applications*. Milton Park, UK: Routledge.

Kessler, R. C., Andrews, G., Colpe, L. J., Hiripi, E., Mroczek, D. K., Normand, S. L., et al. (2002). Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychol. Med.* 32, 959–976. doi: 10.1017/S0033291702006074

Kessler, R. C., Berglund, P., Demler, O., Jin, R., Koretz, D., Merikangas, K. R., et al. (2003). The epidemiology of major depressive disorder: results from the National Comorbidity Survey Replication (NCS-R). *JAMA* 289, 3095–3105. doi: 10.1001/jama.289.23.3095

Killgore, W. D. S., Taylor, E. C., Cloonan, S. A., and Dailey, N. S. (2020). Psychological resilience during the COVID-19 lockdown. *Psychiatry Res.* 291:113216. doi: 10.1016/j.psychres.2020.113216

Klaiber, P., Wen, J. H., Delongis, A., and Sin, N. L. (2021). The ups and downs of daily life during COVID-19: age differences in affect, stress, and positive

events. *J. Gerontol. B Psychol. Sci. Soc. Sci.* 76, e30–e37. doi: 10.1093/geronb/gbaa096

Kroenke, K., Spitzer, R. L., and Williams, J. B. (2001). The PHQ-9: validity of a brief depression severity measure. *J. Gen. Intern. Med.* 16, 606–613. doi: 10.1046/j.1525-1497.2001.016009606.x

Kroenke, K., Spitzer, R. L., Williams, J. B., and Lowe, B. (2010). The Patient Health Questionnaire Somatic, Anxiety, and Depressive Symptom Scales: a systematic review. *Gen. Hosp. Psychiatry* 32, 345–359. doi: 10.1016/j.genhosppsych.2010.03.006

Leger, K. A., Charles, S. T., and Almeida, D. M. (2018). Let it go: lingering negative affect in response to daily stressors is associated with physical health years later. *Psychol. Sci.* 29, 1283–1290. doi: 10.1177/0956797618763097

Lett, H. S., Blumenthal, J. A., Babyak, M. A., Sherwood, A., Strauman, T., Robins, C., et al. (2004). Depression as a risk factor for coronary artery disease: evidence, mechanisms, and treatment. *Psychosom. Med.* 66, 305–315. doi: 10.1097/01.psy.0000126207.43307.c0

Luo, M., Guo, L., Yu, M., Jiang, W., and Wang, H. (2020). The psychological and mental impact of coronavirus disease 2019 (COVID-19) on medical staff and general public – a systematic review and meta-analysis. *Psychiatry Res.* 291:113190. doi: 10.1016/j.psychres.2020.113190

McGinty, E. E., Presskreischer, R., Han, H., and Barry, C. L. (2020). Psychological distress and loneliness reported by US adults in 2018 and April 2020. *JAMA* 324, 93–94. doi: 10.1001/jama.2020.9740

Mroczek, D. K., and Kolarz, C. M. (1998). The effect of age on positive and negative affect: a developmental perspective on happiness. *J. Pers. Soc. Psychol.* 75, 1333–1349. doi: 10.1037/0022-3514.75.5.1333

Musselman, D. L., Evans, D. L., and Nemeroff, C. B. (1998). The relationship of depression to cardiovascular disease: epidemiology, biology, and treatment. *Arch. Gen. Psychiatry* 55, 580–592. doi: 10.1001/archpsyc.55.7.580

Nelson, N. A., and Bergeman, C. S. (2020). Daily stress processes in a pandemic: the effects of worry, age, and affect. *Gerontologist* 61, 196–204. doi: 10.1093/geront/gnaa187

Nicola, M., Alsafi, Z., Sohrabi, C., Kerwan, A., Al-Jabir, A., Iosifidis, C., et al. (2020). The socio-economic implications of the coronavirus pandemic (COVID-19): a review. *Int. J. Surg.* 78, 185–193. doi: 10.1016/j.ijsu.2020.04.018

Novotny, J. S., Gonzalez-Rivas, J. P., Kunzova, S., Skladana, M., Pospisilova, A., Polcrova, A., et al. (2020). Risk factors underlying COVID-19 lockdown-induced mental distress. *Front. Psychol.* 11:603014. doi: 10.3389/fpsyt.2020.603014

Nwachukwu, I., Nkire, N., Shalaby, R., Hrabok, M., Vuong, W., Gusnowski, A., et al. (2020). COVID-19 pandemic: age-related differences in measures of stress, anxiety and depression in Canada. *Int. J. Environ. Res. Public Health* 17:6366. doi: 10.3390/ijerph17176366

Pan, K. Y., Kok, A. A. L., Eikelenboom, M., Horsfall, M., Jorg, F., Luteijn, R. A., et al. (2021). The mental health impact of the COVID-19 pandemic on people with and without depressive, anxiety, or obsessive-compulsive disorders: a longitudinal study of three Dutch case-control cohorts. *Lancet Psychiatry* 8, 121–129. doi: 10.1016/S2215-0366(20)30491-0

Piazza, J. R., Charles, S. T., Sliwinski, M. J., Mogle, J., and Almeida, D. M. (2013). Affective reactivity to daily stressors and long-term risk of reporting a chronic physical health condition. *Ann. Behav. Med.* 45, 110–120. doi: 10.1007/s12160-012-9423-0

Pierce, M., Hope, H., Ford, T., Hatch, S., Hotopf, M., John, A., et al. (2020). Mental health before and during the COVID-19 pandemic: a longitudinal probability sample survey of the UK population. *Lancet Psychiatry* 7, 883–892. doi: 10.1016/S2215-0366(20)30308-4

Rackoff, G. N., and Newman, M. G. (2020). Reduced positive affect on days with stress exposure predicts depression, anxiety disorders, and low trait positive affect 7 years later. *J. Abnorm. Psychol.* 129, 799–809. doi: 10.1037/abn0000639

Shanahan, L., Steinhoff, A., Bechtiger, L., Murray, A. L., Nivette, A., Hepp, U., et al. (2020). Emotional distress in young adults during the COVID-19 pandemic: evidence of risk and resilience from a longitudinal cohort study. *Psychol. Med.* 1–10. doi: 10.1017/S003329172000241X

Sin, N. L., Klaiber, P., Wen, J. H., and Delongis, A. (2021). Helping amid the pandemic: daily affective and social implications of COVID-19-related prosocial activities. *Gerontologist* 61, 59–70. doi: 10.1093/geront/gnaa140

Sin, N. L., Sloan, R. P., Mckinley, P. S., and Almeida, D. M. (2016). Linking daily stress processes and laboratory-based heart rate variability in a national sample of midlife and older adults. *Psychosom. Med.* 78, 573–582. doi: 10.1097/PSY.0000000000000306

Sliwinski, M. J., Almeida, D. M., Smyth, J., and Stawski, R. S. (2009). Intraindividual change and variability in daily stress processes: findings from two measurement-burst diary studies. *Psychol. Aging* 24, 828–840. doi: 10.1037/a0017925

Spitzer, R. L., Kroenke, K., and Williams, J. B. (1999). Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. Primary care evaluation of mental disorders. Patient Health Questionnaire. *JAMA* 282, 1737–1744. doi: 10.1001/jama.282.18.1737

Stawski, R. S., Cichy, K. E., Piazza, J. R., and Almeida, D. M. (2013). Associations among daily stressors and salivary cortisol: findings from the National Study of daily experiences. *Psychoneuroendocrinology* 38, 2654–2665. doi: 10.1016/j.psyneuen.2013.06.023

Stawski, R. S., Sliwinski, M. J., Almeida, D. M., and Smyth, J. M. (2008). Reported exposure and emotional reactivity to daily stressors: the roles of adult age and global perceived stress. *Psychol. Aging* 23, 52–61. doi: 10.1037/0882-7974.23.1.52

Taylor, S., Landry, C. A., Paluszek, M. M., Fergus, T. A., Mckay, D., and Asmundson, G. J. G. (2020). COVID stress syndrome: concept, structure, and correlates. *Depress. Anxiety* 37, 706–714. doi: 10.1002/da.23071

Twisk, J. W., Snel, J., Kemper, H. C., and Van Mechelen, W. (1999). Changes in daily hassles and life events and the relationship with coronary heart disease risk factors: a 2-year longitudinal study in 27-29-year-old males and females. *J. Psychosom. Res.* 46, 229–240. doi: 10.1016/S0022-3999(98)00088-9

Vindegaard, N., and Benros, M. E. (2020). COVID-19 pandemic and mental health consequences: systematic review of the current evidence. *Brain Behav. Immun.* 89, 531–542. doi: 10.1016/j.bbi.2020.05.048

Whiteford, H. A., Degenhardt, L., Rehm, J., Baxter, A. J., Ferrari, A. J., Erskine, H. E., et al. (2013). Global burden of disease attributable to mental and substance use disorders: findings from the Global Burden of Disease Study 2010. *Lancet* 382, 1575–1586. doi: 10.1016/S0140-6736(13)61611-6

Yao, H., Chen, J. H., and Xu, Y. F. (2020). Patients with mental health disorders in the COVID-19 epidemic. *Lancet Psychiatry* 7:e21. doi: 10.1016/S2215-0366(20)30090-0

Zheng, J., Morstead, T., Sin, N., Klaiber, P., Umberson, D., Kamble, S., et al. (2021). Psychological distress in North America during COVID-19: the role of pandemic-related stressors. *Soc. Sci. Med.* 270:113687. doi: 10.1016/j.socscimed.2021.113687

Zhou, F., Yu, T., Du, R., Fan, G., Liu, Y., Liu, Z., et al. (2020). Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet* 395, 1054–1062. doi: 10.1016/S0140-6736(20)30566-3

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 17 September 2021
doi: 10.3389/fpsyg.2021.664780

The Relationship Between Perceived Stress, State-Trait Anxiety, and Sleep Quality Among University Graduates in China During the COVID-19 Pandemic

Bailong Liu, Ke Qiao and Youfeng Lu*

School of Marxism, Xi'an University of Architecture and Technology, Xi'an, China

The study aimed to investigate the relationship among perceived stress, state-trait anxiety, and sleep quality of graduates to provide a reference for improving their psychological status and attitude adjustment of job-searching during the COVID-19 pandemic. The research was conducted in a descriptive cross-sectional online survey between May 2020 and August 2020. The data were collected from 1,200 participants by using the personal information form prepared by the researchers in line with the literature, the Perceived Stress Scale, the State-Trait Anxiety Inventory, and the Pittsburgh Sleep Quality Index (PSQI). Among the surveyed participants, 47.67% were female, and 10.92% were medical students. The mean perceived stress, state anxiety, trait anxiety, and sleep quality were moderate and found as 31.4 ± 6.69, 46.67 ± 5.80, 49.45 ± 5.54, and 5.94 ± 2.47, respectively. The detection rates of state anxiety and trait anxiety were 48.63 and 49.50%, respectively. There was no significant difference in the detection rate of state anxiety and trait anxiety among different genders and majors ($p > 0.05$). The detection rate of state anxiety and trait anxiety of rural family students was higher than that of urban family students ($p < 0.01$). The score on the PSQI was positively associated with the scores on the perceived stress, state anxiety, and trait anxiety scales ($p < 0.001$ for each model). Sleep quality was associated with increased perceived stress, state anxiety, and trait anxiety among graduates in China. Collectively, the study revealed the relationship between perceived stress, state-trait anxiety, and sleep quality among university graduates in China during the COVID-19 pandemic. Our results offer novel practical implications for all circles of the society to ensure students' health under the context of the COVID-19 epidemic.

Keywords: sleep quality, anxiety, COVID-19, perceived stress, university graduates

OPEN ACCESS

Edited by:
Jason H. Huang,
Baylor Scott and White Health,
United States

Reviewed by:
Hongyu Xu,
School of Medicine,
Virginia Commonwealth University,
United States
M. Tasdik Hasan,
University of Liverpool,
United Kingdom

****Correspondence:***
Bailong Liu
liubailong@xauat.edu.cn

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *26 February 2021*
Accepted: *20 August 2021*
Published: *17 September 2021*

Citation:
Liu B, Qiao K and Lu Y (2021) The Relationship Between Perceived Stress, State-Trait Anxiety, and Sleep Quality Among University Graduates in China During the COVID-19 Pandemic. Front. Psychol. 12:664780. doi: 10.3389/fpsyg.2021.664780

INTRODUCTION

The outbreak of the COVID-19 emerged in Wuhan in December 2019 is an important public health problem (Hui et al., 2020; Li et al., 2020b). The WHO declared the outbreak of the novel coronavirus a global health emergency (World Health Organization, 2020). The COVID-19 outbreak is expected to continue in the coming years (Bao et al., 2020;

Paules et al., 2020). It has been reported that the new infectious diseases may cause an increase in anxiety, depression, and stress in the general population (Erdoğan and Hocaoğlu, 2020; Tull et al., 2020; Kim et al., 2021). Facing the COVID-19 virus, a new infectious disease has resulted in a high prevalence of mental health problems in China and other countries (Chan et al., 2020; Choi et al., 2020; Ding et al., 2020). This increased stress in individuals, especially university students, can cause elevated anxiety levels and in turn compromise the sleep quality (Huang and Zhao, 2020; Zacher and Rudolph, 2020).

Meanwhile, the employment situation for university graduates is more and more serious. In recent years, the number of university graduates in China is gradually increasing, but the employment rate for university graduates is decreasing year by year (Li et al., 2020a). In 2020, the number of university graduates in China will reach 8.74 million. With the increasing uncertainty of social employment demand, the employment situation is complex and changeable. The employment of university graduates is facing severe challenges, and employment pressure is greatly increased (Liu et al., 2009; Hou et al., 2019).

It is extremely important to determine the factors that affect the health of university graduates in combating the COVID-19 pandemic. Anxiety is a normal reaction to the novel coronavirus pneumonia and employment pressure (Zhang et al., 2013; Gao et al., 2019). However, some students show overwhelming anxiety reactions, which would affect their daily function and employment mentality (Zhang et al., 2020). Sleep disorder is a common symptom of anxiety, which is one of the most concerned problems of university students and one of the main reasons for psychological counseling (Farrah et al., 2009). It is important for university graduates to obtain quality sleep to concentrate on completing their studies and actively look for jobs. Also, quality sleep plays an important role in defending against various infections (Ohrnberger et al., 2017; Besedovsky and Lange, 2019).

Under the dual influence of COVID-19 and the increasing employment pressure, the mental health and sleep disorders of university graduates have become increasingly prominent, which have attracted the attention of all sectors of society. In this study, 1,200 university graduates were selected to analyze their perceived stress, state anxiety, trait anxiety, and sleep quality to provide a reference for improving the mental health status of university graduates.

PARTICIPANTS AND METHODS

Participants and Sampling

The research was descriptive cross-sectional types. Only university graduates (aged ≥ 18 years) in Shaanxi Province who were able to provide informed consent were recruited in the study. A total of 1,200 university graduates from 11 universities in Shaanxi Province participated in the test. The survey time was from April to August 2020.

Measurements

The data were collected by using the personal information form prepared by the researchers in line with the literature, the Perceived Stress Scale (PSS), the State-Trait Anxiety Inventory, and the PSQI. The study was carried out in the format of a "Questionnaire Star" electronic questionnaire system (Changsha Haoxing Information Technology Co., Ltd., China).

Personal Information Form

This form contains the socio-demographic characteristics of university graduates at 11universities of Shaanxi Province, including age, gender, major, and origin.

Perceived Stress Scale

The PSS was developed by Cohen et al., which is used to assess the degree of stress an individual feel in the past month (Cohen et al., 1983). The Chinese version revised by Yang Tingzhong and Huang Hanteng was adopted (Yang and Huang, 2003). The scores of the PSS with 14 items that used vary between 0 and 56. The participants were evaluated of each item on a 5-point Likert scale ranging from "Never (0)" to "Very often (4)." Seven of the items containing positive statements were scored in reverse order. The high score indicated the excessive perception of stress (Eskin et al., 2013). The Alpha coefficient of the scale was found to be 0.86 (Yang and Huang, 2003).

State-Trait Anxiety Inventory

The State-Trait Anxiety Inventory is a test developed by Spielberger et al. that measures state and trait anxiety levels (Spielberger et al., 1970). The scale consists of two parts, the "state anxiety scale," which is created with the aim of determining the instantaneous feelings, and the "trait anxiety scale," which is created to determine the feelings in general (Yalcin et al., 2015; Kuroshm et al., 2021). Each test consists of 20, 4-point Likert-type questions. It is a four-degree scale ranging from "Nothing" to "All." Scores from each form vary between 20 and 80, with higher scores indicating greater anxiety. A total score of S-AI > 52 indicates state anxiety, and T-AI score > 53 is defined as trait anxiety. The Chinese version of the inventory was revised by Ye Renmin in 1990 (Wang et al., 1999). It was stated that the State-Trait Anxiety Inventory (STAI) had an alpha value of 0.88 for reliability and 0.90 for validity (Wang et al., 1999).

Pittsburgh Sleep Quality Index

The PSQI is a questionnaire with 18 items assessing sleep quality over a 1-mo interval (Buysse et al., 1989; Okely et al., 2021). The scale was translated into Chinese by Liu Xianchen in 1996 (Liu et al., 1996). The 18 items are grouped into seven dimensions: subjective sleep quality, sleep latency, sleep disturbances, sleep duration, habitual sleep efficiency, use of sleeping medication, and daytime dysfunction. The sum of scores for these seven dimensions yields a composite score, ranging from 0 to 21 (Xiao et al., 2020; Jacopo et al., 2021). Higher scores indicate worse

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

Characteristics		*n*(%)
Gender	Male	628(52.33)
	Female	572(47.67)
Major	Science and Engineering	624(52.0)
	Liberal Arts	445(37.08)
	Medicine	131(10.92)
Origin	Urban	629(52.42)
	Rural	571(47.58)
Age(Mean ± SD)		23.36 ± 2.72

TABLE 2 | Mean scores of the sample on the PSS, STAI, and PSQI.

	M + N-MAX	Mean(SD)
Perceived Stress Scale	0 ~ 56	31.44 ± 6.69
State Anxiety	20 ~ 80	46.67 ± 7.80
Trait Anxiety	20 ~ 80	49.25 ± 7.54
Sleep Quality Scale	0 ~ 21	5.94 ± 2.47

sleep quality. A total score of PSQI ≥ 8 indicates poor sleep quality, 5 ~ 7 indicates average sleep quality, and ≤4 indicates good sleep quality. The factor score of PSQI ≥ 2 indicates poor or very poor sleep quality on this factor. The reliability and validity of the scale were 0.99 and 0.85, respectively (Liu et al., 1996).

Statistical Methods

In the data collection process, measurement tools were applied by applying an online data collection method. This work lasted 4 months, using "Personal Information Form," "PSS," "State-Trait Anxiety Inventory," and "PSQI."

The data were analyzed using the SPSS version 23.0 software package. Percentages, Kruskal-Wallis, *t*-test, chi-square test, and correlations tests were used to evaluate the data. Kappa and correlation analyses were conducted to determine consistency among the observers. A value of $p < 0.05$ was considered statistically significant.

RESULTS

Descriptive Results

The socio-demographic characteristics of a total of 1,200 participants were showed in **Table 1**. Among them, there were 628 males and 572 females. The average age was 23.36 ± 2.72 years, from 21 to 26. A total of 624 students (52%) majored in science and engineering, 445 students (37.08%) majored in liberal arts, and 131 students (10.92%) majored in medicine. A total of 52.42% of the participants came from urban families, while 47.58% of them were rural students.

The mean scores of the sample on the PSS, STAI, and PSQI were showed in **Table 2**. The mean perceived stress, state anxiety, trait anxiety, and sleep quality were moderate and found as 31.4 ± 6.69, 46.67 ± 5.80, 49.45 ± 5.54, and 5.94 ± 2.47, respectively.

Correlations Between Outcomes

The average scores of state anxiety and trait anxiety were 46.67 ± 7.80 and 49.25 ± 7.54, respectively. The detection rates of state anxiety and trait anxiety among 1,200 university graduates were 48.42 and 49.25%, respectively. As shown in **Table 3**, there was no significant difference in the detection rates of state anxiety and trait anxiety among university graduates of different genders and majors ($p \geq 0.05$). The detection rates of state anxiety and trait anxiety in rural students were higher than those in urban areas, and the differences were statistically significant ($p < 0.01$).

The total average score of PSQI was 5.94 ± 2.47. As shown in **Table 4**, according to the evaluation standard, among 1,200 university graduates, 27.83% had poor sleep quality, 54.83% had average sleep quality, and 17.33% had good sleep quality. The main symptoms of poor sleep were 77.92% daytime dysfunction, 47.08% sleep duration, 27.33% subjective sleep quality, and 24.25% sleep latency. There were significant differences in the distribution of sleep quality among university graduates from different majors and origins ($p < 0.01$).

The relationships between the socio-demographic characteristics and mean scores of the sample on the PSS, STAI, and PSQI were showed in **Table 5**. According to the results, there was no statistically significant correlation between perceived stress scores and socio-demographic characteristics. State anxiety levels were significantly higher in woman students than man students ($p < 0.05$). University graduates who came from rural families had significantly higher state anxiety levels ($p < 0.05$). There were no significant differences found in terms of trait anxiety levels.

According to the correlation analysis in **Table 6**, there was no significant relationship between state anxiety and perceived stress ($r = -0.037$, $p = 0.611$). There was also no significant relationship between sleep quality and perceived stress ($r = -0.037$, $p = 0.611$). However, a positive relationship was found between the trait anxiety and perceived stress ($r = 0.164$, $p = 0.016$), state anxiety and trait anxiety ($r = 0.520$, $p = 0.000$), state anxiety and sleep quality ($r = 0.157$, $p = 0.021$), and trait anxiety and sleep quality ($r = 0.142$, $p = 0.041$).

Predictors of Change

Taking state anxiety and trait anxiety as dependent variables, sleep quality score as independent variables, and gender, major category, and origin as control variables, binary logistic regression analysis was conducted. The results in **Table 7** showed that the evaluation results and total scores of sleep quality of university graduates were positively correlated with state anxiety and trait anxiety.

Taking trait anxiety as the independent variable and the total score of PSQI and its factors (subjective sleep quality and sleep duration) as the dependent variable, the regression equations were constructed. The results were showed in **Table 8**. Trait anxiety had a significant predictive effect on subjective sleep quality, sleep duration, and PSQI total score, and the explained amount of variation was 2.56, 2.69, and 1.84%, respectively.

TABLE 3 | The comparison of socio-demographic characteristics between the detection rate of state anxiety and trait anxiety.

Characteristics		*n*	Test, *p* value	State Anxiety (Detection rate/%)	Trait Anxiety (Detection rate/%)
Gender	Male	628		294(46.82%)	299(47.61%)
	Female	572		287(50.17%)	292(51.05%)
			χ^2	0.89	1.00
			p	>0.05	>0.05
Major	Science and Engineering	624		297(47.60%)	303(48.56%)
	Liberal arts	445		219(49.21%)	226(50.79%)
	Medicine	131		65(49.62%)	62(47.33%)
			χ^2	0.18	0.07
			p	>0.05	>0.05
Origin	Urban	629		243(38.63%)	252(40.06%)
	Rural	571		338(59.19%)	339(59.37)
			χ^2	31.39	22.29
			p	<0.01	<0.01

TABLE 4 | The comparison of socio-demographic characteristics in the distribution of sleep quality.

Characteristics		*n*	Poor sleep quality (Constituent Ratio/%)	Average sleep quality (Constituent Ratio/%)	Good sleep quality (Constituent Ratio/%)	χ^2	*p*
Gender	Male	628	173(27.55)	344(54.78)	111(17.68)	3.04	>0.05
	Female	572	161(28.15)	314(54.90)	97(16.96)		
Major	Science and Engineering	624	158(25.32)	359(57.53)	107(17.15)	13.54	<0.01
	Liberal arts	445	139(31.24)	230(51.69)	76(17.08)		
	Medicine	131	37(28.24)	69(52.67)	25(19.08)		
Origin	Urban	629	153(24.32)	328(52.15)	148(23.53)	16.33	<0.01
	Rural	571	181(31.70)	330(57.79)	60(10.51)		

TABLE 5 | The comparison of socio-demographic characteristics between mean scores of the sample on the PSS, STAI, and PSQI.

Characteristics		PSS score(M ± SD)	S-AI score(M ± SD)	T-AI score(M ± SD)	PSQI score(M ± SD)
Gender	Male	30.88 ± 6.47	45.49 ± 7.04	48.59 ± 8.12	5.82 ± 2.51
	Female	32.05 ± 6.93	47.96 ± 8.63	49.98 ± 6.91	6.07 ± 2.43
	Test, *p* value	*t* = −1.324	*t* = 2.803	*t* = −1.951	*t* = 1.477
		p = 0.184	*p* = 0.005	*p* = 0.053	*p* = 0.141
Major	Science and Engineering	30.87 ± 6.31	46.94 ± 9.09	49.81 ± 8.24	5.82 ± 2.41
	Liberal arts	32.24 ± 5.98	46.63 ± 8.52	48.86 ± 6.79	6.11 ± 2.49
	Medicine	31.41 ± 7.33	45.67 ± 6.92	47.92 ± 6.75	5.93 ± 2.68
	Test, *p* value	KW = 4.077	KW = 1.124	KW = 0.902	KW = 0.902
		p = 0.231	*p* = 0.737	*p* = 0.813	*p* = 0.813
Origin	Urban	30.82 ± 7.09	45.73 ± 7.34	49.13 ± 7.03	5.69 ± 2.62
	Rural	31.94 ± 6.24	47.68 ± 8.27	49.36 ± 8.12	6.23 ± 2.31
	Test, *p* value	*t* = 0.356	*t* = 1.967	*t* = 0.136	*t* = 1.113
		p = 0.722	*p* = 0.050	*p* = 0.892	*p* = 0.127

DISCUSSION

In the fight against the COVID-19 pandemic, it is extremely important to identify the factors that affect the psychological health of university graduates. A general picture of the psychological state of university graduates in China during the COVID-19 pandemic has been presented. Pandemics have many negative effects on society, economy, psychology, and spirit (Fong et al., 2020; Gao et al., 2020; Salari et al., 2020; Wang et al., 2020; Zhang and Ma, 2020; Li et al., 2020c). Under the pressure of study and employment, the mental health of university graduates has always been the focus of colleges and society (Kahn, 2010; Altonji et al., 2016). Therefore, the impact of novel coronavirus pneumonia, the fear of leaving campus, fierce competition, huge employment pressure, and worries about future development can cause serious mental health problems for university graduates. Lack of sleep or poor sleep quality can lead to college students' fatigue, inattentiveness,

TABLE 6 | Correlations between the PSS, the STAI, and the PSQI.

Characteristics		PSS	S-AI	T-AI	PSQI
PSS	r		−0.037	0.164	−0.037
	P		0.611	0.016	0.607
S-AI	r	−0.037		0.520	0.157
	P	0.611		0.000	0.021
T-AI	r	0.164	0.520		0.142
	P	0.016	0.000		0.041
PSQI	r	−0.037	0.157	0.142	
	P	0.607	0.021	0.041	

TABLE 7 | Regression analysis on the relationship between sleep quality and state-trait anxiety [n = 1,200 odd ratio (OR, 95%CI)].

Sleep quality	State anxiety	Trait anxiety
Subjective sleep quality	2.02 (1.73 ~ 2.94)**	2.07 (1.49 ~ 2.16)**
Sleep duration	1.81 (1.71 ~ 1.99)**	1.98 (1.68 ~ 3.92)**
Sleep latency	2.84 (1.65 ~ 3.12)*	3.08 (1.47 ~ 3.91)**
Daytime dysfunction	3.24 (1.86 ~ 3.68)*	3.37 (2.67 ~ 4.81)*
Habitual sleep efficiency	2.07 (1.65 ~ 2.57)*	2.21 (1.68 ~ 3.95)*
Use of sleeping medication	3.20 (1.98 ~ 4.34)*	3.64 (1.92 ~ 3.80)*
Sleep disturbances	2.98 (1.33 ~ 3.09)**	3.11 (1.72 ~ 4.00)*
Total score	2.57 (1.86 ~ 2.97)**	3.04(2.04 ~ 3.71)*

*$p < 0.05$ and **$p < 0.01$.

low learning efficiency, and other undesirable phenomena (Gadie et al., 2017; Barros et al., 2019; Cao et al., 2021).

Through this cross-sectional study, the mental health problems and the associated factors among Chinese university graduates with pressure increases exposed to COVID-19 were assessed. The degrees of the perceived stress, anxiety, and sleep quality of 1,200 participants were assessed using the Perceived Stress Scale, the State-Trait Anxiety Inventory, and the PSQI, respectively, which found that the mean perceived stress, state anxiety, trait anxiety, and sleep quality were moderate and found as 31.4 ± 6.69, 46.67 ± 5.80, 49.45 ± 5.54, and5.94 ± 2.47, respectively.

The findings of this study demonstrated that the perceived stress, anxiety, and sleep quality of university graduates were affected by some demographic variables. The results showed that the detection rates of state anxiety and trait anxiety were 48.63 and 49.50%. A considerable number of university graduates had different degrees of state anxiety and trait anxiety, which was significantly higher than the detection rates of state anxiety and trait anxiety on the adult population in other studies (Madrid-Valero et al., 2017). The reason for this analysis is that the university graduates will face more pressure, unclear future planning, and fierce competition for employment under the influence of COVID-19. This shows that during the period of COVID-19, universities and all sectors of society should give university graduates more care and psychological support to help them to clear up negative emotions and avoid serious harm to their mental health.

In addition, the detection rates of state anxiety and trait anxiety of different genders and different majors were similar, which indicated that there was a high risk of anxiety for both

TABLE 8 | Regression analysis of trait anxiety and sleep quality.

	ΔR^2	F	β	t
Subjective sleep quality	0.03	12.37	0.16	3.51**
Sleep duration	0.01	5.44	0.11	2.33*
PSQI total score	0.02	11.58	0.16	3.39**

*$p < 0.05$ and **$p < 0.01$.

males and females, regardless of their majors. This study found that state anxiety levels were significantly higher in females than males ($p < 0.05$). This was consistent with the greater pressure on female employment in the current society. The detection rates of state anxiety and trait anxiety on rural students were higher than those in urban areas. It was speculated that it may be due to the low financial support of rural families for further study and the great economic pressure of employment for their families. Serving as reserve talents for the healthcare system, medical students were not yet professionally matured enough to face one of the worst global public health crises. The perceived stress and anxiety induced by the COVID-19 epidemic might affect medical students' future career choice (Zheng et al., 2021).

There was a close relationship between state-trait anxiety and sleep quality of university graduates. Multivariable logistic regression analysis was performed to identify factors associated with mental health outcomes among university graduates during COVID-19. The regression analysis showed that each factor and total score of sleep quality were positively correlated with state and trait anxiety. They can influence each other and form a vicious circle (Liu et al., 2016). The relationship between sleep quality and anxiety should be paid attention in order to reduce the state and trait anxiety of university graduates. The results of the study showed that trait anxiety had a significant predictive effect on subjective sleep quality, sleep duration, and PSQI total score.

CONCLUSION

The study managed to capture some immediate positive and negative mental health impacts of the COVID-19 pandemic. The results showed that rural graduates looking for employment, especially students majored in liberal arts, were found to have a high risk of mental health symptoms that were not conducive to development and may need psychological support or interventions. Since the COVID-19 pandemic is still ongoing, these findings need to be confirmed and investigated in future.

LIMITATIONS

This study is a cross-sectional study, which can not reveal the causal direction of the relationship between perceived stress, state-trait anxiety, and sleep quality. It needs to carry out a prospective cohort study to explore.

The effect of state anxiety on sleep quality is direct and significant. The trait anxiety can trigger and cause all kinds of sleep problems by influencing individual anxiety tendency steadily. In this study, the explanation rate of trait anxiety to the variance of PSQI is not high, which may also be due to this. Trait anxiety has an indirect effect on sleep quality, which mainly affects sleep quality through the mediating effect of state anxiety.

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 Xi'an University of Architecture and Technology. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

BL conceived the initial idea for the study and helped to study design. KQ designed the study, collected the data, performed the statistical analysis, and helped to recruit the participants. BL and YL contributed to intervention design and draft the manuscript. All authors have read and agreed to the published version of the manuscript.

FUNDING

This study is supported by the Excellent Project of University Student Work in Shaanxi Province (2020FXM06).

REFERENCES

Altonji, J. G., Kahn, L. B., and Speer, J. D. (2016). Cashier or consultant? Entry labor market conditions, field of study, and career success. *J. Labor Econ.* 34, S361–S401. doi: 10.1086/682938

Bao, Y., Sun, Y., Meng, S., Shi, J., and Lu, L. (2020). 2019-nCoV epidemic: address mental health care to empower society. *Lancet* 395, e37–e38. doi: 10.1016/S0140-6736(20)30309-3

Barros, M., Lima, M., Ceolim, M., Zancanella, E., and Cardoso, T. (2019). Quality of sleep, health and well-being in a population-based study. *Revista. de. saude publica.* 53:82. doi: 10.11606/s1518-8787.2019053001067

Besedovsky, L., Lange, T., and Haack, M. (2019). The sleep-immune crosstalk in health and disease. *Physiol. Rev.* 99, 1325–1380. doi: 10.1152/physrev.00010.2018

Buysse, D. J., Reynolds, C. R., Monk, T. H., Berman, S. R., and Kupfer, D. J. (1989). The Pittsburgh sleep quality index: a new instrument for psychiatric practice and research. *Psychiatry Res.* 28, 193–213. doi: 10.1016/0165-1781(89)90047-4

Cao, X., Chen, Z., Wu, L., and Zhou, J. (2021). Co-occurrence of chronic pain, depressive symptoms, and poor sleep quality in a health check-up population in China: a multicenter survey. *J. Affect. Disord.* 281, 792–798. doi: 10.1016/j.jad.2020.11.060

Chan, E. Y. Y., Huang, Z., Lo, E. S. K., Hung, K. K. C., Wong, E. L. Y., and Wong, S. Y. S. (2020). Socio-demographic predictors of health risk perception, attitude and behavior practices associated with health-emergency disaster risk management for biological hazards: the case of COVID-19 pandemic in Hong Kong, SAR China. *Int. J. Environ. Res. Public Health.* 17:3869. doi: 10.3390/ijerph17113869

Choi, E. P. H., Hui, B. P. H., and Wan, E. Y. F. (2020). Depression and anxiety in Hong Kong during COVID-19. *Int. J. Environ. Res. Public Health.* 17:3740. doi: 10.3390/ijerph17249346

Cohen, S., Kamarck, T., and Mermelstein, R. A. (1983). Global measure of perceived stress. *J. Health Soc. Behav.* 24, 385–396.

Ding, Y., Xu, J., Huang, S., Li, P., Lu, C., and Xie, S. (2020). Risk perception and depression in public health crises: evidence from the COVID-19 crisis in China. *Int. J. Environ. Res. Public Health* 17:5728. doi: 10.3390/ijerph17165728

Erdoğan, A., and Hocaoğlu, Ç. (2020). Psychiatric aspect of infectious diseases and pandemic: a review. *KlinikPsikiyatriDergisi.* 23, 72–80. doi: 10.5505/kpd.2020.90277

Eskin, M., Harlak, H., Demirkıran, F., and Dereboy, Ç. (2013). The adaptation of the perceived stress scale into Turkish: a reliability and validity analysis. *New/Yeni. Symp. J.* 51, 132–140.

Farrah, J., Nakhaee, N., Sheibani, V., et al. (2009). Psychometric properties of the Persian version of the Pittsburgh sleep quality index addendum for PTSD (PSQI-A). *Sleep Breath.* 13, 259–262. doi: 10.1007/s11325-008-0233-3

Fong, B. Y. F., Wong, M. C. S., Law, V. T. S., Lo, M. F., Ng, T. K. C., Yee, H. H. L., et al. (2020). Relationships between physical and social behavioural changes and the mental status of homebound residents in Hong Kong during the COVID-19 pandemic. *Int. J. Environ. Res. Public Health* 17:6653. doi: 10.3390/ijerph17186653

Gadie, A. M., Shafto, M., Yue, L., and Kievit, R. A. (2017). How are age-related differences in sleep quality associated with health outcomes? An epidemiological investigation in a UK cohort of 2406 adults. *BMJ Open* 7:e014920. doi: 10.1136/bmjopen-2016-014920

Gao, W., Ping, S., and Liu, X. (2019). Gender differences in depression, anxiety, and stress among college students: a longitudinal study from China. *J. Affect. Disord.* 263, 292–300. doi: 10.1016/j.jad.2019.11.121

Gao, J., Zheng, P., Jia, Y., Chen, H., Mao, Y., Chen, S., et al. (2020). Mental health problems and social media exposure during COVID-19 outbreak. *PLoS One* 15:e0231924. doi: 10.1371/journal.pone.0238327

Hou, L., Ji, C., and Zhang, Z. (2019). Analysis of stress status of medical postgraduates in China. *Basic. Clin. Med.* 39, 1503–1507.

Huang, Y., and Zhao, N. (2020). Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 epidemic in China: a web-based cross-sectional survey. *Psychiatry Res.* 288:112954. doi: 10.1016/j.psychres.2020.112954

Hui, D. S., E, I. A., Madani, T. A., Ntoumi, F., Kock, R., Dar, O., et al. (2020). The continuing 2019-nCoV epidemic threat of novel coronaviruses to global health—The latest 2019 novel coronavirus outbreak in Wuhan China. *Int. J. Infect. Dis.* 91, 264–266. doi: 10.1016/j.ijid.2020.01.009

Jacopo, C., Maxana, W., Bernat, D. L. H., Almudena, M. R., et al. (2021). The effects of exercise on sleep quality in persons with Parkinson's disease: a systematic review with meta-analysis. *Sleep Med. Rev.* 55:101384. doi: 10.1016/j.smrv.2020.101384

Kahn, L. B. (2010). The long-term labor market consequences of graduating from college in a bad economy. *Labour Econ.* 17, 303–316. doi: 10.1016/j.labeco.2009.09.002

Kim, J.-H., Sung, J., Kwon, H.-J., and Cheong, H.-K. (2021). Effects of El Niño/La Niña on the number of imported shigellosis cases in the Republic of Korea, 2004-2017. *Int. J. Environ. Res. Public Health* 18:211. doi: 10.3390/ijerph18158161

Kuroshm, J., Kamel, A., Masoumeh-Sadat, M., Razieh, M., Hamid, A., Vijayaraddi, V., et al. (2021). Effect of rosa damascene aromatherapy on anxiety and sleep quality in cardiac patients: a randomized controlled trial. *Complement. Ther. Clin. Pract.* 42:101299. doi: 10.1016/j.ctcp.2020.101299

Li, Q., Guan, X., Wu, P., Wang, X., Zhou, L., Tong, Y., et al. (2020b). Early transmission dynamics in Wuhan, China, of novel coronavirus–infected pneumonia. *N. Engl. J. Med.* 382, 1199–1207. doi: 10.1056/NEJMoa2001316

Li, X., Lu, P., Hu, L., Huang, T., and Lu, L. (2020c). Factors associated with mental health results among workers with income losses exposed to COVID-19 in China. *Int. J. Environ. Res. Public Health.* 17:5627. doi: 10.3390/ijerph17155627

Li, H. Y., Zheng, F. L., Zhang, J., Guo, Z. K., Yang, H., Ren, C. X., et al. (2020a). Using employment data From a medical university to examine the current occupation situation of Master's graduates in public health and preventive medicine in China. *Front. Public Health.* 8:508109. doi: 10.3389/fpubh.2020.508109

Liu, K., Hu, G., Zhang, M., Yan, Y., and Nie, J. (2009). Psychological anxiety evaluation and analysis of graduates at a medical university under employment pressure. *J. South. Med. Univ.* 29, 1071–1072.

Liu, X., Liu, C., Tian, X., Zou, G., Li, G., Kong, L., et al. (2016). Associations of perceived stress, resilience and social support with sleep disturbance among community-dwelling adults: sleep disturbance and psychosocial correlates. *Stress. Health.* 32, 578–586. doi: 10.1002/smi.2664

Liu, X. C., Tang, M. Q., Hu, L., Wang, A. Y., Wu, H. X., Zhao, G. F., et al. (1996). Reliability and validity of Pittsburgh sleep quality index. *J. Chin. Psychiatry* 29, 103–107.

Madrid-Valero, J. J., Martínez-Selva, J. M., Bruno, R. D. C., et al. (2017). Age and gender effects on the prevalence of poor sleep quality in the adult population. *Gac. Sanit.* 31, 18–22. doi: 10.1016/j.gaceta.2016.05.013

Ohrnberger, J., Fichera, E., and Sutton, M. (2017). The relationship between physical and mental health: a mediation analysis. *Soc. Sci. Med.* 195, 42–49. doi: 10.1016/j.socscimed.2017.11.008

Okely, J. A., Corley, J., Welstead, M., Taylor, A. M., Page, D., Skarabela, B., et al. (2021). Change in physical activity, sleep quality, and psychosocial variables during COVID-19 lockdown: evidence from the Lothian birth cohort 1936. *Int. J. Environ. Res. Public Health.* 18:210. doi: 10.3390/ijerph18010210

Paules, C. I., Marston, H. D., and Fauci, A. S. (2020). Coronavirus infections—more than just the common cold. *JAMA* 323, 707–708. doi: 10.1001/jama.2020.0757

Salari, N., Hosseinian-Far, A., Jalali, R., Vaisi-Raygani, A., Rasoulpoor, S., Mohammadi, M., et al. (2020). Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: a systematic review and meta-analysis. *Glob. Health.* 16, 1–11. doi: 10.1186/s12992-020-00589-w

Spielberger, C., Gorsuch, R. L., and Lushene, R. (1970). *Manual for the State-Trait Inventory. Palo Alto*. CA: Consulting Psychologists Press.

Tull, M. T., Edmonds, K. A., Scamaldo, K., Richmond, J. R., Rose, J. P., and Gratz, K. L. (2020). Psychological outcomes asso-ciated with stay-at-home orders and the perceived impact of COVID-19 on daily life. *Psychiatry Res.* 289:113098. doi: 10.1016/j.psychres.2020.113098

Wang, X., Jiang, C., and Ma, H. (1999). Ranting scales for mental health[J]. *Chin. Ment. Health J.* 12:238.

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., et al. (2020). Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *Int. J. Environ. Res. Public Health.* 17:1729. doi: 10.3390/ijerph17249556

World Health Organization (2020). Coronavirus disease (COVID-19) pandemic. Available at: https://www.who.int/emergencies/diseases/novel-coronavirus-2019 (Accessed July 20,2020).

Xiao, H., Zhang, Y., Kong, D., Li, S., and Yang, N. (2020). The effects of social support on sleep quality of medical staff treating patients with coronavirus disease 2019 (COVID-19) in January and February 2020 in China. *Med. Sci. Monitor: Int Med J. Exp. Clin. Res.* 26:e923549. doi: 10.12659/MSM.923549

Yalcin, B. M., Unal, M., Pirdal, H., and Karahan, T. F. (2015). The effect of a stress and anxiety coping programme on objective structured clinical exam performance in medical students, a randomised clinical trial. *Educ. Psychol.* 35, 1–14. doi: 10.1080/01443410.2015.1050355

Yang, T., and Huang, H. (2003). An epidemiological study on stress among urban residents in social transition period. *Chin. J. Epidemiol.* 24, 760–764.

Zacher, H., and Rudolph, C. W. (2020). Individual differences and changes in subjective wellbeing during the early stages of the COVID-19 pandemic. *Am. Psychol.* 76, 50–62. doi: 10.1037/amp0000702

Zhang, Y. L., Liang, W., Chen, Z. M., Zhang, H. M., Zhang, J. H., Weng, X. Q., et al. (2013). Validity and reliability of patient health Questionnaire-9 and patient health Questionnaire-2 to screen for depression among college students in China. *Asia Pac. Psychiatry.* 5, 268–275. doi: 10.1111/appy.12103

Zhang, Y., and Ma, Z. F. (2020). Impact of the COVID-19 pandemic on mental health and quality of life among local residents in Liaoning Province, China: a cross-sectional study. *Int. J. Environ. Res. Public Health.* 17:2381. doi: 10.3390/ijerph17249520

Zhang, Y., Zhang, H., Ma, X., and Di, Q. (2020). Mental health problems during the COVID-19 pandemics and the mitigation effects of exercise: a longitudinal study of college students in China. *Int. J. Environ. Res. Public Health.* 17:3722. doi: 10.3390/ijerph17249520

Zheng, Q., Lin, X., He, L., et al. (2021). Impact of the perceived mental stress During the COVID-19 pandemic on medical Students' loneliness feelings and future career choice: a preliminary survey study. *Front. Psych.* 12:666588. doi: 10.3389/fpsyt.2021.666588

Conflict of Interest: The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's Note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

frontiers in Psychology

SYSTEMATIC REVIEW
published: 21 September 2021
doi: 10.3389/fpsyg.2021.703838

Mental Health in COVID-19 Pandemic: A Meta-Review of Prevalence Meta-Analyses

Geovan Menezes de Sousa Júnior[1,2], *Vagner Deuel de Oliveira Tavares*[1,2], *Maria Lara Porpino de Meiroz Grilo*[1,2], *Monique Leite Galvão Coelho*[1], *Geissy Lainny de Lima-Araújo*[1,3], *Felipe Barreto Schuch*[4] and *Nicole Leite Galvão-Coelho*[1,2,5,6*]

[1] Laboratory of Hormone Measurement, Department of Physiology and Behaviour, Federal University of Rio Grande Do Norte, Natal, Brazil, [2] Graduate Program in Psychobiology and Department of Physiology and Behaviour, Federal University of Rio Grande Do Norte, Natal, Brazil, [3] Brain Institute, Federal University of Rio Grande Do Norte, Natal, Brazil, [4] Department of Sports Methods and Techniques, Federal University of Santa Maria, Santa Maria, Brazil, [5] National Science and Technology Institute for Translational Medicine (INCT-TM), São Paulo, Brazil, [6] NICM Health Research Institute, Western Sydney University, Westmead, NSW, Australia

Background: Mental health burden has been massively reported during the COVID-19 pandemic period. Aiming to summarise these data, we present a meta-review of meta-analyses that evaluated the impact of COVID-19 pandemic on anxiety, depressive and stress symptoms, psychological distress, post-traumatic stress disorder/symptoms (PTSD), and sleep disturbance, reporting its prevalence on general public (GP) and health care workers (HCW).

Methods: A search was performed in the PubMed, EMBASE, and the Web of Science. Sleep disturbances, psychological distress, stress, and burnout were grouped as "Psychophysiological stress," and anxiety, depression, and PTSD were grouped as "Psychopathology." A random-effects model, calculating the pooled prevalence together with 95% confidence interval was performed for each domain. Subgroup analyses were performed for each population type (GP and HCW) and for each mental health outcome. For anxiety and depression, subgroup analysis for population type was performed. Heterogeneity is reported as I^2. Publication bias was assessed through visual inspection of the funnel plot, and further tested by Egger's test and trim and fill analyses.

Results: A total of 18 meta-analyses were included. The prevalence of psychophysiological stress was 31.99% (CI: 26.88–37.58, $I^2 = 99.9\%$). HCW showed a higher prevalence (37.74%, CI: 33.26–42.45, $I^2 = 99.7\%$) than the GP (20.67%, 15.07–27.66, $I^2 = 99.9\%$). The overall prevalence of insomnia, psychological distress, and stress were, respectively, 32.34% (CI: 25.65–39.84), 28.25% (CI: 18.12–41.20), and 36% (CI: 29.31–43.54). Psychopathology was present at 26.45% (CI: 24.22–28.79, $I^2 = 99.9\%$) of the sample, with similar estimates for population (HCW 26.14%, CI: 23.37–29.12, $I^2 = 99.9\%$; GP: 26.99%, CI: 23.41–30.9, $I^2 = 99.9\%$). The prevalence of anxiety, depression, and PTSD was 27.77% (CI: 24.47–31.32), 26.93% (CI: 23.92–30.17), and 20% (CI: 15.54–24.37), respectively. Similar proportions between populations were found for anxiety (HCW = 27.5%, CI: 23.78–31.55; GP = 28.33%, CI: 22.1–35.5) and depression (HCW = 27.05%, CI: 23.14–31.36; GP = 26.7%, CI: 22.32–31.59).

OPEN ACCESS

Edited by:
Fang Pan,
Shandong University, China

Reviewed by:
Eric Mayor,
University of Basel, Switzerland
Lin Sun,
Weifang Medical University, China

***Correspondence:**
Nicole Leite Galvão-Coelho
nicolelgalvaocoelho@gmail.com

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *30 April 2021*
Accepted: *20 August 2021*
Published: *21 September 2021*

Citation:
Sousa GMd Jr, Tavares VDdO, de Meiroz Grilo MLP, Coelho MLG, Lima-Araújo GLd, Schuch FB and Galvão-Coelho NL (2021) Mental Health in COVID-19 Pandemic: A Meta-Review of Prevalence Meta-Analyses. Front. Psychol. 12:703838. doi: 10.3389/fpsyg.2021.703838

Asymmetry in the funnel plot was found, and a slight increase in the estimate of overall psychopathology (29.08%, CI: 26.42–31.89) was found after the trim and fill analysis.

Conclusions: The prevalence of mental health problems ranged from 20 to 36%. HCW presented a higher prevalence of psychophysiological stress than the general population.

Systematic Review Registration: https://www.crd.york.ac.uk/PROSPERO/display_record.php?RecordID=252221, identifier: CRD42021252221.

Keywords: COVID-19, anxiety, depression, healthcare worker, general public

INTRODUCTION

On March 11, 2020, the World Health Organisation (WHO) declared the new coronavirus disease (COVID-19) a pandemic (World Health Organization, 2020). The pandemic began in December, 2019, in Wuhan, China, and spread all over the world. The new coronavirus identified as SARS-CoV-2 has infected 206,958,371 people and caused 4,357,179 deaths to date (August 16, 2021 [12:23pm CEST]) (World Health Organization, 2019).

Among the procedures to prevent dissemination of the virus, social distancing and quarantining have been advised by authorities (World Health Organization, 2020). It is important to mention that the social isolation and lockdown brought important economic consequences, especially for self-employed workers. Moreover, the fear of contamination also presents an important negative impact on mental health, such as increased depressive and anxious symptoms, worsening cognitive performance and disrupting sleep (Brooks et al., 2020; Ornell et al., 2020).

Although studies during COVID-19 are mostly based on online surveys, using self-reported questionnaires applied *via* web, evidence from previous and recent work shows that the overall prevalence of psychopathology symptoms of depression and anxiety since the onset of COVID-19 was 31.5 and 31.9%, respectively (Wu et al., 2021). For COVID-19 patients, the prevalence of depression was 41.7% and for anxiety 42.3% (Wu et al., 2021). According to WHO in 2017, the depression rate among the global population was 4.4% and 3.6% for anxiety disorders (World Health Organization, 2017). These results, besides the bias towards region and methodological issues, suggest a huge impact of the COVID-19 pandemic on the psychological wellbeing not only to the general public (GP) but especially for health workers due the high demand and extenuating working hours (Luo et al., 2020; Li et al., 2021; Wu et al., 2021). In fact, data in a recent study showed the prevalence of anxiety in health care workers (HCW) at 25%, with a highlight to the frontline HCW with 43% (Santabárbara et al., 2021a,b).

Despite the mental health of all people being impacted, those with previous diagnoses or symptoms of mental disorders and impaired cognition require special attention in quarantine and social isolation. Once they might face additional difficulties to follow recommendations and to understand the limitations and may also face limited mental health assistance (Ornell et al., 2020). During the COVID-19 pandemic, families are even more challenged to lead their lives with people with mental disorders confined at home (Ornell et al., 2020).

With the confinement and social isolation along with eventual economic, health, and political crises, different populations are under a lot of stress due to the increase in the fear of contamination, the burden, and the intensity of work for those who stand at the frontline such as HCW (Santabárbara et al., 2021a,b). In addition, all groups of people are subject to experience loneliness, fear of staying away from the family (Schellekens and van der Lee, 2020), anxiety (Schuch et al., 2020), depression (Schuch et al., 2020), stress (Burtscher et al., 2020), insomnia/sleep disorders (Partinen, 2021), and psychological stress (Li et al., 2020).

Meta-reviews are useful to provide an integrated view of the several studies that are currently being conducted regarding COVID-19. Recently, an umbrella review assessed seven meta-analytic studies published between 2019 and 2020, revealing a similar estimated prevalence of anxiety (24.94%) and depressive (24.83%) symptoms in HCW (Sahebi et al., 2021). However, estimates for the GP as well as the comparison between these two populations are lacking. Therefore, an updated meta-review addressing these issues would benefit the literature providing a framework for the impact of the ongoing pandemic on the mental health of the public in general and health workers.

Based on these assumptions we proposed a meta-review to (i) aggregate and evaluate the top-tier evidence for situational analysis of the present scenario, collecting evidence of meta-analyses currently available from several countries, and (ii) quantify the prevalence of various psychological morbidities among the general population and health care professionals in the midst of the COVID-19 pandemic. To achieve this, we identified, synthesised, and appraised available data from meta-analyses examining the mental health outcomes during the COVID-19 pandemic.

MATERIALS AND METHODS

This systematic review and meta-analysis were conducted in accordance with the recommendations outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher et al., 2009). The review protocol was registered at PROSPERO as CRD42021252221.

Search Strategy and Study Selection

A search from 2019 up to March 2, 2021, was carried out, according to the PO (population: GP and HCW; outcome: prevalence/proportion of depression, anxiety, stress, or sleep disorders) framework, and using the following electronic databases: PubMed, Embase, and Web of Science. The search strategy used in PubMed combined the terms "coronavirus" or "SARS-COV-2" or "COVID-19," and "anxiety" or "mental health" or "psychological" or "humor" or "mood" or "affective symptoms" or "mood states" or "depressive symptoms" or "depression" or "affective disorders." The searches for other databases were slightly adapted (**Supplementary Table 1**). Filters of date of publication (2019–2021) and study type (meta-analysis) were applied when available. Titles and abstracts of retrieved articles were individually evaluated by two reviewers (GMSJ and MLPMG) to assess their eligibility for meta-review. Study inclusions were checked by a third reviewer (VT). Study abstracts that did not provide sufficient information according to the inclusion criteria were retrieved for full-text evaluation. A search on Google Scholar and in the references of included studies was further performed to identify any non-included relevant study.

Eligibility Criteria

Articles were eligible for inclusion if they met the following criteria: (1) consisted of meta-analytical study assessing symptoms of depression, anxiety, and stress, or sleep disorders, assessed by validated screening instruments; (2) was assessed in GP or HCW; (3) peer-reviewed articles published in English; (3) adult participants (≥18 years of age); (4) provided sufficient information to calculate the prevalence/proportion of symptoms of depression, anxiety, stress, or sleep disorders among HCW and GP excluding COVID patients (e.g., percentage or sample size and number of events). Articles were excluded if (1) consisted of systematic review or other type excluding meta-analysis; (2) did not present prevalence as the effect size; (3) assessed outcomes only in patients; or (4) full-text was unavailable.

Data Extraction

Data were blindly extracted by two reviewers (GMSJ and MLPMG) and compiled into an Excel spreadsheet. Relevant data were collected regarding study characteristics (outcome, population type, number of studies, and sample size by outcome and population type) and study results (pooled outcome prevalence by population and I^2).

Statistical Analysis

The analyses were conducted using the *meta* package of R software (version 4.0.3). The effect size was the prevalence rate. Between-study variability was examined for heterogeneity, using the I^2 statistic for quantifying inconsistency (Higgins et al., 2003). Heterogeneity thresholds were set at $I^2 = 25\%$ (low), $I^2 = 50\%$ (moderate), and $I^2 = 75\%$ (high) (Higgins et al., 2003). A random-effects model was applied to pool the data for each analysis. For adequate statistical power, a minimum of five studies were included in the pooled random-effects analysis (Jackson and Turner, 2017). Subgroup analysis for population type (GP and HCW) was performed for anxiety and depression, since the number of studies for each population was ≥5. Cochran's Q and degrees of freedom were reported for comparison tests between subgroups as $Q\left(df\right)$. The level of significance was set at $p \leq 0.05$ for subgroup comparisons. Publication bias was assessed using funnel plots, and Egger's test of effect size against its standard error, when $k \geq 10$.

RESULTS

Study Characteristics

A total of 372 studies were retrieved (156 from PubMed, 51 from Embase and 165 from Web of Science) and 36 were selected after removing duplicates. After the title/abstract screening, 18 meta-analyses ($n = 1{,}074{,}438$) were found to be eligible for analysis (**Figure 1**). The majority of articles included studies performed in Asian countries ($k = 17$, 94.4%), followed by European countries ($k = 10$, 55.6%), South and Central Americas ($k = 6$, 33.3%) and North America ($k = 6$, 33.3%) with the same proportion, Africa countries were included in 5 articles (27.1%), and finally Oceania countries ($k = 2$, 11.1%). One article (5.6%) did not have the information about the countries of the analyzed studies (**Supplementary Table 2**). Information regarding the quality assessment of included meta-analyses can be found in **Supplementary Table 2**.

Stress was assessed by five studies (Batra et al., 2020; Cooke et al., 2020; Salari et al., 2020a,c; Al Maqbali et al., 2021), three among HCW (Batra et al., 2020; Salari et al., 2020c; Al Maqbali et al., 2021), and two among the GP (Cooke et al., 2020; Salari et al., 2020a). Distress was assessed in GP and HCW by one study (Wu et al., 2021); and psychological distress was assessed by two others, one in GP and HCW subjects (Cénat et al., 2021) and the another in HCW only (Batra et al., 2020). Sleep disturbance was assessed by two studies, one in HCW (Al Maqbali et al., 2021) and another in physicians and nurses (Salari et al., 2020b); while four studies assessed insomnia (Batra et al., 2020; Pappa et al., 2020; Cénat et al., 2021; Wu et al., 2021), two of them in HCW and GP (Cénat et al., 2021; Wu et al., 2021) and the other two in HCW only (Batra et al., 2020; Cénat et al., 2021). One study assessed burnout in HCW (Batra et al., 2020) (**Supplementary Table 2**).

Anxiety was assessed in 16 studies (Bareeqa et al., 2020; Batra et al., 2020; Lasheras et al., 2020; Luo et al., 2020; Panda et al., 2020; Pappa et al., 2020; Salari et al., 2020a,b,c; Al Maqbali et al., 2021; Cénat et al., 2021; da Silva and Neto, 2021; Deng et al., 2021; Li et al., 2021; Santabárbara et al., 2021b; Wu et al., 2021), 8 among GP (Lasheras et al., 2020; Luo et al., 2020; Panda et al., 2020; Salari et al., 2020a; Cénat et al., 2021; Deng et al., 2021; Santabárbara et al., 2021b; Wu et al., 2021), and 15 among HCW (Bareeqa et al., 2020; Batra et al., 2020; Luo et al., 2020; Pappa et al., 2020; Salari et al., 2020c; Al Maqbali et al., 2021; Cénat et al., 2021; da Silva and Neto, 2021; Deng et al., 2021; Li et al., 2021; Santabárbara et al., 2021a; Wu et al., 2021) (**Supplementary Table 2**).

Depression was assessed by 13 studies (Bareeqa et al., 2020; Batra et al., 2020; Luo et al., 2020; Panda et al., 2020; Pappa et al., 2020; Salari et al., 2020a,c; Al Maqbali et al., 2021; Cénat et al., 2021; da Silva and Neto, 2021; Deng et al., 2021; Li et al., 2021;

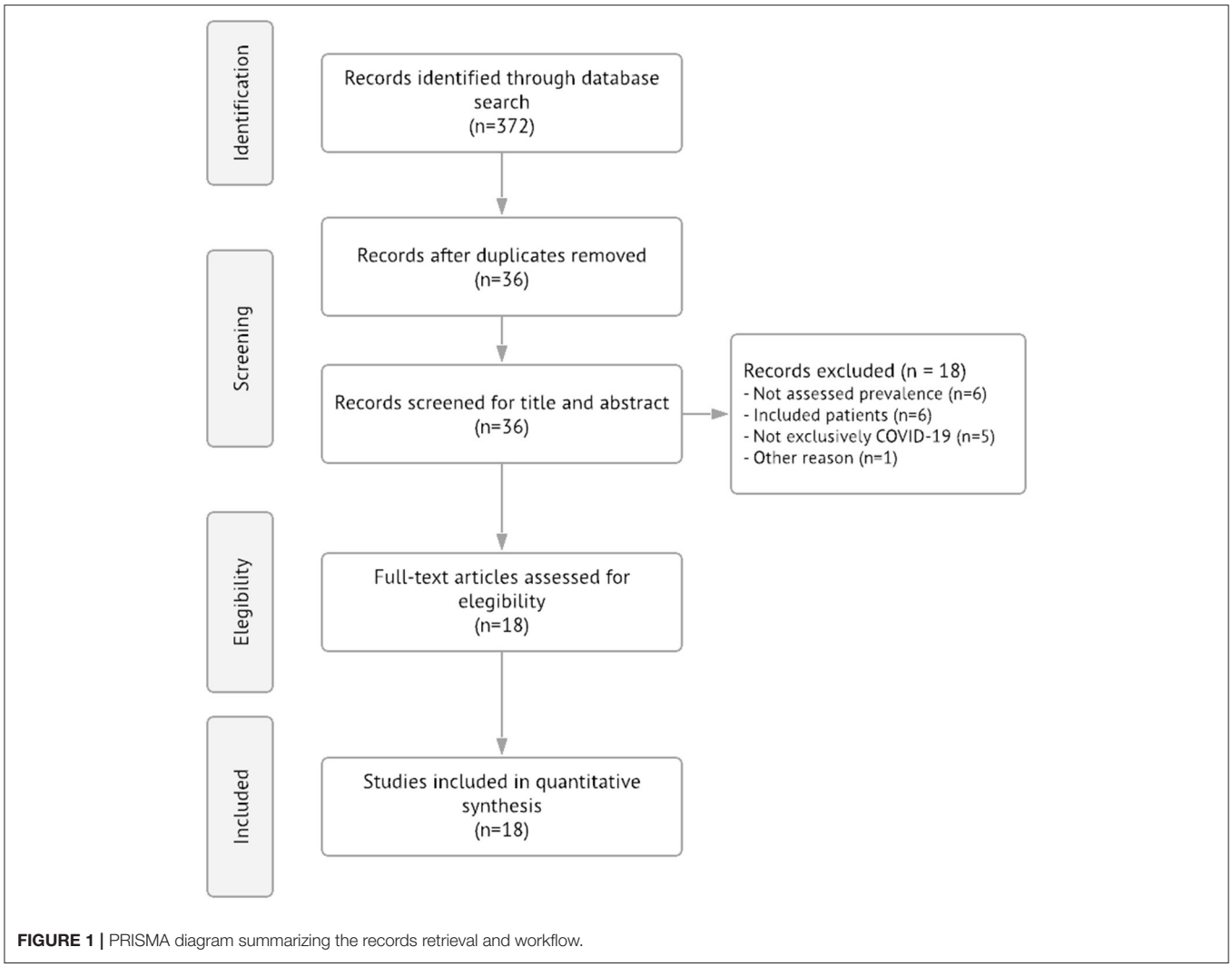


FIGURE 1 | PRISMA diagram summarizing the records retrieval and workflow.

Wu et al., 2021), 4 assessed in GP and HCW (Luo et al., 2020; Cénat et al., 2021; Deng et al., 2021; Wu et al., 2021), 2 in GP only (Panda et al., 2020; Salari et al., 2020a), and 7 in HCW only (Bareeqa et al., 2020; Batra et al., 2020; Pappa et al., 2020; Salari et al., 2020c; Al Maqbali et al., 2021; da Silva and Neto, 2021; Li et al., 2021) (**Supplementary Table 2**).

Four studies assessed the post-traumatic stress disorder/symptoms (PTSD) (Batra et al., 2020; Cooke et al., 2020; Cénat et al., 2021; Li et al., 2021), 2 of them in HCW (Batra et al., 2020; Li et al., 2021), 1 in GP (Cooke et al., 2020), and 1 in both GP and HCW subjects (Cénat et al., 2021) (**Supplementary Table 2**).

For the analysis, we merged "Distress" and "Burnout" in "Psychological distress," and "Sleep disturbance" with "Insomnia" and then this groups was named as "Insomnia." Then, the outcomes "Stress," "Psychological distress," and "Insomnia" were pooled into the so-called "Psychophysiological stress" domain, in order to get the overall estimate of stress-related outcomes. Similarly, "Anxiety," "Depression," and "PTSD" were pooled into the "Psychopathology" domain.

Pooled Estimates for Psychophysiological Stress

The overall estimated prevalence for psychophysiological stress was 31.99% (CI: 26.88–37.58, $\tau^2 = 0.32$, $I^2 = 99.9\%$) (**Figure 2**). The prevalence between population type was significantly different [$Q(1) = 14.76$; $p = 0.0001$], where HCW showed a higher prevalence (37.74%, CI: 33.26–42.45, $\tau^2 = 0.14$, $I^2 = 99.7\%$) than the GP (20.67%, CI: 15.07–27.66, $\tau^2 = 0.23$, $I^2 = 99.9\%$) (**Figure 2**).

For GP and HCW the overall prevalence of stress was 36.12% (CI: 29.31–43.54, $\tau^2 = 0.12$, $I^2 = 99.7\%$). Whereas for psychological distress, a prevalence of 28.25 (CI: 18.12–41.20, $\tau^2 = 0.52$, $I^2 = 99.9\%$) was found and for insomnia it was 32.34 (CI: 25.65–39.84, $\tau^2 = 0.25$, $I^2 = 99.8\%$) (**Figure 2**, **Supplementary Figure 1**).

Pooled Estimates for Psychopathology

The overall estimated prevalence for psychopathology was 26.45% (CI: 24.22–28.79, $\tau^2 = 0.16$, $I^2 = 99.9\%$) (**Figure 3**). The was no difference [$Q(1) = 0.12$; $p = 0.724$] between the

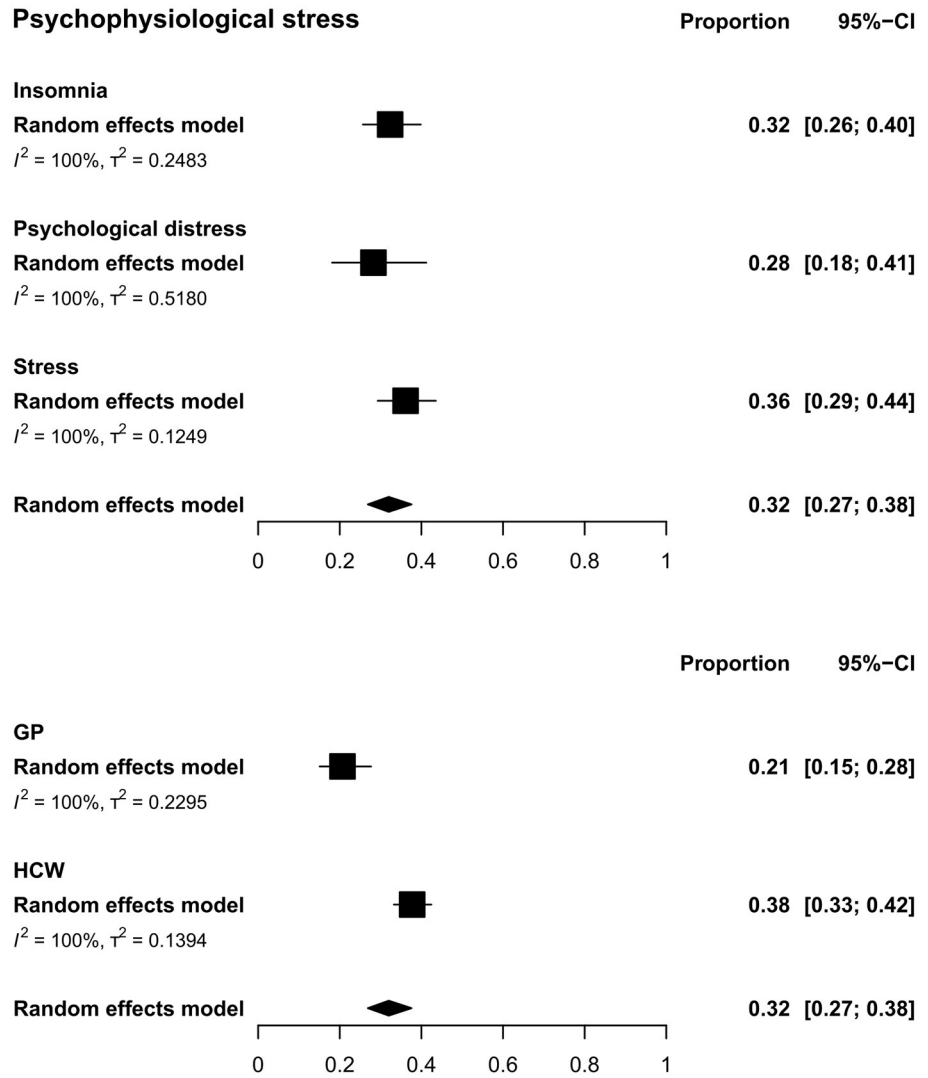


FIGURE 2 | Pooled prevalence for psychophysiological stress by outcomes (upper) and by population type (lower). In the upper panel, squares represent the overall estimate prevalence for each outcome without specifying the population. In the lower panel, squares represent the overall estimate prevalence for each population without specifying the outcome. In both cases, diamonds represent the overall prevalence for the psychophysiological stress domain. GP, general public; HCW, health care workers.

prevalence of psychopathology in HCW (26.14%, CI: 23.37–29.12, $\tau^2 = 0.17$, $I^2 = 99.9\%$) and in the GP (26.99%, CI: 23.41–30.9, $\tau^2 = 0.15$, $I^2 = 99.9\%$) (**Figure 3**).

Anxiety

The overall prevalence of anxiety was 27.77% (CI: 24.47–31.32; $\tau^2 = 0.17$, $I^2 = 99.9\%$) (**Figure 3**). No difference was found for between-population analysis under the random effects model analysis [$Q(1) = 0.04$, $p = 0.83$]. For GP, the pooled prevalence was 28.33% (CI: 22.1–35.5; $\tau^2 = 0.23$, $I^2 = 100.0\%$). For HCW, the prevalence was 27.5% (CI: 23.78–31.55; $\tau^2 = 0.15$, $I^2 = 99.9\%$) (**Supplementary Figure 2**).

Depression

The overall prevalence of depression was 26.93% (CI: 23.92–30.17; $\tau^2 = 0.11$, $I^2 = 99.9\%$) (**Figure 3**). No difference between populations was found under the random effects model analysis [$Q(1) = 0.01$, $p = 0.91$]. For GP, the pooled prevalence was 26.7% (CI: 22.32–31.59; $\tau^2 = 0.08$, $I^2 = 99.8\%$). For HCW, a prevalence of 27.05% was found (CI: 23.14–31.36; $\tau^2 = 0.12$, $I^2 = 99.9\%$) (**Supplementary Figure 2**).

Post-traumatic Stress Disorder/Symptoms

The overall prevalence of PTSD was 19.58% (CI: 15.54–24.37, $\tau^2 = 0.10$, $I^2 = 99.5\%$) (**Figure 3**). Due to the small number of studies by populations, no between-population subgroup analysis was performed for PTSD.

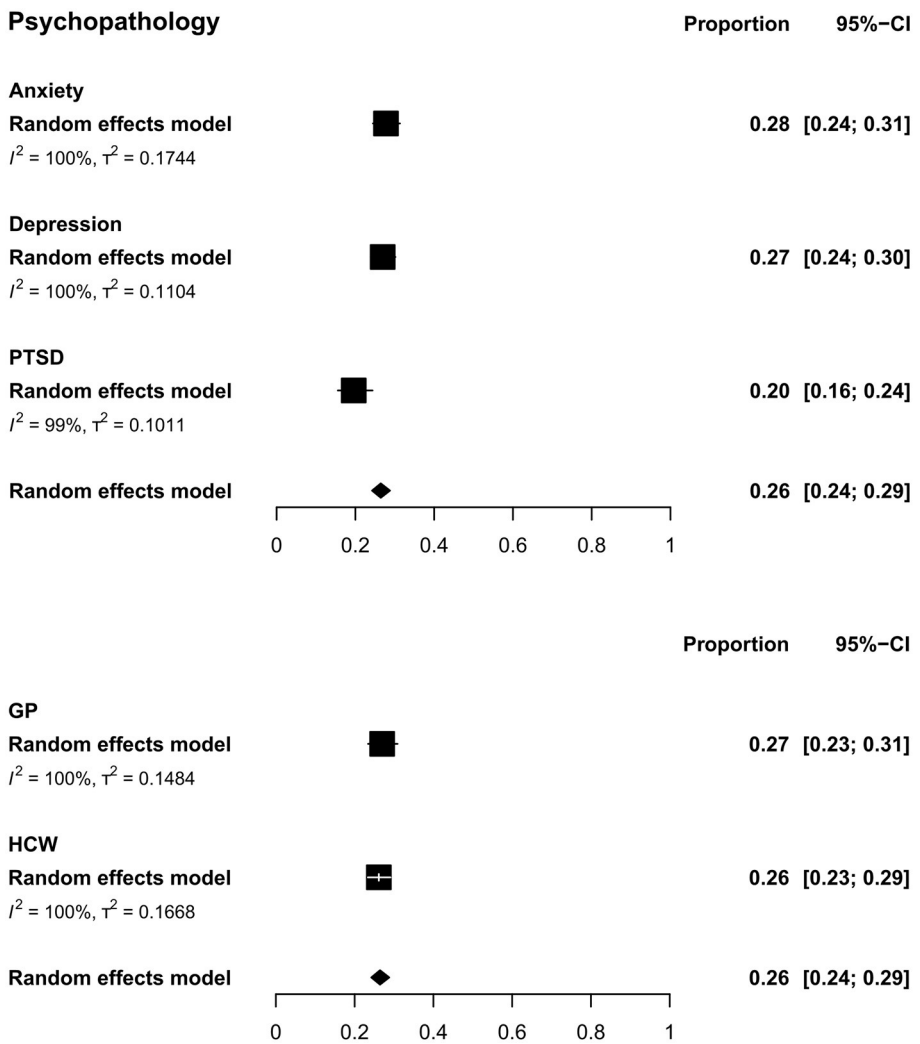


FIGURE 3 | Pooled prevalence for psychopathology by outcomes (upper) and by population type (lower). In the upper panel, squares represent the overall estimate prevalence for each outcome without specifying the population. In the lower panel, squares represent the overall estimate prevalence for each population without specifying the outcome. In both cases, diamonds represent the overall prevalence for the psychopathology domain. PTSD, post-traumatic stress disorder; GP, general public; HCW, health care workers.

Publication Bias

Visual inspection of funnel plots suggests bias for psychophysiological stress, psychopathology, anxiety, and depression (**Supplementary Figure 3**). Asymmetry in the funnel plots was confirmed by the Egger's test (psychophysiological stress: $t_{(23)} = -0.01$, $p = 0.99$; psychopathology: $t_{(50)} = -0.67$, $p = 0.50$; anxiety: $t_{(21)} = -0.24$, $p = 0.81$; depression: $t_{(15)} = -0.56$, $p = 0.58$). The trim and fill analysis adjusted estimates for psychophysiological stress to 31.99% (CI: 26.88–37.58), psychopathology to 29.08% (CI: 26.42–31.89), anxiety to 27.77 (CI: 24.47–31.33), and depression to 26.94% (23.93–30.17). The virtual lack of conspicuous change in psychophysiological stress, anxiety, and depression may be due to the high between-study heterogeneity.

DISCUSSION

In this meta-review, we pooled data from 18 meta-analyses evaluating the prevalence of general psychophysiological stress and psychopathology among the GP and HCW populations during the COVID-19 pandemic. The majority of meta-analyses included studies performed in Asian countries.

We found an overall prevalence of 32% of psychophysiological stress, representing 32% of insomnia/sleep disturbance, 28% of psychological stress, and 36% of stress. The prevalence of psychophysiological stress was higher for HCW (38%) than for the GP (21%). However, psychophysiological stress issues are often reported for HCW even in the absence of disease outbreaks (Liu et al., 2019; Lee et al., 2020; Woo et al., 2020), so these results should be interpreted with some caution.

Regarding psychopathology, an overall prevalence of 26% was found, with a similar prevalence for anxiety (28%), and depression (27%), and 20% of PTSD. A similar prevalence of psychopathology was observed in the HCW (26%) and in the GP (27%). A subgroup analysis by population for anxiety and depression showed similar prevalence for HCW (anxiety: 27.5%, depression: 27.05%) and the GP (anxiety: 28.33%, depression: 26.7%).

A previous review of meta-analyses found slightly lower estimates for anxiety (24.94%) and depression (24.83%) in HCW during the COVID-19 pandemic (Sahebi et al., 2021) as compared to our findings. The review included seven studies published between January and October 2020. Therefore, since our study included studies also published in 2021, with a total of 18 studies published between May 2020 and March 2021, the difference in the estimates could be due to this temporal lag and may suggest an increase in the prevalence of these outcomes in this population.

When compared with the estimates of previous viral epidemic outbreaks, for instance, Severe Acute Respiratory Syndrome (SARS), Middle Eastern respiratory syndrome (MERS), H1N1, in HCW, Serrano-Rippol and colleagues found a lower proportion for depression (24%) and a higher proportion for anxiety (30%) (Serrano-Ripoll et al., 2020). The prevalence of PTSD (13%) was lower for HCW than our overall estimate (not specifying population) (Serrano-Ripoll et al., 2020). It is important to highlight that these previous estimates were made by pooling several diseases within the time range of 2002–2020. Since our estimates bring homogeneous data regarding COVID-19, we may speculate that in this 2019–2021 timeframe, COVID-19 only reaches similar levels of anxiety and surpasses depression and PTSD rates of these past viral outbreaks together.

It was shown that lockdown has a small but significant and heterogeneous effect on depression and anxiety (Prati and Mancini, 2021). Therefore, possible solutions to help coping these adversities during the social isolation and the frontline care are needed. Cabarkapa and colleagues point some ways to deal with psychological risks in HCW, such as self-coping strategies, psychoeducation, and awareness in the workplace (Cabarkapa et al., 2020). Complementary therapies, such as nutraceuticals and lifestyle changes are suggested as a way to reduce COVID-19-induced inflammation overload, once it would help to reduce negative mental health symptoms (Sarris et al., 2014, 2021; Neto et al., 2020), and improve sleep even in COVID-19 patients (Ding et al., 2021).

In addition to those approaches, we also encourage the use of feasible individual homemade practices to address such issues. For instance, physical exercise is related to physical, psychological, and cognitive improvements in mood and general health (Schuch et al., 2016; Ashdown-Franks et al., 2019; Wolf et al., 2021). Mind–body integrative practices such as mindfulness meditation and yoga have also shown to be effective in reducing psychophysiological distress while improving positive psychological measures (Cahn et al., 2017; Pascoe et al., 2017; Goldberg et al., 2018; Solhaug et al., 2019; Sousa et al., 2021). In addition, cultivating mind–body practices flourishes positive feelings about the self and toward others, such as (self-)compassion, empathy, and pro-sociality (Garland et al., 2015; Voci et al., 2019), what may be useful to face social distancing in a less detrimental way.

This study has some key limitations, such as the high heterogeneity and the publication bias. In addition, it should be noted that the studies comprising the present meta-review were conducted when there were no wide-ranging vaccines or variants of concern. Nevertheless, our study provides a current overview of the burden of COVID-19 in the GP and in HCW. Having these measures is crucial for the development and proper direction of public policies and government campaigns in order to mitigate the worsening of this scenario as well as for paving the way to face similar future events.

In summary, in this study, we showed, by the overall pooling of other meta-analytical reports regarding COVID-19 burden of emotional outcomes, high proportions of psychophysiological stress in the general population and in HCW, and higher prevalence of psychopathology in HCW compared with the GP.

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.

AUTHOR CONTRIBUTIONS

VT performed the searches and inspected selection process. GS and MG selected studies and extracted data. GS, VT, NG-C, GL-A, FS, MG, and MC drafted and edited the manuscript. All authors contributed to the article and approved the submitted version.

FUNDING

NG-C is supported by National Science and Technology Institute for Translational Medicine (INCT-TM Fapesp 2014/50891-1; CNPq 465458/2014-9). GS is supported by Coordination for the Improvement of Higher Education Personnel (CAPES, Proc. No. 88887.597821/2021-00). The funders had no role in study conception, data extraction and analysis, decision to publish, or in the preparation of the manuscript.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.703838/full#supplementary-material

REFERENCES

Al Maqbali, M., Al Sinani, M., and Al-Lenjawi, B. (2021). Prevalence of stress, depression, anxiety and sleep disturbance among nurses during the COVID-19 pandemic: a systematic review and meta-analysis. *J. Psychosom. Res.* 141:343. doi: 10.1016/j.jpsychores.2020.110343

Ashdown-Franks, G., Sabiston, C. M., and Stubbs, B. (2019). The evidence for physical activity in the management of major mental illnesses. *Curr. Opin. Psychiatry* 32, 375–380. doi: 10.1097/YCO.0000000000000526

Bareeqa, S. B., Ahmed, S. I., Samar, S. S., Yasin, W., Zehra, S., Monese, G. M., et al. (2020). Prevalence of depression, anxiety and stress in China during COVID-19 pandemic: A systematic review with meta-analysis. *Int. J. Psychiatry Med.* 12, 22–23. doi: 10.1177/0091217420978005

Batra, K., Singh, T. P., Sharma, M., Batra, R., and Schvaneveldt, N. (2020). Investigating the psychological impact of COVID-19 among healthcare workers: a meta-analysis. *Int. J. Environ. Res. Public Health* 17, 1–33. doi: 10.3390/ijerph17239096

Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., et al. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *Lancet* 395, 912–920. doi: 10.1016/S0140-6736(20)30460-8

Burtscher, J., Burtscher, M., and Millet, G. P. (2020). (Indoor) isolation, stress, and physical inactivity: vicious circles accelerated by COVID-19? *Scand. J. Med. Sci. Sport.* 30, 1544–1545. doi: 10.1111/sms.13706

Cabarkapa, S., Nadjidai, S. E., Murgier, J., and Ng, C. H. (2020). The psychological impact of COVID-19 and other viral epidemics on frontline healthcare workers and ways to address it: a rapid systematic review. *Brain, Behav. Immun. Heal.* 8:100144. doi: 10.1016/j.bbih.2020.100144

Cahn, B. R., Goodman, M. S., Peterson, C. T., Maturi, R., and Mills, P. J. (2017). Yoga, meditation and mind-body health: increased BDNF, cortisol awakening response, and altered inflammatory marker expression after a 3-month yoga and meditation retreat. *Front. Hum. Neurosci.* 11, 1–13. doi: 10.3389/fnhum.2017.00315

Cénat, J. M., Blais-Rochette, C., Kokou-Kpolou, C. K., Noorishad, P. G., Mukunzi, J. N., McIntee, S. E., et al. (2021). Prevalence of symptoms of depression, anxiety, insomnia, posttraumatic stress disorder, and psychological distress among populations affected by the COVID-19 pandemic: a systematic review and meta-analysis. *Psychiatry Res.* 295:113599. doi: 10.1016/j.psychres.2020.113599

Cooke, J. E., Eirich, R., Racine, N., and Madigan, S. (2020). Prevalence of posttraumatic and general psychological stress during COVID-19: a rapid review and meta-analysis. *Psychiatry Res.* 292, 3–5. doi: 10.1016/j.psychres.2020.113347

da Silva, F. C. T., and Neto, M. L. R. (2021). Psychological effects caused by the COVID-19 pandemic in health professionals: a systematic review with meta-analysis. *Prog. Neuro-Psychopharmacology Biol. Psychiatry* 104:62 doi: 10.1016/j.pnpbp.2020.110062

Deng, Y., Chen, Y., and Zhang, B. (2021). Different prevalence trend of depression and anxiety among healthcare workers and general public before and after the peak of COVID-19 occurred in China: a meta-analysis. *Asian J. Psychiatr.* 56:102547. doi: 10.1016/j.ajp.2021.102547

Ding, H., He, F., Lu, Y. G., Hao, S. W., and Fan, X. J. (2021). Effects of non-drug interventions on depression, anxiety and sleep in COVID-19 patients: a systematic review and meta-analysis. *Eur. Rev. Med. Pharmacol. Sci.* 25, 1087–1096. doi: 10.26355/eurrev_202101_24679

Garland, E. L., Farb, N. A., R., Goldin, P., and Fredrickson, B. L. (2015). Mindfulness broadens awareness and builds eudaimonic meaning: a process model of mindful positive emotion regulation. *Psychol. Inq.* 26, 293–314. doi: 10.1080/1047840X.2015.1064294

Goldberg, S. B., Tucker, R. P., Greene, P. A., Davidson, R. J., Wampold, B. E., Kearney, D. J., et al. (2018). Mindfulness-based interventions for psychiatric disorders: a systematic review and meta-analysis. *Clin. Psychol. Rev.* 59, 52–60. doi: 10.1016/j.cpr.2017.10.011

Higgins, J. P. T., Thompson, S. G., Deeks, J. J., and Altman, D. G. (2003). Measuring inconsistency in meta-analyses. *BMJ* 27, 159–184. doi: 10.1136/bmj.327.7414.557

Jackson, D., and Turner, R. (2017). Power analysis for random-effects meta-analysis. *Res. Synth. Methods* 8, 290–302. doi: 10.1002/jrsm.1240

Lasheras, I., Gracia-García, P., Lipnicki, D. M., Bueno-Notivol, J., López-Antón, R., de la Cámara, C., et al. (2020). Prevalence of anxiety in medical students during the covid-19 pandemic: a rapid systematic review with meta-analysis. *Int. J. Environ. Res. Public Health* 17, 1–12. doi: 10.3390/ijerph17186603

Lee, S., Gonzalez, B. D., and Small, B. J. (2020). My job impacts my sleep: signs and symptoms of insomnia among healthcare workers. *Ind. Health* 2020–0291. doi: 10.2486/indhealth.2020-0291

Li, W., Yang, Y., Liu, Z. H., Zhao, Y. J., Zhang, Q., Zhang, L., et al. (2020). Progression of mental health services during the COVID-19 outbreak in China. *Int. J. Biol. Sci.* 16, 1732–1738. doi: 10.7150/ijbs.45120

Li, Y., Scherer, N., Felix, L., and Kuper, H. (2021). Prevalence of depression, anxiety and post-traumatic stress disorder in health care workers during the COVID-19 pandemic: a systematic review and meta-analysis. *PLoS ONE* 16:e0246454. doi: 10.1371/journal.pone.0246454

Liu, H., Liu, J., Chen, M., Tan, X., Zheng, T., Kang, Z., et al. (2019). Sleep problems of healthcare workers in tertiary hospital and influencing factors identified through a multilevel analysis: a cross-sectional study in China. *BMJ Open* 9:e032239. doi: 10.1136/bmjopen-2019-032239

Luo, M., Guo, L., Yu, M., Jiang, W., and Wang, H. (2020). The psychological and mental impact of coronavirus disease 2019 (COVID-19) on medical staff and general public—a systematic review and meta-analysis. *Psychiatry Res.* 291:113190. doi: 10.1016/j.psychres.2020.113190

Moher, D., Liberati, A., Tetzlaff, J., and Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *BMJ* 339, 332–336. doi: 10.1136/bmj.b2535

Neto, L. O., Tavares, V. D., de, O., Galvão-Coelho, N. L., Schuch, F. B., and Lima, K. C. (2020). Aging and coronavirus: exploring complementary therapies to avoid inflammatory overload. *Front. Med.* 7:354. doi: 10.3389/fmed.2020.00354

Ornell, F., Schuch, J. B., Sordi, A. O., and Kessler, F. H. P. (2020). "Pandemic fear" and COVID-19: mental health burden and strategies. *Brazilian J. Psychiatry* 08, 1–5. doi: 10.1590/1516-4446-2020-0008

Panda, P. K., Gupta, J., Chowdhury, S. R., Kumar, R., Meena, A. K., Madaan, P., et al. (2020). Psychological and behavioral impact of lockdown and quarantine measures for COVID-19 pandemic on children, adolescents and caregivers: a systematic review and meta-analysis. *J. Trop. Pediatr.* 1–13. doi: 10.1093/tropej/fmaa122

Pappa, S., Ntella, V., Giannakas, T., Giannakoulis, V. G., Papoutsi, E., and Katsaounou, P. (2020). Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: a systematic review and meta-analysis. *Brain. Behav. Immun.* 88, 901–907. doi: 10.1016/j.bbi.2020.05.026

Partinen, M. (2021). Sleep research in 2020: COVID-19-related sleep disorders. *Lancet Neurol.* 20, 15–17. doi: 10.1016/S1474-4422(20)30456-7

Pascoe, M. C., Thompson, D. R., and Ski, C. F. (2017). Yoga, mindfulness-based stress reduction and stress-related physiological measures: A meta-analysis. *Psychoneuroendocrinology* 86, 152–168. doi: 10.1016/j.psyneuen.2017.08.008

Prati, G., and Mancini, A. D. (2021). The psychological impact of COVID-19 pandemic lockdowns: a review and meta-analysis of longitudinal studies and natural experiments. *Psychol. Med.* 51, 201–211. doi: 10.1017/S0033291721000015

Sahebi, A., Nejati-Zarnaqi, B., Moayedi, S., Yousefi, K., Torres, M., and Golitaleb, M. (2021). The prevalence of anxiety and depression among healthcare workers during the COVID-19 pandemic: an umbrella review of meta-analyses. *Prog. Neuro-Psychopharmacology Biol. Psychiatry* 107, 110247. doi: 10.1016/j.pnpbp.2021.110247

Salari, N., Hosseinian-Far, A., Jalali, R., Vaisi-Raygani, A., Rasoulpoor, S., Mohammadi, M., et al. (2020a). Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: a systematic review and meta-analysis. *Global. Health* 16, 1–11. doi: 10.1186/s12992-020-00589-w

Salari, N., Khazaie, H., Hosseinian-Far, A., Ghasemi, H., Mohammadi, M., Shohaimi, S., et al. (2020b). The prevalence of sleep disturbances among physicians and nurses facing the COVID-19 patients: a systematic review and meta-analysis. *Global. Health* 16, 1–14. doi: 10.1186/s12992-020-00620-0

Salari, N., Khazaie, H., Hosseinian-Far, A., Khaledi-Paveh, B., Kazeminia, M., Mohammadi, M., et al. (2020c). The prevalence of stress, anxiety and depression within front-line healthcare workers caring for COVID-19 patients: a systematic review and meta-regression. *Hum. Resour. Health* 18, 1–14. doi: 10.1186/s12960-020-00544-1

Santabárbara, J., Bueno-Notivol, J., Lipnicki, D. M., Olaya, B., Pérez-Moreno, M., Gracia-García, P., et al. (2021a). Prevalence of anxiety in health care professionals during the COVID-19 pandemic: a rapid systematic review (on published articles in Medline) with meta-analysis. *Prog. Neuro-Psychopharmacology Biol. Psychiatry* 107:110244. doi: 10.1016/j.pnpbp.2021.110244

Santabárbara, J., Lasheras, I., Lipnicki, D. M., Bueno-Notivol, J., Pérez-Moreno, M., López-Antón, R., et al. (2021b). Prevalence of anxiety in the COVID-19 pandemic: an updated meta-analysis of community-based studies. *Prog. Neuro-Psychopharmacology Biol. Psychiatry* 109:110207. doi: 10.1016/j.pnpbp.2020.110207

Sarris, J., Marx, W., Ashton, M. M., Ng, C. H., Galvao-Coelho, N., Ayati, Z., et al. (2021). Plant-based Medicines (Phytoceuticals) in the treatment of psychiatric disorders: a meta-review of meta-analyses of randomized controlled trials: les médicaments à base de plantes (phytoceutiques) dans le traitement des troubles psychiatriques: une méta-r. *Can. J. Psychiatry* 147, 167–175. doi: 10.1177/0706743720979917

Sarris, J., O'Neil, A., Coulson, C. E., Schweitzer, I., and Berk, M. (2014). Lifestyle medicine for depression. *BMC Psychiatry* 14:107. doi: 10.1186/1471-244X-14-107

Schellekens, M. P. J., and van der Lee, M. L. (2020). Loneliness and belonging: Exploring experiences with the COVID-19 pandemic in psycho-oncology. *Psychooncology*. 29, 1399–1401. doi: 10.1002/pon.5459

Schuch, F. B., Bulzing, R. A., Meyer, J., Vancampfort, D., Firth, J., Stubbs, B., et al. (2020). Associations of moderate to vigorous physical activity and sedentary behavior with depressive and anxiety symptoms in self-isolating people during the COVID-19 pandemic: a cross-sectional survey in Brazil. *Psychiatry Res.* 1, 1–15. doi: 10.1590/SciELOPreprints.526

Schuch, F. B., Vancampfort, D., Richards, J., Rosenbaum, S., Ward, P. B., and Stubbs, B. (2016). Exercise as a treatment for depression: A meta-analysis adjusting for publication bias. *J. Psychiatr. Res.* 77, 42–51. doi: 10.1016/j.jpsychires.2016.02.023

Serrano-Ripoll, M. J., Meneses-Echavez, J. F., Ricci-Cabello, I., Fraile-Navarro, D., Fiol-deRoque, M. A., Pastor-Moreno, G., et al. (2020). Impact of viral epidemic outbreaks on mental health of healthcare workers: a rapid systematic review and meta-analysis. *J. Affect. Disord.* 277, 347–357. doi: 10.1016/j.jad.2020.08.034

Solhaug, I., de Vibe, M., Friborg, O., Sørlie, T., Tyssen, R., Bjørndal, A., et al. (2019). Long-term mental health effects of mindfulness training: a 4-Year Follow-up Study. *Mindfulness (N. Y).* 10, 1661–1672. doi: 10.1007/s12671-019-01100-2

Sousa, G. M., De, Lima-Araújo, G. L., de, Araújo, D. B., De, and Sousa, M. B. C., de (2021). Brief mindfulness-based training and mindfulness trait attenuate psychological stress in university students: a randomized controlled trial. *BMC Psychol.* 9:21. doi: 10.1186/s40359-021-00520-x

Voci, A., Veneziani, C. A., and Fuochi, G. (2019). Relating mindfulness, heartfulness, and psychological well-being: the role of self-compassion and gratitude. *Mindfulness (N. Y).* 10, 339–351. doi: 10.1007/s12671-018-0978-0

Wolf, S., Seiffer, B., Zeibig, J.-M., Welkerling, J., Brokmeier, L., Atrott, B., et al. (2021). Is physical activity associated with less depression and anxiety during the COVID-19 pandemic? a rapid systematic review. *Sports Med.* 1–13. doi: 10.21203/rs.3.rs-81150/v1

Woo, T., Ho, R., Tang, A., and Tam, W. (2020). Global prevalence of burnout symptoms among nurses: a systematic review and meta-analysis. *J. Psychiatr. Res.* 123, 9–20. doi: 10.1016/j.jpsychires.2019.12.015

World Health Organization (2017). *World Health Organization. Depression and other common mental disorders: global health estimates*. [Internet]. 2017. Available online at: https://apps.who.int/iris/handle/10665/254610

World Health Organization (2019). *WHO Coronavirus (COVID-19) Dashboard*. Available online at: https://covid19.who.int/ (accessed April 17, 2021).

World Health Organization (2020). WHO *Director-General's opening remarks at the media briefing on COVID-19*. Available online at: https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19-$-$11-march-2020 (accessed April 17, 2021).

Wu, T., Jia, X., Shi, H., Niu, J., Yin, X., Xie, J., et al. (2021). Prevalence of mental health problems during the COVID-19 pandemic: a systematic review and meta-analysis. *J. Affect. Disord.* 281, 91–98. doi: 10.1016/j.jad.2020.11.117

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 29 September 2021
doi: 10.3389/fpsyg.2021.671124

OPEN ACCESS

Edited by:
Jason H. Huang, Baylor Scott and White Health, United States

Reviewed by:
Han Zheng, Nanyang Technological University, Singapore
Wenwang Rao, University of Macau, China

***Correspondence:**
Elham Akhlaghi
elham.akhlaghi72@yahoo.com
Samaneh Torkian
Torkiansamane72@gmail.com

†ORCID:
Elham Akhlaghi
orcid.org/0000-0003-3552-1685
Samaneh Torkian
orcid.org/0000-0002-7913-2801
Vahid Khosravi
orcid.org/0000-0002-7994-800X
Reza Etesami
orcid.org/0000-0003-4141-8852
Erika Sivarajan Froelicher
orcid.org/0000-0003-1852-8922
Hamid Sharif Nia
orcid.org/0000-0002-5570-3710
Saeed Pahlevan Sharif
orcid.org/0000-0001-8082-4541

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *22 March 2021*
Accepted: *12 July 2021*
Published: *29 September 2021*

Citation:
Sharif Nia H, Akhlaghi E, Torkian S, Khosravi V, Etesami R, Froelicher ES and Pahlevan Sharif S (2021) Predictors of Persistence of Anxiety, Hyperarousal Stress, and Resilience During the COVID-19 Epidemic: A National Study in Iran. Front. Psychol. 12:671124. doi: 10.3389/fpsyg.2021.671124

Predictors of Persistence of Anxiety, Hyperarousal Stress, and Resilience During the COVID-19 Epidemic: A National Study in Iran

Hamid Sharif Nia[1†], Elham Akhlaghi[2†], Samaneh Torkian[3*†], Vahid Khosravi[4†], Reza Etesami[5†], Erika Sivarajan Froelicher[6,7†] and Saeed Pahlevan Sharif[8†]*

[1] Department of Nursing, Mazandaran University of Medical Science, Sari, Iran, [2] Department of Medical Surgical Nursing, School of Nursing and Midwifery, Iran University of Medical Sciences, Tehran, Iran, [3] Department of Epidemiology, School of Public Health, Iran University of Medical Sciences, Tehran, Iran, [4] Health Education and Promotion, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran, [5] Department of Statistics, Shahid Bahonar University, Kerman, Iran, [6] Department of Physiological Nursing, Schools of Nursing, University of California, San Francisco, San Francisco, CA, United States, [7] Department of Epidemiology & Biostatistics, Schools of Medicine, University of California, San Francisco, San Francisco, CA, United States, [8] Taylor's Business School, Taylor's University, Subang Jaya, Malaysia

Background: The coronavirus pandemic can cause unprecedented global anxiety, and, in contrast, resilience can help the mental health of people in stressful situations. This study aimed to assess anxiety, hyperarousal stress, the resilience of the Iranian population, and their related factors during the coronavirus disease 2019 (COVID-19) epidemic.

Methods: A cross-sectional study was conducted in 31 provinces in Iran between March 18 and 25, 2020. A four-part questionnaire, including the demographic information, the State-Trait Anxiety Inventory (STAI-y1—a 20-item standard questionnaire for obvious anxiety), the Connor–Davidson Resilience Scale (CD-RISC—a 25 item standard questionnaire), and the stress hyperarousal subscale from the Impact of Event Scale-Revised (IES-R), was used to collect data. The ordinal multivariable generalized estimating equation (GEE) model was used to identify correlates of the psychological factors mentioned above. The Fisher exact test was used to investigate the relationship between anxiety, stress, resilience, and the COVID-19 outbreak. All analyses were conducted with SPSS 26 and GIS 10.71.

Results: The findings show that most people had moderate-to-severe anxiety (80.17%) and a high level of resilience (96.4%) during the COVID-19 epidemic. The majority of participants had a moderate level of stress (58.9%). The lowest and highest prevalences of psychiatric disorders were in Sistan and Baluchestan (3.14 cases per 100,000 people) and Semnan (75.9 cases per 100,000 people) provinces, respectively. Men and unmarried people were the only variables significantly associated with anxiety and resilience. Age, gender, and education were significantly associated with hyperarousal stress.

Conclusion: The high and moderate levels of anxiety and stress in Iranians can have negative effects on the well-being and performance of the people and can lead to serious problems. Also, high resilience during negative life events (such as the COVID-19 pandemic) is associated with the well-being in the lives of people. The results of this study can be used in interventions and other psychological studies.

Keywords: anxiety, COVID-19, mental health, hyperarousal stress, resilience

INTRODUCTION

The novel coronavirus disease 2019 (COVID-19) first appeared in Wuhan, Hubei Province, China, in late 2019, and it rapidly spread throughout China and to nearly every country in the world (Bogoch et al., 2020). A pandemic was declared by World Health Organization (WHO) in March 2020 (Zhu et al., 2020). According to the WHO statistics, more than 184,820,132 people have been infected, and more than 4,002,209 deaths have been recorded worldwide as of July 8, 2021. Iran has the 13th highest number of coronavirus infection cases in the world. Between February 19 and 23, 2020, Iran reported 43 confirmed cases and 8 deaths in Qom. Since July 2021, the coronavirus toll in Iran reached 3,327,526 infections and 85,397 deaths (World Health Organization, 2021). The coronavirus outbreak reached its peak in 2 months in China and in <1 month in Iran (World Health Organization, 2021).

Because of the high transmissibility of the COVID-19, it can spread from person to person even if the person is asymptomatic (Li Q. et al., 2020; Pan et al., 2020). The very high number of confirmed cases and high fatality rates have resulted in psychological problems such as stress, anxiety, and depression among the medical staff as well as in the community (Kang et al., 2020; Qiu et al., 2020; Xiang et al., 2020). The general panic caused by the coronavirus outbreak has increased the symptoms of anxiety (Huang and Zhao, 2020). These symptoms are related to the natural protective response of the body against the stress of the pandemic (Maunder et al., 2003). The stress response system has both positive and negative aspects (Nesse et al., 2016); while the stress response system causes symptoms, it also has long-term benefits by increasing adaptability; therefore, responding to stress is to some extent a necessary and beneficial mechanism (Charney, 2004).

Another response to stress is the activation of the sympathetic system coupled with symptoms such as increased arousal, fever, sweating, and respiratory rate (Nesse et al., 2016). To that end, research has shown that anxiety can also cause dyspnea (Hinz et al., 2012; Holas et al., 2017). For some people, it can be confusing to identify the difference between symptoms of stress and coronavirus because coronavirus shares some of the symptoms with panic, such as fever, sweating, and dyspnea (Chen et al., 2020; Huang et al., 2020). Thus, excessive and constant anxiety is a common and debilitating problem that causes considerable suffering for the individual and their loved ones and is expensive due to the overuse of health services (Fink et al., 2010).

Anxiety, as a form of psychological stress, can also cause physiological changes and weakens the immune system (Liu et al., 2020). The immune system can protect against pathogens and can have positive effects by reducing stress and anxiety of patients (Reed and Raison, 2016; Li G. et al., 2020).

One study found that symptoms of anxiety in the COVID-19 epidemic were present among people under the age of 35 and those who spent a lot of time focusing on the epidemic and did not show a difference in anxiety between men and women (Huang and Zhao, 2020), while women were more anxious than men in other studies during this pandemic (Guo et al., 2016; Gao et al., 2020).

The field of psychology recognized the interaction between the individual and the environment (Masten and Reed, 2002) in the late nineteenth and early twentieth centuries. Connor and Davidson regard resilience as the ability of an individual to maintain a psychological balance in perilous situations (Connor and Davidson, 2003).

Considerable research on the role of resilience under various situations has shown that resilience can help people in the face of stressful life adversity (Izadinia et al., 2010). It can also modulate levels of stress and disability in stressful situations and enhance problem-solving skills (Pinquart, 2008). Resilient people use coping skills to deal with stress (Campbell-Sills et al., 2006). Resilience is about improving social activities and overcoming problems despite exposure to severe stress, anxiety, and difficult life experiences. Resilience is the ability to grow, mature, and increase the capacity of an individual against adverse conditions (Amiry, 2019). Resilience is an adaptation that manifests itself during debilitating problems and stresses. This definition of resilience states that there is a complex interaction between a dangerous situation and the protective factors (Cénat and Derivois, 2014).

It is also important to prevent anxiety among people, to teach them health principles, and to maintain calmness (Farnoosh et al., 2020). Findings from this study can guide the designing and implementation of policies for mental health interventions to effectively address this challenge. Based on the limited evidence of the stress during earlier epidemics, this study hypothesized that, given the severity of the COVID-19 pandemic, similar adverse psychological responses may manifest (Maunder et al., 2003). The main purpose of this study is to measure the severity of anxiety, stress, and resilience in Iranians in order to determine the current mental health needs and to design interventions for the Iranian population.

Abbreviations: STAI, State-Trait Anxiety Inventory; CD-RISC, Connor–Davidson Resilience Scale; IES-R, Impact of Event Scale-Revised; GEE, Generalized estimating equations; CIs, Confidence intervals; OR, Odds ratio.

METHODS

A cross-sectional study was used to evaluate the psychological responses in the general population in Iran during the COVID-19 pandemic from March 18 to 25, 2020. Data were collected with a web-based questionnaire in 31 provinces in Iran using a snowball-sampling technique. The aim was to measure anxiety, hyperarousal stress, and resilience in this critical situation. A total of 70,180 persons completed the questionnaire. This study was limited to individuals who had access to the web (to complete the questionnaire) and were literate. Participation in this study was voluntary and confidential.

A four-part questionnaire, including the demographic information, the State-Trait Anxiety Inventory (STAI-y1—a 20-item standard questionnaire for obvious anxiety), the Connor–Davidson Resilience Scale (CD-RISC—a 25-item standard questionnaire), and the stress hyperarousal subscale from the Impact of Event Scale-Revised (IES-R), was used to collect the data.

Demographic variables included gender (male and female), age (<30, 31–40, 41–50, and >50), marital status (married, single, divorced, and widowed), chronic pre-existing conditions (yes or no), education (diploma or less, associate degree, bachelor, masters, and doctorate), job (health workers and others), and economic status (good, moderate, and poor).

The anxiety measure STAI-y_1 has 20 items, and all items were rated on a 5-point scale (from "Almost Never = 1" to "Almost Always=4"). A score of four indicates greater anxiety, but for questions 1, 2, 5, 8, 10, 11, 15, 16, and 19, a high score indicates a lack of anxiety, and grading weights for these questions are reversed (Julian, 2011). This questionnaire was used to evaluate the anxiety symptoms during the past week. The STAI-y1 questionnaire was scored from 20 to a maximum of 80 points. STAI-y_1 scores are commonly classified as "no or low anxiety" (20–37), "moderate anxiety" (38–44), and "high anxiety" (45–80) (Козьминых, 2019).

The resilience measure CD-RISC consists of 25 items that are evaluated on a 5-point Likert scale ranging from 0 to 4: not true at all (0), rarely true (1), sometimes true (2), often true (3), and true nearly all of the time (4). These ratings result in a number between 0 and 100, and higher scores indicate a higher resilience (Connor and Davidson, 2003). The cut-point for the resilience questionnaire was based on the Likert score, and the average score of the questionnaire was used (Garland, 1991; Narli, 2010). Accordingly, participants with mean scores of ≤1.33, 1.34–2.66, and 2.67–4 were regarded as having low resilience, moderate resilience, and high resilience, respectively.

The stress hyperarousal subscale consisted of six questions from the IES-R questionnaire. IES-R included the three subscales: intrusion (eight items), avoidance (eight items), and hyperarousal (six items); we used only the hyperarousal subscale (Beck et al., 2008). The 5-point Likert scale response options were used (0–4): not true at all (0), rarely true (1), sometimes true (2), often true (3), and true nearly all of the time (4). The score ranges are from 0 to 24, and higher scores indicate more stress (Christianson and Marren, 2012). The high reliability and the validity of the three questionnaires have been established in earlier studies (Panaghi and Mogadam, 2006; Jowkar et al., 2010; Keyhani et al., 2015; Mahram, 2018). In this study, Cronbach's alpha for the anxiety questionnaire, the stress questionnaire, and the resilience questionnaire were 0.85, 0.73, and 0.93, respectively.

Also, the data of incidence of COVID-19 were obtained from the cases announced from the latest news of the provinces between March 6 and 20, 2020 to investigate the relationship between the COVID-19 outbreak and anxiety, stress, and resilience.

Ethical Approval and Consent to Participate

Ethical approval for this study was obtained from the Mazandaran University of Medical Sciences. The Ethical Code IR.MAZUMS.REC.1399.7293 was assigned to this study. On the first page of the questionnaire, the objectives of the study, the email ID for questions, the ethics of the study, and information about the optional participation in the study and their anonymity given to the participants were explained.

Statistical Procedures

In this study, the dependent variables had three categories; therefore, we used the ordinal multivariable generalized estimating equation (GEE) models to identify correlates of the psychological factors mentioned above. Odds ratios (ORs) with 95% confidence intervals (CI) were reported. The geographic information system (GIS) was used to draw hotspots of anxiety, stress, and resilience. This method used the median, and the hotspots for anxiety, stress hyperarousal, and resilience in Iran were plotted. The cutoffs were the same as those mentioned above, but the median was used instead of the mean. The incidence risk of COVID-19 (confirmed COVID-19 cases/population at risk) between March 6 and 19, 2020 was shown in a bar chart. The Fisher's exact test was used to investigate the relationship between the COVID-19 outbreak with anxiety, stress, and resilience. A $P < 0.05$ was considered statistically significant. We conducted all analyses using SPSS 26 and GIS 10.71.

RESULTS

In this survey, most of the participants were male (64.3%), were married (75.8%), had a bachelor degree (37.6%), had a medium-income level (70.4%), and had no chronic pre-existing conditions (80.9%). The mean age (±SD) of the participants was 41.21 (±11.71) years.

The prevalence of anxiety, stress, and resilience in subgroups by demographic variables is shown in **Table 1**. The anxiety, stress hyperarousal, and resilience in Iranians during the COVID-19 epidemic were means (SD) of 47.64 (±11.51), 10.28 (±3.91), and 64.74 (±16.44), respectively. In this study, 59.4% of the people reported high anxiety, 20.8% reported moderate anxiety, and 19.8% reported low anxiety. Most of the Iranians had moderate-to-severe anxiety (80.17%) during the COVID-19 epidemic. A high level of stress hyperarousal was reported by 6.6%; a moderate level was reported by the majority of people (59.4%),

TABLE 1 | Characteristics of participants according to the demographic and the psychological variables during the COVID-19 pandemic ($n = 70,180$).

Variables	*n* (%)	Resilience			Anxiety			Stress		
		Low	Moderate	High	Low	Moderate	High	Low	Moderate	High
Gender										
Male	25,037 (35.7)	902 (3.6)	9,556 (38.2)	14,579 (58.2)	12,063 (48.2)	686 (2.7)	12,288 (49.1)	8,580 (34.3)	14,738 (58.9)	1,719 (6.9)
Female	45,143 (64.3)	1,916 (4.2)	23,491 (52.0)	19,736 (43.7)	1,857 (4.1)	13,877 (30.7)	29,409 (65.1)	15,279 (33.8)	26,968 (59.7)	2,899 (6.4)
Total	70,180	2,818 (4.0)	33,047 (47.1)	34,318 (48.9)	13,920 (19.8)	14,697 (20.8)	41,697 (59.4)	23,856 (34.0)	417.6 (59.4)	4,618 (6.6)
Age (years)										
(8–30)	11,568 (16.9)	411 (3.6)	5,467 (47.3)	5,690 (49.2)	2,165 (18.7)	2,648 (22.9)	6,755 (58.4)	3,977 (34.4)	6,826 (59.0)	765 (6.6)
(31–40)	24,513 (35.7)	995 (4.1)	11,609 (47.4)	11,909 (48.6)	4,669 (19.0)	5,324 (21.7)	14,520 (59.2)	8,175 (33.3)	14,666 (59.8)	1,672 (6.8)
(41–50)	17,728 (25.8)	723 (4.1)	8,370 (47.2)	8,635 (48.7)	3,628 (20.5)	3,536 (19.9)	10,564 (59.6)	6,074 (34.3)	10,539 (59.4)	1,115 (6.3)
(51–99)	14,786 (21.6)	614 (4.2)	6,857 (46.4)	7,315 (49.5)	3,190 (21.6)	2,687 (18.2)	8,909 (60.3)	5,114 (34.6)	8,723 (59.0)	949 (6.4)
Marital status										
Single	14,097 (20.1)	486 (3.4)	6,163 (43.7)	7,448 (52.8)	2,845 (20.2)	4,487 (31.8)	6,765 (48.0)	4,691 (33.3)	8,419 (59.7)	987 (7.0)
Divorce/Widowed	2,901 (4.1)	135 (4.7)	1,468 (50.6)	1,298 (44.7)	257 (8.9)	814 (28.1)	1,830 (63.1)	972 (33.5)	1,735 (59.8)	194 (6.7)
Married	53,182 (75.8)	2,197 (4.1)	25,416 (47.8)	25,569 (48.1)	10,818 (20.3)	9,262 (17.4)	33,102 (62.2)	18,193 (34.2)	31,552 (59.3)	3,437 (6.5)
Chronic pre-existing conditions										
No	56,778 (80.9)	2,286 (4.0)	26,721 (47.1)	27,771 (48.9)	11,142 (19.6)	12,019 (21.2)	33,617 (59.2)	19,240 (33.9)	33,809 (59.5)	3,729 (6.6)
Yes	13,402 (19.1)	532 (4.0)	6,326 (47.2)	6,544 (48.8)	2,778 (20.7)	2,544 (19.0)	8,080 (60.3)	4,616 (34.4)	7,897 (58.9)	889 (6.6)
Education										
Diploma and less	18,526 (26.4)	772 (4.2)	8,855 (47.8)	8,899 (48.0)	3,544 (19.1)	3,829 (20.7)	11,153 (60.2)	6,483 (35.0)	10,961 (59.2)	1,082 (5.8)
Associate degree	7,170 (10.2)	311 (4.3)	3,387 (47.2)	3,472 (48.4)	1,487 (20.7)	1,379 (19.2)	4,304 (60.0)	2,355 (32.8)	4,375 (61.01)	440 (6.1)
Bachelor	26,373 (37.6)	1,029 (3.9)	12,459 (47.2)	12,885 (48.9)	4,868 (18.5)	5,693 (21.6)	15,812 (60.0)	8,969 (34.0)	15,612 (59.4)	1,792 (6.8)
Masters Doctorate	18,111 (25.8)	706 (3.9)	8,346 (46.1)	9,059 (50.0)	4,021 (22.2)	3,662 (20.2)	10,428 (57.6)	6,049 (33.4)	10,758 (59.4)	1,304 (7.2)
Job										
Other	63,460 (60.4)	2,558 (4.0)	2,558 (4.0)	31,154 (49.1)	12,823 (4.0)	12,959 (20.4)	37,678 (59.4)	21,636 (34.1)	37,618 (59.3)	4,206 (6.6)
Health workers	6,720 (9.6)	260 (3.9)	260 (3.9)	3,161 (47.0)	1,097 (16.3)	1,604 (23.9)	4,019 (59.8)	2,220 (33.0)	4,088 (60.8)	412 (6.1)
Economic situation										
Good	11,449 (16.3)	463 (4.0)	5,585 (48.8)	5,401 (47.2)	1,841 (16.1)	2,555 (22.3)	7,053 (61.6)	3,830 (33.5)	6,890 (60.2)	729 (6.4)
Moderate	49,382 (70.4)	1,987 (4.0)	23,186 (47.0)	24,209 (49.0)	9,758 (19.8)	10,266 (20.8)	29,358 (59.5)	16,848 (34.1)	29,237 (59.2)	3,297 (6.7)
Poor	9,348 (13.3)	368 (3.9)	4,275 (45.7)	4,705 (50.3)	2,321 (24.8)	1,742 (18.6)	5,285 (56.5)	3,178 (34.0)	5,578 (59.7)	592 (6.3)

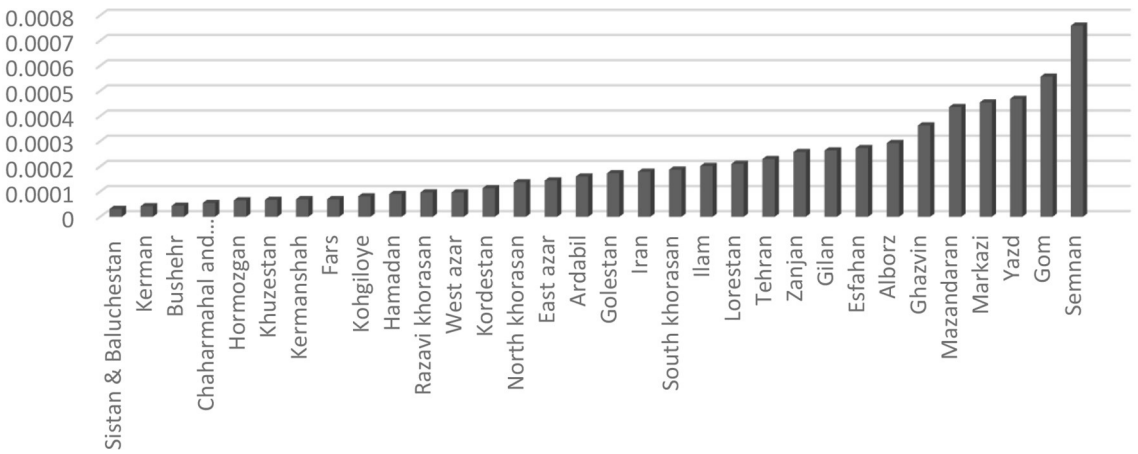


FIGURE 1 | The incidence risk of COVID-19 in the provinces of Iran from March 6 to 28, 2020.

and 34% reported a low level of stress. Most of the people reported moderate (47.1%) and high (48.9%) levels of resilience.

The incidence of COVID-19 in the provinces is shown in **Figure 1**. The lowest and highest incidence risks of COVID-19 were in Sistan and Baluchestan (3.14 cases per 100,000 people) and in Semnan (75.9 per cases 100,000 people) provinces, respectively.

The median distribution of the anxiety score is shown in **Figure 2**. As shown in **Figure 2**, the people in almost all parts of Iran were highly anxious.

Figure 3 shows that many parts of Iran have moderate levels of stress.

Figure 4 also shows the high and moderate resistances of all parts of Iran.

The distribution of the incidence cases of COVID-19 in Iran between March 6 and 28, 2020 is shown in **Figure 5**.

The association between the demographic variables and the psychological impact of the COVID-19 outbreak is shown in **Table 2**. The following demographic variables, gender (female), age (>50 years), marital status (being married), having a chronic pre-existing condition, education (masters degree), employment (other jobs), and economic status (being poor), were reference groups for the GEE models.

Gender and marital status were the only variables significantly associated with anxiety and resilience. Being male were significantly associated with a higher resilience level (OR = 1.76, 95% CI: 1.70, 1.82) and a lower anxiety level (OR = 0.28, 95% CI: 0.25, 0.26). Marital status was significantly associated with the CD-RISC and STAI levels. Being single (OR = 1.25, 95% CI: 1.20, 1.30) and being widowed/divorced were significantly associated (OR = 1.02, 95% CI: 1.00, 1.10) with higher resilience. Also, being single (OR = 0.57, 95% CI: 0.55, 0.59) and divorced/widowed (OR = 0.57, 95% CI: 0.55, 0.59) were significantly associated with lower anxiety.

Other sociodemographic variables including age, underlying chronic disease, education, job, and economic situation were not associated with the CD-RISC and STAI levels. Age groups ≤30, being single, diploma, and lower education level were significantly associated with hyperarousal stress. Being single (OR = 1.05, 95% CI: 1.01, 1.09) and age groups (≤30 years) (OR = 1.05, 95% CI: 1.00, 1.09) were significantly associated with a higher IES-R subscale level and those who had a diploma or education level (OR = 1.05, 95% CI: 1.00, 1.09) were significantly associated with a lower IES-R subscale level. Other sociodemographic variables including gender, widowed/divorced, age (except age groups ≤30), underlying chronic disease, education (except diploma and less education), job, and economic situation were not associated with the IES-R subscale levels.

The median resilience score was significantly associated ($p = 0.044$) with an outbreak, but the median anxiety ($p = 1.000$) and stress ($p = 0.073$) scores had no significant relationship with the COVID-19 outbreak.

DISCUSSION

The salient findings of this study include the following. Most of the Iranians reported moderate-to-severe levels of anxiety, moderate stress, and resilience during the COVID-19 pandemic. These findings confirm those reported during the initial phase of the COVID-19 outbreak in China, where about one-third of the general population in China reported moderate-to-severe anxiety (Wang et al., 2020). In Rome, 89.4% of students reported an increase in stress (66% moderate and 23.4% high stress), which remained consistent with our results (Quintiliani et al., 2021). The prevalence of anxiety in a systematic review and meta-analysis in 2016 in Iranians showed mild (31%), moderate (37%), intense (19%), and highly intense (2%) levels of anxiety

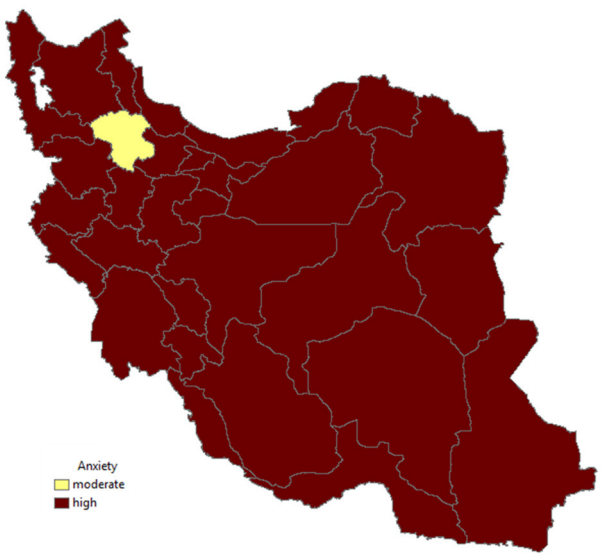


FIGURE 2 | Anxiety in the provinces of Iran.

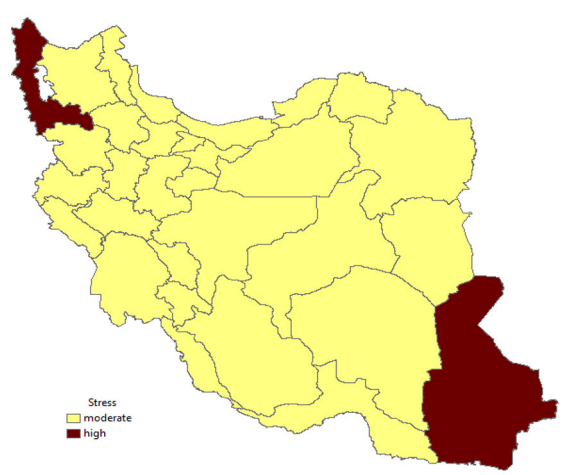


FIGURE 3 | Stress in the provinces of Iran.

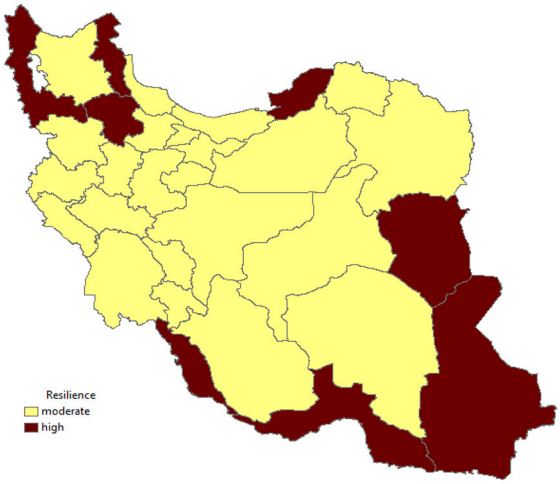


FIGURE 4 | Resilience in the provinces of Iran.

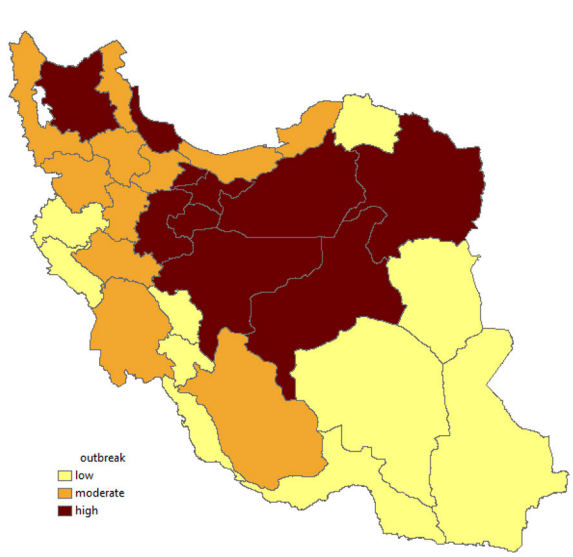


FIGURE 5 | Outbreak of COVID-19 in the provinces of Iran.

(Valizadeh et al., 2016). These findings suggest that an increase in the prevalence of high anxiety during the COVID-19 epidemic was reported.

Consistent with this study, Limcaoco et al. in their study reported higher levels of anxiety in women during the COVID-19 epidemic (Limcaoco et al., 2020). Consistent with our findings, Wang et al. showed in their study that gender and age were associated with anxiety and that anxiety rates were higher in women and younger people (<40 years). However, in our study, <40 years of age was not associated with anxiety (Wang et al., 2021). A meta-analysis study conducted until May 2020 showed that the prevalence of stress in five studies with a total sample size of 9,074 was 29.6% and the prevalence of anxiety in 17 studies with a sample size of 63,439 was 31.9%. The prevalence of stress in this meta-analysis was higher than that of the severe stress in the present study but the prevalence of anxiety was lower (Salari et al., 2020).

High levels of stress and anxiety were not associated with the COVID-19 epidemic in this study. We guess that stress and anxiety are associated with the two important consequences of the COVID-19 pandemic: availability of medical equipment and economic status (Abdoli, 2020; Taherinia and Hassanvand, 2020). Iran is suffering from the political and economic sanctions that have directly and indirectly restricted the activities of its banking systems. This, in turn, has led to restrictions on trade, the manufacturing sector, insurance, and ventures

TABLE 2 | The ordinal multivariable generalized estimating equation models to determine the correlates of the psychological impact of the COVID-19 in Iran ($n = 70,180$).

Variables	Resilience	Anxiety		Stress hyperarousal		
	OR (95% CI)	*p*-value	OR (95% CI)	*p*-value	OR (95% CI)	*p*-value
Gender						
Male	1.76 (1.70, 1.82)	**<0.001**	0.28 (0.25, 0.26)	**<0.001**	0.99 (0.96, 1.03)	0.960
Female	1	1	1	1	1	1
Age (years)						
(8–30)	0.98 (0.93, 1.03)	0.587	1.03 (0.97, 1.08)	0.243	0.99 (0.94, 1.05)	0.941
(31–40)	0.98 (0.94, 1.02)	0.436	0.96 (0.92, 1.01)	0.130	1.05 (1.00, 1.09)	**0.022**
(41–50)	0.98 (0.94, 1.03)	0.559	0.95 (0.91, 0.99)	**0.047**	1.00 (0.96, 1.04)	0.838
(51–99)	1	1	1	1	1	1
Marital status						
Single	1.25 (1.20, 1.30)	**<0.001**	0.57 (0.55, 0.59)	<0.001	1.05 (1.01, 1.09)	**0.014**
Divorced/Widowed	1.02 (1.00, 1.10)	**<0.001**	0.85 (0.79, 0.92)	**<0.001**	1.05 (0.97, 1.13)	0.217
Married	1	1	1	1	1	**1**
Chronic pre-existing conditions						
No	1.00 (0.96, 1.04)	0.721	0.97 (0.93, 1.01)	0.269	1.01 (0.97, 1.05)	0.591
Yes	1	1	1	1	1	1
Education						
Diploma and less	0.96 (0.92, 1.00)	0.105	1.03 (0.98, 1.08)	0.150	0.91 (0.87, 0.95)	**<0.001**
Associate degree	0.96 (0.91, 1.02)	0.223	1.02 (0.97, 1.08)	0.353	0.99 (0.94, 1.05)	0.833
Bachelor	1.00 (0.91, 1.01)	0.847	1.03 (0.99, 1.08)	0.067	0.97 (0.93, 1.00)	0.125
Masters/doctorate	1	1	1	1	1	1
Job						
Health workers	0.96 (0.92, 1.01)	0.214	0.96 (0.91, 1.01)	0.159	1.00 (0.95, 1.05)	0.828
Other	1	1	1	1	1	1
Economic situation						
Good	0.98 (0.93, 1.05)	0.695	1.05 (0.99, 1.12)	0.060	1.00 (0.94, 1.06)	0.964
Moderate	1.01 (0.96, 1.06)	0.636	1.02 (0.97, 1.07)	0.335	0.98 (0.94, 1.03)	0.508
Poor	1	1	1	1	1	1

The bold values are indicate statistical significance.

(Abdoli, 2020). These conditions have hampered the provision of basic medical equipment for the prevention, diagnosis, and treatment of COVID-19. Concerns about the provision of equipment needed for the prevention and treatment can be one of the most important causes of fear and anxiety in the community during the COVID-19 pandemic. The COVID-19 pandemic plunged the world economy into a recession (Hashemi-Shahri et al., 2020). This recession has doubled the problems of the economy in Iran, and people are worried about unemployment, inflation, and business closures in Iran.

In this study, women presented with more symptoms of anxiety than men, and this may be related to a greater exposure of a women to stressful factors, such as a low socioeconomic status, fewer resources, lack of energy, role overload, psychological problems, and low self-esteem (Watkins et al., 2013; Carvalho et al., 2016). The lower prevalence of these symptoms among men may be attributed to what some authors have identified as men compensated differently compared with women such as the use of anger, aggressiveness, antisocial behavior, excessive consumption of alcohol, smoking, and hostility (Watkins et al., 2013; Carvalho et al., 2016). Contrary to our findings, Broche-Pérez et al. in Cuba showed that anxiety did not differ between genders (Broche-Pérez et al., 2021).

The WHO considers the COVID-19 pandemic to be a stressful and anxious time for people (World Health Organization, 2021). One of the reasons for stress and anxiety during the COVID-19 pandemic is the extensive news coverage of coronavirus causing stress and anxiety. "Headline stress disorder" was first coined by Dr. Steven Stosny who referred to mental disorders such as stress and anxiety being caused by excessive attention to news coverage. Also, the use of mobile phones provides wide news coverage (Dong and Zheng, 2020). Until 2018, Iran had an estimated Internet penetration rate of between 64 and 69% out of a population of about 82 million, about 56,700,000, that increased recently (Wikipedia, 2020). This study is limited to internet users, which include about 68% of the population of Iran.

Connor and Davidson (2003) describe resilience as an ability to cope with stress. Consistent with the present study, the average psychological resilience score of the hospital staff after the outbreak of the respiratory syndrome in South Korea showed good resilience (Son et al., 2019). In another study, most of

the employees in Sierra Leone (in West Africa) had a resilience score of 71–80 during the Ebola epidemic (Colorado, 2017), indicating a high resilience; our results are similar. Similarly, Bonnano (2004) defined resilience as the ability of an individual to maintain a stable psychological equilibrium; this is the counterpart to psychological vulnerability. According to these definitions, resilience differs from recovery, accounting not for the ability of an individual to "bounce back" after a negative experience but for the ability of an individual maintain a steady psychological state despite the changing circumstances (Seery, 2011).

Despite the long-term sanctions on Iran, the people have faced and struggled with many problems (Abdoli, 2020). With their minimum facilities and maximum capabilities, they have used the opportunities for progress (Agheli and Emamgholipour, 2020). This long-term compatibility is probably one of the reasons for the high resilience of the Iranian people.

The presence or absence of resilience greatly affects the response of an individual to adverse life events. Individuals with low resilience are more likely to experience psychological distress following an adverse life event than individuals who report high resilience (Faircloth, 2017). Differences in resilience accounted for a variation in emotional responses following adverse experiences. High accounts of resilience resulted in weaker associations between stressful events and the emotional state of an individual (Ong et al., 2006). The relationship between a high level of resilience and men in the present study may be because women use coping strategies more frequently, while men focus on the problem itself, in which an individual opts to solve difficulties and attitudes in order to be able to deal with the habitual pressure, decreasing or even eliminating situations that generate stress (Bazrafshan et al., 2014; Carvalho et al., 2016).

The WHO has six recommendations for the mental and psychological well-being of people in a community, working together as one community, and supporting the medical staff. Also, instead of negative thoughts and excessive attention to news, the experiences of people who have recovered from the disease have to be followed up (World Health Organization, 2021).

The comprehensive support of the people from the government, for example, easy access to preventive equipment, rapid and free vaccination of the people, support of harmful businesses in the COVID-19 pandemic, and redoubled efforts to control the epidemic in Iran, can reduce the psychological pressure of the people in this pandemic.

Limitations of this study include the use of a snowball-sampling method. Given the emergence of this health crisis, this sampling method was considered to be most appropriate. Random sampling was not an option due to the lack of a sampling frame. However, the large sample size of this study that covered about one-tenth of a percent of the Iran population was a strong representation of Iranian society. The web-based data collection could however be a limitation, as not everyone in Iran has access to the web. This problem was minimized because a link to the questionnaire was published on Instagram, WhatsApp, and Telegram in order to be inclusive to the majority of the news channels of the provinces of Iran. Another limitation of this study was that the COVID-19 status of the participants was not obtained. This omission is important as psychological stress is likely to be much higher in those who were infected with COVID-19 than those who were not infected.

CONCLUSIONS

The findings of this study showed a high-to-moderate level of anxiety and resilience and a low-to-moderate stress in this Iranian population. These findings suggest that there is a need for psychological interventions. An emphasis on increasing and continuous monitoring of mental health services in the health centers is recommended. The high and moderate levels of anxiety and stress in Iranians can negatively affect the well-being and performance of the population and can lead to serious problems. Also, a high resilience during negative life events is associated with well-being. The results of this study can be used to design psychological interventions. A focus on developing resilience skills may reduce psychological disorders against the COVID-19 pandemic.

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 IR.MAZUMS.REC.1399.7293. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin. Written informed consent was obtained from the individual(s), and minor(s)' legal guardian/next of kin, for the publication of any potentially identifiable images or data included in this article.

AUTHOR CONTRIBUTIONS

EA, ST, and HS contributed significantly in designing, collecting data, and writing articles. RE analyzed the data. VK, EF, and SP were involved in interpreting the findings and reviewing the manuscript. All authors were read and approved the final version.

FUNDING

The research leading to these results was financed by the Mazandaran University of Medical Sciences.

ACKNOWLEDGMENTS

The authors thank all the Iranian people who took part in this study.

REFERENCES

Abdoli, A. (2020). Iran, sanctions, and the COVID-19 crisis. *J. Med. Econ*. 23, 1461–1465. doi: 10.1080/13696998.2020.1856855

Agheli, L., and Emamgholipour, S. (2020). An analysis of the economic consequences of COVID-19 and the functioning of governments' financial packages in its management. journal of culture and health promotion (academy of medical sciences of Islamic Republic of Iran). *Iran. J. Cult. Health Promot.* 4, 71–78.

Amiry, H. L. (2019). Comparison of resilience and anxiety among parents with disabled children in Tehran. *J. Excell. Counsel. Psychother*. 8, 65–76.

Bazrafshan, M.-R., Jahangir, F., Mansouri, A., and Kashfi, S. H. (2014). Coping strategies in people attempting suicide. *Int. J. High Risk Behav. Addict*. 3:e16265. doi: 10.5812/ijhrba.16265

Beck, J. G., Grant, D. M., Read, J. P., Clapp, J. D., Coffey, S. F., Miller, L. M., et al. (2008). The impact of event scale-revised: psychometric properties in a sample of motor vehicle accident survivors. *J. Anxiety Disord*. 22, 187–198. doi: 10.1016/j.janxdis.2007.02.007

Bogoch, I. I., Watts, A., Thomas-Bachli, A., Huber, C., Kraemer, M. U., and Khan, K. J. (2020). Potential for global spread of a novel coronavirus from China. *J. Travel Med.* 27:taaa011. doi: 10.1093/jtm/taaa011

Bonnano, G. (2004). Loss, trauma and human resilience: conceptual and empirical connections and separateness. *Am. Psychol.* 59, 20–28. doi: 10.1037/0003-066X.59.1.20

Broche-Pérez, Y., Fernández-Fleites, Z., Fernández-Castillo, E., Jiménez-Puig, E., Vizcaíno-Escobar, A. E., Ferrer-Lozano, D. M., et al. (2021). Anxiety, health self-perception, and worry about the resurgence of COVID-19 predict fear reactions among genders in the Cuban population. *Front. Glob. Womens Health* 2:14. doi: 10.3389/fgwh.2021.634088

Campbell-Sills, L., Cohan, S. L., and Stein, M. B. (2006). Relationship of resilience to personality, coping, and psychiatric symptoms in young adults. *Behav. Res. Ther.* 44, 585–599. doi: 10.1016/j.brat.2005.05.001

Carvalho, I. G., Bertolli Ed, S., Paiva, L., Rossi, L. A., Dantas, R. A. S., and Pompeo, D. A. (2016). Anxiety, depression, resilience and self-esteem in individuals with cardiovascular diseases. *Rev. Lat. Am. Enfermagem* 24:e2836. doi: 10.1590/1518-8345.1405.2836

Cénat, J. M., and Derivois, D. J. (2014). Psychometric properties of the creole haitian version of the resilience scale amongst child and adolescent survivors of the 2010 earthquake. *Comprehen. Psychiatry* 55, 388–395. doi: 10.1016/j.comppsych.2013.09.008

Charney, D. S. (2004). Psychobiological mechanisms of resilience and vulnerability: implications for successful adaptation to extreme stress. *Am. J. Psychiatry* 161, 195–216. doi: 10.1176/appi.ajp.161.2.195

Chen, N., Zhou, M., Dong, X., Qu, J., Gong, F., Han, Y., et al. (2020). Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China. *Lancet* 395, 497–506. doi: 10.1016/S0140-6736(20)30211-7

Christianson, S., and Marren, J. (2012). The impact of event scale-revised (IES-R). *Medsurg. Nurs*. 21, 321–322.

Colorado, E. E. (2017). *A Mixed-Method Study of Aid Workers in Sierra Leone During the 2014-2015 Ebola Epidemic: Exploring Psychological Distress, Trauma, Resilience, and Coping.* Chicago, IL: The Chicago School of Professional Psychology.

Connor, K. M., and Davidson, J. R. J. (2003). Development of a new resilience scale: the connor-davidson resilience scale (CD-RISC). *Depress. Anxiety* 18, 76–82. doi: 10.1002/da.10113

Dong, M., and Zheng, J. (2020). Letter to the editor: headline stress disorder caused by Netnews during the outbreak of COVID-19. *Health Expect.* 23, 259–260. doi: 10.1111/hex.13055

Faircloth, A. L. (2017). *Resilience as a mediator of the relationship between negative life events and psychological well-being* (Electronic Theses and Dissertations). Georgia Southern University, Georgia, United States

Farnoosh, G., Alishiri, G., Hosseini Zijoud, S. R., Dorostkar, R., and Jalali Farahani, A. J. (2020). Understanding the 2019-novel coronavirus (2019-nCoV) and coronavirus disease (COVID-19) based on available evidence-a narrative review. *J. Mil. Med.* 22, 1–11. doi: 10.1017/dmp.2020.341

Fink, P., Ørnbøl, E., and Christensen, K. S. (2010). The outcome of health anxiety in primary care. A two-year follow-up study on health care costs and self-rated health. *PLoS ONE* 5:e9873. doi: 10.1371/journal.pone.0009873

Gao, W., Ping, S., and Liu, X. J. (2020). Gender differences in depression, anxiety, and stress among college students: a longitudinal study from China. *J. Affect. Disord*. 263, 292–300. doi: 10.1016/j.jad.2019.11.121

Garland, R. (1991). The mid-point on a rating scale: Is it desirable. *Market. Bull.* 2, 66–70.

Guo, X., Meng, Z., Huang, G., Fan, J., Zhou, W., Ling, W., et al. (2016). Meta-analysis of the prevalence of anxiety disorders in mainland China from 2000 to 2015. *Sci. Rep*. 6:28033. doi: 10.1038/srep28033

Hashemi-Shahri, S. M., Barfar, E., Ansari-Moghaddam, A., Khammarnia, M., Setoodehzadeh, F., and Okati-Aliabad, H. (2020). Economic consequences of COVID-19 in the middle East and North Africa region countries. *J. Adv. Med. Biomed. Res*. 28, 304–306. doi: 10.30699/jambs.28.131.304

Hinz, A., Brähler, E., Möde, R., Wirtz, H., and Bosse-Henck, A. (2012). Anxiety and depression in sarcoidosis: the influence of age, gender, affected organs, concomitant diseases and dyspnea. *Sarcoidosis Vasc. Diffuse Lung Dis.* 29, 139–146.

Holas, P., Szymańska, J., Dubaniewicz, A., Farnik, M., Jarzemska, A., Krejtz, I., et al. (2017). Association of anxiety sensitivity-physical concerns and FVC with dyspnea severity in sarcoidosis. *Gen. Hosp. Psychiatry*. 47, 43–47. doi: 10.1016/j.genhosppsych.2017.04.013

Huang, C., Wang, Y., Li, X., Ren, L., Zhao, J., Hu, Y., et al. (2020). Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 395, 497–506. doi: 10.1016/S0140-6736(20)30183-5

Huang, Y., and Zhao, N. J. (2020). Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 epidemic in China: a web-based cross-sectional survey. *Psychiatry Res.* 288:112954. doi: 10.1016/j.psychres.2020.112954

Izadinia, N., Amiri, M., Ghorban Jahromi, R., and Hamidi, S. J. (2010). A study of relationship between suicidal ideas, depression, anxiety, resiliency, daily stresses and mental health among Tehran university students. *Proc. Sock. Behav. Sci.* 5, 1615–1619 doi: 10.1016/j.sbspro.2010.07.335

Jowkar, B., Friborg, O., and Hjemdal, O. (2010). Cross-cultural validation of the resilience scale for adults (RSA) in Iran. *Scand. J. Psychol.* 51, 418–425. doi: 10.1111/j.1467-9450.2009.00794.x

Julian, L. J. (2011). Measures of anxiety: state-trait anxiety inventory (STAI), beck anxiety inventory (BAI), and hospital anxiety and depression scale-anxiety (HADS-A). *Arthritis Care Res.* 63(Suppl. 11), S467–S472. doi: 10.1002/acr.20561

Козьминых, В. А. (2019). Investigation of the relationship between nostalgia proneness and anxiety in high achieving adolescents and their unselected peers: Магистерская Диссертация По Направлению Подготовки: 37.04.01 - Психология/Козьминых. Томск: Валерия Александровна.

Kang, L., Li, Y., Hu, S., Chen, M., Yang, C., Yang, B. X., et al. (2020). The mental health of medical workers in Wuhan, China dealing with the 2019 novel coronavirus. *Lancet Psychiatry* 7:e14. doi: 10.1016/S2215-0366(20)30047-X

Keyhani, M., Taghvaei, D., Rajabi, A., and Amirpour, B. (2015). Internal consistency and confirmatory factor analysis of the connor-davidson resilience scale (CD-RISC) among nursing female. *Iran J. Med. Educ.* 14, 857–865.

Li, G., Fan, Y., Lai, Y., Han, T., Li, Z., Zhou, P., et al. (2020). Coronavirus infections and immune responses. *J. Med. Virol.* 92, 424–432 doi: 10.1002/jmv.25685

Li, Q., Guan, X., Wu, P., Wang, X., Zhou, L., Tong, Y., et al. (2020). Early transmission dynamics in Wuhan, China, of novel coronavirus–infected pneumonia. *N. Engl. J. Med.* 382, 1199–1207. doi: 10.1056/NEJMoa2001316

Limcaoco, R. S. G., Mateos, E. M., Fernandez, J. M., and Roncero, C. (2020). Anxiety, worry and perceived stress in the world due to the COVID-19 pandemic, March 2020 preliminary results. *medRxiv [preprint]*. doi: 10.1101/2020.04.03.20043992

Liu, K., Chen, Y., Wu, D., Lin, R., Wang, Z., and Pan, L. J. (2020). Effects of progressive muscle relaxation on anxiety and sleep quality in patients with COVID-19. *Complement. Ther. Clin. Pract*. 39:101132. doi: 10.1016/j.ctcp.2020.101132

Mahram, B. (2018). *Standardization Speilberger State-Trait Anxiety Inventory in Mashad City (Iran), Vol. 6.* Tehran: International Journal of Women's Health and Reproduction Sciences, 67–74

Masten, A. S., and Reed, M.-G. (2002). *Resilience in Development*.

Maunder, R., Hunter, J., Vincent, L., Bennett, J., Peladeau, N., Leszcz, M., et al. (2003). The immediate psychological and occupational impact of the 2003 SARS outbreak in a teaching hospital. *CMAJ Can. Med. Assoc. J.* 168, 1245–1251.

Narli, S. (2010). An alternative evaluation method for likert type attitude scales: rough set data analysis. *Sci. Res. Essays* 5, 519–528. doi: 10.5897/SRE.9000150

Nesse, R., Bhatnagar, S., and Ellis, B. (2016). "Evolutionary origins and functions of the stress response system," in *Stress: Concepts, Cognition, Emotion, and Behavior,* ed Fink G, editor. San Diego, CA: Academic Press, 95–101. doi: 10.1016/B978-0-12-800951-2.00011-X

Ong, A. D., Bergeman, C. S., Bisconti, T. L., and Wallace, K. A. (2006). Psychological resilience, positive emotions, and successful adaptation to stress in later life. *J. Pers. Soc. Psychol.* 91, 730–749. doi: 10.1037/0022-3514.91.4.730

Pan, X., Chen, D., Xia, Y., Wu, X., Li, T., Ou, X., et al. (2020). Asymptomatic cases in a family cluster with SARS-CoV-2 infection. *Lancet Infect. Dis.* 20, 410–411 doi: 10.1016/S1473-3099(20)30114-6

Panaghi, L., and Mogadam, J. A. (2006). Persian version validation in impact of event scale-revised. *Tehran Univer. Med. J. TUMS Public*. 64, 52–60.

Pinquart, M. (2008). Moderating effect of dispositional Resilience on association between hassles and Psychological distress. *J. Appl. Dev. Psychol.* 23, 1–8. doi: 10.1016/j.appdev.2008.10.005

Qiu, J., Shen, B., Zhao, M., Wang, Z., Xie, B., and Xu, Y. (2020). A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: implications and policy recommendations. *BMJ Gen. Psychiatry* 33:e100213. doi: 10.1136/gpsych-2020-100213

Quintiliani, L., Sisto, A., Vicinanza, F., Curcio, G., and Tambone, V. (2021). Resilience and psychological impact on Italian university students during COVID-19 pandemic. Distance learning and health. *Psychol. Health Med.* doi: 10.1080/13548506.2021.1891266. [Epub ahead of print].

Reed, R. G., and Raison, C. L. (2016). "Stress and the immune system," in *Environmental Influences on the Immune System,* Esser C, editor. Vienna: Springer Vienna. p. 97–126. doi: 10.1007/978-3-7091-1890-0_5

Salari, N., Hosseinian-Far, A., Jalali, R., Vaisi-Raygani, A., Rasoulpoor, S., Mohammadi, M., et al. (2020). Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: a systematic review and meta-analysis. *Glob. Health*. 16:57. doi: 10.1186/s12992-020-00589-w

Seery, M. D. (2011). Resilience: a silver lining to experiencing adverse life events? *Curr. Dir. Psychol. Sci*. 20, 390–394. doi: 10.1177/0963721411424740

Son, H., Lee, W. J., Kim, H. S., Lee, K. S., and You, M. (2019). Hospital workers' psychological resilience after the 2015. Middle East respiratory syndrome outbreak. *Soc. Behav. Pers. Int. J.* 47, 1–13. doi: 10.2224/sbp.7228

Taherinia, M., and Hassanvand, A. (2020). Economic consequences of Covid-19 disease on the Iranian economy; with an emphasis on employment. quarterly journal of nursing management (IJNV) original article. *Q. J. Ners. Manage*. 9, 43–58.

Valizadeh, R., Sarokhani, D., Sarokhani, M., Sayehmiri, K., Ostovar, R., Angh, P., et al. (2016). A study of prevalence of anxiety in Iran: systematic review and meta-analysis. *Der Pharm. Chem.* 8, 48–57.

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., et al. (2020). Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in china. *Int. J. Environ. Res. Public Health* 17:1729. doi: 10.3390/ijerph17051729

Wang, Y., Di, Y., Ye, J., and Wei, W. (2021). Study on the public psychological states and its related factors during the outbreak of coronavirus disease 2019 (COVID-19) in some regions of China. *Psychol. Health Med.* 26, 13–22. doi: 10.1080/13548506.2020.1746817

Watkins, L. L., Koch, G. G., Sherwood, A., Blumenthal, J. A., Davidson, J. R., O'Connor, C., et al. (2013). Association of anxiety and depression with all-cause mortality in individuals with coronary heart disease. *J. Am. Heart Assoc.* 2:e000068. doi: 10.1161/JAHA.112.000068

Wikipedia. (2020). *Internet Censorship in Iran*. Available online at: https://en.wikipedia.org/wiki/Internet_censorship_in_Iran (accessed March 13, 2021).

World Health Organization (2021). *Novel Coronavirus (2019-nCoV) Situation Reports*. Technical Report 1-24. WHO.

Xiang, Y.-T., Yang, Y., Li, W., Zhang, L., Zhang, Q., Cheung, T., et al. (2020). Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. *Lancet Psychiatry* 7, 228–229 doi: 10.1016/S2215-0366(20)30046-8

Zhu, N., Zhang, D., Wang, W., Li, X., Yang, B., Song, J., et al. (2020). A novel coronavirus from patients with pneumonia in China, 2019. *N. Engl. J. Med.* 382, 727–733. doi: 10.1056/NEJMoa2001017

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

BRIEF RESEARCH REPORT
published: 13 October 2021
doi: 10.3389/fpsyg.2021.703214

A 6-Month Follow-Up Study on Worry and Its Impact on Well-Being During the First Wave of COVID-19 Pandemic in an Italian Sample

Giulia Ongaro[1,2], Clizia Cincidda[1,2], Valeria Sebri[1,2], Lucrezia Savioni[1,2], Stefano Triberti[1,2], Roberta Ferrucci[3,4,5], Barbara Poletti[6], Bernardo Dell'Osso[7,8,9] and Gabriella Pravettoni[1,2]*

[1] Applied Research Division for Cognitive and Psychological Science, IEO, European Institute of Oncology IRCCS, Milan, Italy, [2] Department of Oncology and Hemato-Oncology, University of Milan, Milan, Italy, [3] Aldo Ravelli Center for Neurotechnology and Experimental Brain Therapeutics, Department of Health Sciences, University of Milan, Milan, Italy, [4] Neurology Clinic III, ASST Santi Paolo e Carlo, Milan, Italy, [5] Istituto di Ricovero e Cura a Carattere Scientifico (IRCCS) Ca' Granda Foundation Maggiore Policlinico Hospital, Milan, Italy, [6] Department of Neurology and Laboratory of Neuroscience, Istituto Auxologico Italiano, Istituto di Ricovero e Cura a Carattere Scientifico (IRCCS), Milan, Italy, [7] Department of Biomedical and Clinical Sciences Luigi Sacco, Department of Mental Health, University of Milan, ASST Fatebenefratelli-Sacco, Milan, Italy, [8] CRC Aldo Ravelli, Milan, Italy, [9] Department of Psychiatry and Behavioural Sciences, Stanford University, Stanford, CA, United States

OPEN ACCESS

Edited by:
Yi-Yuan Tang,
Texas Tech University, United States

Reviewed by:
Lisa Di Blas,
University of Trieste, Italy
Silvio Ionta,
University of Lausanne, Switzerland

***Correspondence:**
Giulia Ongaro
giulia.ongaro@unimi.it

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *30 April 2021*
Accepted: *20 September 2021*
Published: *13 October 2021*

Citation:
Ongaro G, Cincidda C, Sebri V, Savioni L, Triberti S, Ferrucci R, Poletti B, Dell'Osso B and Pravettoni G (2021) A 6-Month Follow-Up Study on Worry and Its Impact on Well-Being During the First Wave of COVID-19 Pandemic in an Italian Sample. Front. Psychol. 12:703214. doi: 10.3389/fpsyg.2021.703214

The Italian state adopted serious safety measures to manage the COVID-19 pandemic in the year 2020. The lockdown was associated with negative psychological consequences in healthy populations, mostly in terms of anxiety, distress, depression, and even traumatic symptoms. This longitudinal study aimed at briefly documenting the psychological impact among an Italian sample, in terms of worry and its impact on psychological well-being levels, of the first wave of COVID-19, taking into account the changes in the lockdown scenario. A three-time follow-up survey was administered to 177 subjects (*Female*: 78%, M_{age} =36.33), during (T0), at the end (T1), and 3 months after the end of the first lockdown (T2). Since the first wave of COVID-19, results showed a decrease in worry and the perception of virus diffusion's controllability over time while psychological well-being increased. Furthermore, factors such as personality traits (neuroticism and agreeableness) and dysfunctional coping strategies predicted increases in worry levels at the end of the lockdown and 3 months after in the Italian context. However, worry levels during and at the end of the lockdown did not predict well-being levels 3 months after the end of the lockdown. Based on these findings, mental health policymakers should design tailored interventions able to improve the perception of virus diffusion management, as well as address the psychological needs of Italian citizens and support it, including a plan for the follow-up evaluation.

Keywords: COVID-19, psychological well-being, worry, longitudinal study, personality traits

INTRODUCTION

The Italian state adopted serious safety measures to manage the COVID-19 pandemic in the year 2020 (Vicentini et al., 2020). Starting from March 11, an extensive lockdown was adopted, featuring the closure of commercial activities, schools, and the cancelation of public events. Citizens were requested to stay at home and to avoid social contact except for documented work or health emergency reasons. This severe lockdown (T0 for the sake of the present study) lasted until mid-May when most restrictions to the personal movement were mitigated (T1), and mid-September when they were terminated and the government announced that the "first wave" of COVID-19 had ended (T2). Nowadays, the pandemic health emergency is still ongoing along with intermittent lockdowns and limitations; thus, it is important to analyze citizens' psychological state longitudinally.

Indeed the COVID-19 pandemic and related lockdowns brought a huge number of psychological and sociological studies to account for international citizens' experience. The limitations imposed to work and movement improved notable economic losses (Cerami et al., 2020; Codagnone et al., 2020) and the lockdown triggered negative psychological consequences in healthy populations, mostly in terms of anxiety and distress (Castelli et al., 2020; Rossi et al., 2020; Cincidda et al., 2021; Petrocchi et al., 2021), depression (Meda et al., 2021) and even traumatic symptoms (Johnson et al., 2020; Masiero et al., 2020; Rossi et al., 2021) creating a burden that mental health services are likely to deal with for a long time (D'Agostino et al., 2020; Lasalvia et al., 2021). Qualitative research based on the critical incident technique (Durosini et al., 2021) showed that healthy citizens were able to experience also positive events during the lockdown (e.g., in terms of cultivation and enjoinment of relationships with loved ones), but at the same time they were subjected to notable emotional distress: for example, the daily experience of the lockdown, along with the alarming messages coming from the media and the unreal perception of emptiness and isolation in the cities, were connected to a novel "sensation of emergency" accompanied by everlasting negative arousal. Likewise, research showed that people with higher perception of COVID-19 severity and lower perception of control over the possibility of infection reported higher levels of worry and anxiety (Sebri et al., 2021). A longitudinal study (Pellerin and Raufaste, 2020) demonstrated how psychological resources created a buffer against the negative effects on well-being. In particular, the study highlighted how emotional well-being was positively predicted by gratitude and hope, and, to a lesser extent, by acceptance and how psychological well-being was positively predicted by wisdom, self-efficacy, and gratitude.

During COVID-19 pandemic, personality traits and in particular neuroticism emerged as one of the correlates of most of psychopathological outcomes and distress, although not as uniformly as expected (Kroencke et al., 2020; Lee and Crunk, 2020; Modersitzki et al., 2020; Somma et al., 2020). Unfortunately, very few studies investigated the association between personality traits and adjustment to COVID-19 with a longitudinal methodology (Rettew et al., 2021; Zacher and Rudolph, 2021). In these studies, authors revealed that higher levels of neuroticism favored increases in distress (Rettew et al., 2021; Zacher and Rudolph, 2021); higher levels in emotional stability anticipated decreases in perceived stressfulness of the COVID-19 pandemic (Zacher and Rudolph, 2021); while higher levels in agreeableness and conscientiousness anticipated increases in mood (Rettew et al., 2021).

The goal of the present contribution is to extend the information on the "tracking" of worry and emotional well-being of Italian citizens over the first wave of the COVID-19 pandemic, taking into account the changes in the lockdown scenario (T0, T1, T2). Specifically, it was hypothesized that:

- Hp1: worry levels will reduce from T0 to T2 while psychological well-being will increase from T0 to T2 considering that safety measures were increasingly mitigated;
- Hp2: higher worry scores at T0 and T1 will predict a decrease in psychological well-being at T2.

Also, explorative research questions are considered:

1. RQ1: which personality characteristics and individual coping strategies at T0 will contribute to predict worry scores at T2?
2. RQ2: which specific COVID-related worry affects people with high worry levels in the three evaluation times and which specific COVID-related worry affects at T2 people with specific personality traits?

METHODS

Participants

759 respondents (out of a total sample of 1233) of the initial survey (Sebri et al., 2021) expressed their consent to participate in a follow-up study, gave email addresses, and were contacted to fulfill the next phase. 436 agreed to take part and complete the first follow-up evaluation but only 177 completed both the first (T1) and the second follow-up evaluation (T2). Thus, the final sample of this longitudinal study comprised 177 participants (Male: 39, 22%; Female: 138, 78%) that were included in the analysis. The mean age was 36.33 (SD 11.60), ranging from 20 to 69 years old. The majority of the sample was composed of adults, well-educated, white-collar workers, from the Northern regions of Italy, and lived with partners and/or children. Regarding the working status, the majority of first survey respondents were working from home (37.9%; $N = 67$) or continued working in presence (18.1%, $N = 32$). Other participants were students (4.5%, $N = 8$), unemployed (12.4%, $N = 22$), or in other working conditions (15.8%, $N = 28$). Three months after the end of the lockdown the majority of the participants returned to work under normal conditions (54.8%, $N = 97$). During all the evaluation, most of the participants were not infected by COVID-19 (T0: 99.4%; T1: 92.1%; T2: 94.9%), as for their acquaintances (T0: 98.9%; T1: 89.8%; T2: 82.8%). However, at the two follow-ups, respectively 7.3 and 3.8% of the participants showed symptoms similar to COVID-19 symptoms. More descriptive statistics are presented in **Table 1**.

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

Sample (*N* = 177)	
Age (M ± SD, range)	36.33 ± 11.60; 20–69
Age groups	
Emerging adults	42.4% (75)
Adults	57.6% (102)
Gender	
Male	22% (39)
Female	78% (138)
Educational level	
Primary/Middle school	1.7% (3)
High school	18.6% (33)
Bachelor/Master's degree	59.9% (106)
Post Ph.D.	19.8% (35)
Employment	
Student	9.6% (17)
Unemployed	4.5% (8)
Healthcare professional	4% (7)
Blue-collar	39% (69)
White-collar	42.9% (76)
Provenience	
North of Italy	70.6% (125)
Center of Italy	20.9% (37)
South of Italy	8.5% (15)
Living with	
No one	10.7% (19)
Family	29.4% (52)
Partner and/or children	55.4% (98)
Roommates	4.5% (8)

Materials and Procedure

The current study was approved by the lead author's Institutional Review Board (IRB), in conformity with the principles embodied in the Declaration of Helsinki. An anonymous online survey was set on Qualtrics and distributed on various internet platforms to evaluate worry and psychological well-being in an Italian sample during COVID-19 lockdown, 2 and 6 months after it began. Specifically, the survey was administered on the same online platform as the baseline (Sebri et al., 2021). Data were collected at the baseline (T0) from March 20 to April 10, 2020, after 2 months (T1) from May 15 to May 30, 2020 and after 6 months (T2) from 15 September to 30 September, 2020. A self-administered questionnaire was created to assess socio-demographic characteristics such as biological sex, age, education, provenience, employment, and living conditions during the COVID-19 outbreak. Furthermore, information related to COVID-19 was collected and participants were asked to indicate their working status and if they, their acquaintances, or loved ones (such as family members or friends) were infected with COVID-19 in all three times of evaluation. Moreover, two *ad hoc* questionnaires had been administered in the three surveys:

- *COVID-19 severity and controllability:* we assessed the individual perception of COVID-19 severity in terms of mortality, rate, morbidity, and the current impact on both social and economic aspects in Italy with 5 items on a 5-point Likert scale (ranging from "not severe at all" to "very severe"). Participants' perception of controllability over the possibility to contract or spread COVID-19 infection was evaluated with two items on a 5-point Likert scale (ranging from "totally uncontrollable" to "totally controllable").
- *COVID-19 related worry:* worry levels were assessed regarding some key areas: economic impact of the pandemic and lockdown; the challenge of recovering the previous lifestyle; the risks inherent to meeting unknown people; changes in future life plans; the risk of personally contracting COVID-19; the risk of significant others contracting COVID-19; and the recurrence of the health emergency in the future. All of these sources of worry were assessed with one specific item on a 3-point Likert scale, ranging from "not worried" to "very worried."

Psychological well-being and coping strategies that resulted associated with worry levels during the COVID-19 crisis in the first evaluation (Sebri et al., 2021) were evaluated also in both the follow-up administrations, using the same self-report and standardized questionnaires at all times (T0, T1 and T2): Psychological General Well Being Index (PGWBI—Grossi et al., 2006) to measure psychological distress and affective well-being (note that this measure names "distress" the low levels of well-being, although this aspect is controversial; Winefield et al., 2012)., that are defined as the reactions to internal and external demands characterized by heterogeneous psychological symptoms, such as low self-esteem, hopelessness, sadness, helplessness, and fear (Dohrenwend et al., 1980), and the prevalence of positive affect over negative affect, respectively (Kahneman et al., 1999); Brief Coping Orientation to Problems Experienced Inventory (Brief-COPE—Monzani et al., 2015) based on the assessment of coping strategies recognizing as thoughts and behaviors that individuals use to manage the internal and external demands of situations that are appraised as stressful (Lazarus and Folkman, 1984); and Penn State Worry Questionnaire (PSWQ- Morani et al., 1999) that measures the intensity of worry, a sequence of uncontrolled thoughts that may evoke elevated levels of anxiety and distress closely related to the fear of uncertain and probably negative outcomes (Kelly and Miller, 1999). We then supplemented this survey data with previously collected data on personality traits, such as the relatively enduring patterns of thoughts, behaviors, and feelings that distinguish an individual from another one (Roberts et al., 2008), evaluated using Big Five Inventory–Short Form (BFI-S—Guido et al., 2015). Specific characteristics of these scales have been largely explained in the first phase of our study (Sebri et al., 2021).

Data Analysis

Data analyses were performed using the statistical software analysis package SPSS (Version 26.0). First, within-subjects ANOVA analysis was run to explore the differences in the mean scores of the psychological variables (PSWQ, PGWBI, Controllability of virus diffusion) over the three times of evaluation. Second, stepwise multivariable regression analyses

were run to investigate the association between PSWQ scores during the final period of the lockdown, controlling for demographic variables and PSWQ scores at the baseline, and the following independent variables: Brief COPE and BFI-S scores from the initial period of the lockdown, because they resulted to be significant predictors in the first period of the lockdown (Sebri et al., 2021). The collinearity assumption was checked before running the model. The threshold level of statistical significance for each variable to enter the model set was $p < 0.05$.

RESULTS

Differences Between the Initial, the Final Period of the Lockdown and After 3 Months

Table 2 reports the average scores on the psychological variables over the three times of the study. The results of the within-subjects ANOVA revealed a significant difference between the baseline and the final evaluation (T2). In particular, worry decreased significantly over time [$F_{(2,278)} = 42.96$, $p < 0.001$, $\eta_p^2 = 0.24$], and *post hoc* pairwise comparisons showed that worry is reduced by 6.586 between T0 and T2 ($p < 0.001$) and it is reduced by 5.379 between T1 and T2 ($p < 0.001$). Instead psychological well-being increased significantly [$F_{(2,280)} = 9.97$, $p < 0.001$, $\eta_p^2 = 0.06$], specifically between T0 and T1 ($p < 0.001$) and between T1 and T2 ($p < 0.001$), as shown by *post hoc* pairwise comparisons. The perception of controllability of virus diffusion significantly decreased between the lockdown phase and the end of the first wave of COVID-19 pandemic [$F_{(2,312)} = 10.70$, $p < 0.001$, $\eta_p^2 = 0.06$]. *Post hoc* pairwise comparisons showed that the perception of controllability reduced by.204 between T0 and T1 ($p < 0.001$) and then reduced by an additional.146 between T1 and T2 ($p = 0.004$).

Regression Analysis

Based on our hypothesis, a linear regression analysis was run to verify whether worry levels collected during the initial period of the lockdown (T0) and at the end of the lockdown (T1) predicted the level of psychological general well-being 3 months after the end of lockdown (T2), controlling for T0 and T1 well-being levels and socio demographic information (gender and age). Worry levels at T0 and T1 showed a significant negative correlation with psychological well-being levels at T2 (T0: $r = -0.46$; $p < 0.01$; T1: $r = -0.58$; $p < 0.01$). For model 1, we entered worry and well-being levels at T0 controlling for socio-demographic information, and then we also entered worry and well-being levels at T1. The final model was significant [$F_{(2,138)} = 72.379$, $p < 0.001$], and explained 51.2% of variance in the level of psychological well-being at T2 [$R^2 = 0.512$, Adjusted $R^2 = 0.505$, $\Delta F_{(1,138)} = 48.39$, $p < 0.001$]. The results of the regression indicated that only well-being level at T0 and at T1 predicted levels of psychological general well-being 3 months after the end of the lockdown (PGWBI_T0: $\beta = 0.225$, $p < 0.01$; PGWBI_T1: $\beta = 0.547$, $p < 0.001$). However, PSWQ scores collected at T0 and T1 were excluded from the model. **Table 3** showed results of regression analysis on psychological well-being 3 months after the end of the lockdown.

In order to fully test Hp2 and to analyze the direction of the association between worry and psychological well-being, a linear regression analysis was run to verify whether well-being levels collected during the initial period of the lockdown (T0) and at the end of the lockdown (T1) predicted the level of worry 3 months after the end of lockdown (T2), controlling for T0 and T1 worry levels and socio demographic information (gender and age). The model was significant [$F_{(2,137)} = 63.009$, $p < 0.001$] but the results of the regression indicated that only worry levels at T0 and at T1 predicted worry levels at T2. PGWBI scores collected at T0 and T1 were excluded from the model.

In order to answer to RQ1, two stepwise multiple regression analyses were run, including as predictors the psychological variables (personality traits and coping strategies) that prior research has shown impacting worry levels during the first period of the lockdown. The Brief COPE, the Big Five-S, the psychological well-being and PSWQ scores, collected during the initial period of the lockdown (T0), were included as predictors. PSWQ scores, collected both at the end of the lockdown (T1) and 3 months after the end of the lockdown (T2), were considered as an outcome. Both stepwise multiple regression analyses were controlled for demographic characteristics (gender and age). **Table 4** shows the results of the multiple regressions analysis.

In the first analysis, we inserted the PSWQ scores collected at the end of the lockdown (T1) as the outcome. The final model, that included neuroticism, and worry levels during the lockdown as predictor, accounted for a significant proportion of the variance in level of worry [$R^2 = 0.616$, Adjusted $R^2 = 0.612$, $\Delta F_{(1,173)} = 12.308$, $p = 0.001$]. Specifically, initial higher neuroticism levels predicted increases in worry from T0 to T1, after controlling for initial worry levels and socio-demographic data (*Neuroticism*: $\beta = 0.237$, $p < 0.001$). Extraversion, agreeableness, openness, conscientiousness, emotion- and problem-focused coping, dysfunctional coping, and psychological well-being were excluded from the model.

The second stepwise multiple regression was run with PSWQ scores collected 3 months after the end of the lockdown (T2). The final model was significant, [$F_{(3,136)} = 34.372$, $p < 0.001$], and explained 43.1% of variance in the level of worry [$R^2 = 0.431$, Adjusted $R^2 = 0.419$, $\Delta F_{(1,136)} = 5.45$, $p < 0.021$]. Initial higher agreeableness levels and dysfunctional coping strategies predicted increases in worry from T0 to T2, after controlling for initial worry levels and socio-demographic data. Specifically, dysfunctional coping strategies showed a significant positive

TABLE 2 | Difference between evaluation times in levels of worry, psychological well-being and controllability of COVID-19 diffusion.

Variables	*M* (*SD*)T0	*M* (*SD*)T1	*M* (*SD*)T2
PSWQ	44.04 ± 11.89	42.84 ± 11.78	37.46 ± 7.57
PGWBI	74.67 ± 14.22	78.12 ± 14.28	78.89 ± 14.07
Controllability of virus diffusion	4.3 ± 0.76	4.11 ± 0.81	3.96 ± 0.85

PSWQ, Penn State Worry Questionnaire; PGWBI, Psychological General Well-Being Index.

effect ($\beta = 0.247$, $p = 0.001$), whereas agreeableness showed a significant negative effect ($\beta = -0.156$, $p = 0.021$). Moreover, dysfunctional coping strategies alone explained 5% of the variance in worry levels, so a wide use of dysfunctional coping strategies predicted high levels of worry at T2 ($t = 3.533$, $p = 0.001$). Emotion- and problem-focused coping, extraversion, neuroticism, openness, conscientiousness, and psychological well-being were excluded from the model.

Also worry related to specific COVID-19 areas/factors was recorded (e.g., risks for personal future projectuality, economic impact). These were collected by 3-point scales not to respond to specific research hypotheses but only to report anecdotally on the sample. While inferential value in respect to the population could not be attributed to these data, it is interesting to report them as an example of the COVID-19 scenario with mere descriptive value. **Figure 1** shows the percentage of participants with elevated COVID-19 related worry during the three times of evaluations. During that time, there was only a linear increase of subjects who reported high levels of worry related to the recurrence of COVID-19 pandemic in the future.Additional descriptive analyses revealed that 3 months after the end of lockdown, participants with moderate/high PSWQ scores (based on the cut offs used in the literature, see Meyer et al., 1990) reported to be highly worried about outbreak economic impact (60.5%), giving up on personal future projects (44.2%), significant others COVID-19 infection (58.1%) and the recurrence of COVID-19 pandemic (67.4%). The descriptive analysis also tried to see what people with specific personality characteristics, which were found to be significant from the regression analyzes, worry more about. Based on quartiles of the personality scales, in line with Al Moubayed et al. (2014), results showed that individuals with scores in the top quartile (75%) of agreeableness reported high levels of specific COVID-19 related worries for the economic impact ($M = 2.28$ out of 3; $SD = 0.86$), risk of significant others' COVID-19 infection ($M = 2.35$ out of 3; $SD = 0.76$) and recurrence of COVID-19 ($M = 2.52$ out of 3; $SD = 0.73$). Finally, scores in the top quartile of neuroticism correspond to higher levels of specific COVID-19 related worries for recurrence of COVID-19 emergency ($M = 2.68$ out of 3; $SD = 0.54$) and significant other COVID-19 infection ($M = 2.47$ out of 3; $SD = 0.73$).

DISCUSSION

This prospective longitudinal study aimed at briefly documenting the psychological impact of the first wave of COVID-19 in the Italian context, in terms of worry and its impact on psychological well-being especially. COVID-19 represents an unprecedented threat to mental health and a psychological challenge, specifically in world countries that have been strongly affected by the pandemic and the consequent restrictive measures adopted. In comparison with other longitudinal studies that focused the attention on the psychological impact of the COVID-19 lockdown and its increased signs of psychological suffering (Roma et al., 2020; Salfi et al., 2020), we focused our attention on a wider period, to assess the prevalence of any psychological symptoms even 3 months after the end of the lockdown. Our findings have shown that the levels of worry significantly decreased throughout the first wave caused by COVID-19 in Italy, while the levels of psychological well-being significantly increased. Other studies emphasized changes not only in emotions but also in health behavior along the COVID-19 phases, for example Cecchetto et al. (2021) found that negative emotions experienced during the initial phase of the lockdown influenced eating behavior leading to more frequent binge eating. Furthermore, they found a significant reduction in emotional eating and binge eating related to a decrease of the negative emotions between the onset of lockdown and the second phase of the COVID-19 pandemic. This example shows that the emotions and mood felt during the first phase of the lockdown could affect health conduct and citizen's quality of life. Several factors may contribute to explain the trend emerging from multiple studies; in particular, it could be related to individuals' progressive acquisition of the ability to cope with stressful events, as suggested by Zacher and Rudolph (2021) in a longitudinal study in a German sample. Furthermore, the mitigation of the containment measures, the possibility of being able to slowly come back to the previous rhythm of life, resume contacts and movements combined with more positive/hopeful media communications may have contributed to improving the psychological state 6 months after the beginning of the first lockdown. Additionally, we observed a significant decrease in the perception of controllability

TABLE 3 | Stepwise regression analysis on worry and psychological well-being during COVID-19.

Outcome	Predictors	β	*t*	R^2	*F*	ΔR	ΔF
PGWBI_T2	Model 1						
	PGWBI_T0	0.584	8.477***	0.341	71.866***		
	Model 2						
	PGWBI_T0	0.225	2.861**				
	PGWBI_T1	0.547	6.956***	0.512	72.370***	0.171	48.390***
PWSQ_ T2	Model 1						
	PSWQ_T1	0.676	10.767***	0.457	115.930***		
	Model 2						
	PSWQ_T1	0.512	5.617***				
	PSWQ_T0	0.222	2.437*	0.472	63.009***	0.023	5.939*

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
PGWB, Psychological General Well-Being Index; PSWQ, Penn State Worry Questionnaire.

TABLE 4 | Stepwise regression analysis on worry during COVID-19 with personality traits and coping strategies as predictors.

Outcome	Predictors	β	*t*	R^2	*F*	Δ R	Δ F
PSWQ_ T1	Model 1						
	PSWQ_T0	0.767	15.792***	0.589	249.37***		
	Model 2						
	PSWQ_T0	0.597	8.823***				
	Neuroticism	0.237	3.508***	0.616	138.944***	0.027	12.308***
PSWQ_ T2	Model 1						
	PSWQ_T0	0.599	8.795***	0.359	77.347***		
	Model 2						
	PSWQ_T0	0.510	7.199***				
	Dysfunctional coping	0.239	3.378***	0.408	47.297***	0.049	11.412***
	Model 3						
	PSWQ_T0	0.470	6.559***				
	Dysfunctional coping	0.247	3.533***				
	Agreeableness	−0.156	−2.334*	0.431	34.372***	0.023	5.450*

*$p < 0.05$; ***$p < 0.001$.
PSWQ, Penn State Worry Questionnaire.

concerning the spread of the virus; this may be related to the confusion generated by the context and conflicting mass media communication. It is important to underline how this aspect coexists with the improvement of emotional well-being. Some studies showed that the perception of controllability predicted the intention and the compliance with the recommended preventive measures against coronavirus infection (Sobkow et al., 2020); in addition, it may act as a protective factor for psychological health during the outbreak (Zheng et al., 2020; Petrocchi et al., 2021). As the individual perception of capacity to handle the environment was associated with the perception regarding a threat (Witt et al., 2005), it might be useful to monitor the evolution of the perception of COVID-19 diffusion's controllability in the general population and develop interventions aimed at increasing it, to promote individual health behaviors (Brivio et al., 2020).

Our results suggest that several factors, such as personality traits and dysfunctional coping strategies, may contribute to predict worry during the first wave of COVID-19 in the Italian context. In particular, subjects with neurotic personality seem to be at greater risk of higher worry levels. Neurotic people are typically more likely to experience and report negative emotions, also in COVID-19 pandemic context as confirmed by other studies (Rettew et al., 2021). Indeed, Aschwanden et al. (2021) showed that high neuroticism levels were associated with more COVID-related concern, and worry related to the pandemic duration. It is possible that the neurotic tendency to experience negative mood was exacerbated during the solitude and isolation of the lockdown, reducing people's ability to recover hope and an optimistic attitude in the post-lockdown phases. On the other hand, 3 months after the end of the lockdown, also the agreeableness trait emerged as a protective factor against worry levels. Agreeable people tend to have more resources for social support (Barańczuk, 2019; Yu et al., 2020) which contribute to reducing worry by means of positive social interactions and shared meaning-making regarding distressing events (Zysberg and Zisberg, 2020; Al-Omiri et al., 2021). The fact that such a protective factor emerged in the third phase specifically may be related to the renovated opportunities for social aggregation after the limitations imposed by the lockdown.

Therefore, even in the context of the pandemic, it is important to recognize the role of individual differences (Kroencke et al., 2020; Modersitzki et al., 2020; Somma et al., 2020; Osimo et al., 2021). Regarding dysfunctional coping strategies, our study confirmed that the use of these strategies was maladaptive, not only because they were correlated to worry levels as found in our previous study (Sebri et al., 2021), but also because they predicted the increase of the level of worry 3 months after the end of the lockdown. Moreover, in another study related to the present longitudinal study, it was found that dysfunctional coping strategies at the initial stages of COVID-19 increased the levels of worry which in turn mediated the relationship between the aforementioned coping strategies and state anxiety enhancing it (Cincidda et al., 2021). These results suggested the importance of taking into account both personality characteristics and dysfunctional coping strategies implemented during the pandemic in order to plan personalized interventions based on these characteristics.

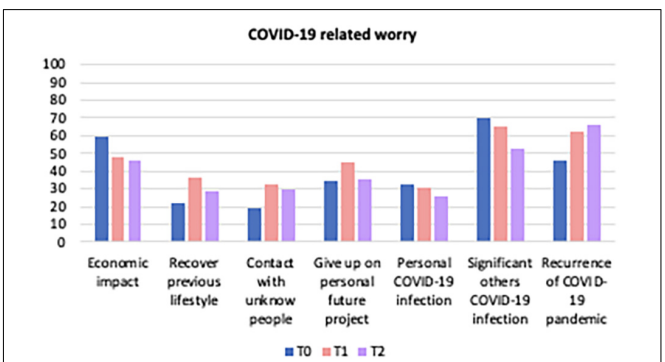


FIGURE 1 | COVID-19 related worry.

Finally, even if our study showed a significant negative correlation between worry and psychological well-being, confirming the results of previous studies (Taylor et al., 2020; Cincidda et al., 2021; Sebri et al., 2021), it emerged that worry levels during the lockdown and at the end of the lockdown did not predict well-being levels 3 months after the end of the lockdown, and vice versa. What turns out to be a predictor of levels of psychological well-being is well-being itself, measured at baseline and at the end of the lockdown. Several studies have shown the role of worry in the genesis of depressive/anxiety disorders (Olatunji et al., 2010; Spinhoven et al., 2017; Prete et al., 2020) so maybe different constructs and questionnaires could be used in future studies in order to analyze the longitudinal impact of high worry levels during COVID-19 pandemic. Specifically, future studies could analyze the predictive role of worry during COVID-19 on the development of mood or anxiety disorders, instead of evaluating the impact on a variable as broad as well-being, which can be influenced by several other different parameters. In this line, while the present study aimed at analyzing the impact of worry on well-being, future studies may explore other antecedents of well-being to provide further evidence about the effects of the COVID-19 pandemic on healthy populations (Shanahan et al., 2020; Götmann and Bechtoldt, 2021).

The present study has several limitations and should be interpreted with caution. The first limitation of the study concerns the sample size, which is limited and reduced in the three evaluation times; we could not follow up with the majority of our participants, probably due to the modality of communication, the email, that limited the contact with the respondents. Furthermore, the survey relied on voluntary sampling, so the sample could be composed of highly motivated subjects to participate in the study and it may inflate the generalizability of the results. Therefore, our study should be affected by an attrition bias. The limited sample size made it impossible to run more complex analyses featuring mediating or moderating factors. However, to our knowledge, this is the first web-based longitudinal study on the psychological impact during the first wave of COVID-19 in Italian context. The second limitation concerns the measures applied in the study. In an attempt to reduce participant's compilation time, to maintain an acceptable engagement in the study and to avoid increasing respondents' psychological burden, we carefully balanced the number of questions and selected the short version of some of the measures, such as the Big Five Inventory–Short Form (BFI-S), that is composed of only 10 items. So, some of the selected measures are not the most sophisticated and may be more prone to measurement errors. Finally, descriptive analyses with a mere anecdotal value showed that there may be differences in worry among citizens depending on personality and specific worrying factors. Future research may consider exploring this suggestion with more sophisticated variables and dedicated methodology.

It could be interesting to conduct a further examination to gather information on changes in psychological outcomes in the different phases and waves related to COVID-19, not only in the Italian context but also in other countries heavily affected by the health emergency. Future studies should use more sophisticated trait measures, specifically about personality characteristics, to verify and confirm its relevance in terms of moderating the psychological response to the threat of COVID-19 pandemic. Furthermore, specific longitudinal studies about worry and distress should be implemented for specific categories of subjects, such as ones tested positive for COVID-19 or health professionals, higher impacted by this challenge. Finally, future studies could explore how COVID-related worry may be associated with individuals' well-being; in particular, after controlling the well-being level at the baseline, it could be interesting to analyse whether COVID-related worry may predict well-being across time or vice versa. Despite this limitation, the strength of our study is the longitudinal nature of the work that extends the information on the "tracking" of worry and emotional well-being of Italian citizens over the first wave of the COVID-19 pandemic.

In conclusion, our research suggests the presence of risk factors for the development of worry, detectable in personality characteristics and dysfunctional coping strategies. Furthermore, our findings highlight a long-term reduction in both levels of worry and in the perception of controllability of the virus diffusion, which appear to be linear and linked to the easing of COVID-19 restrictions and the improvement of cases' infection conditions; our results showed an increased in psychological well-being levels. However, worry did not predict psychological well-being during the first wave of COVID-19 in an Italian sample.

Based on these findings, mental health policymakers should design tailored interventions able to improve the perception of virus diffusion management, as well as to address the psychological needs of Italian citizens and to support it, including a plan for the follow-up evaluation. In addition, in order to improve public health communication and the effectiveness of interventions, it is necessary to highlight individual differences among people, with a special focus on personality characteristics, specifically to people with high levels of neuroticism and with openness to experience, who resulted at higher risk of worry and distress. As suggested by Triberti et al. (2021), citizens' personality characteristics should be considered by public health communication to improve the effectiveness of the messages and to promote positive behavioral changes related to COVID-19 pandemic. In particular, it might be useful to emphasize positive consequences for one's life in following messages and, for more open individuals, to emphasize the possibility to find more unconventional ways to adjust to the pandemic and to use their high curiosity toward new things as a way to better cope with the new situation. In addition, evidence-based interventions (such as Cognitive Behavioral Therapy) could be devised to reduce the levels of worry that people experienced during the early stages of lockdown and to decrease the use of dysfunctional coping strategies by providing alternative and more functional coping strategies. In an uncertain situation, web-based mindfulness training or relaxation ones (Spinhoven et al., 2017; Mauri et al., 2018; Pizzoli et al., 2020; Antonova et al., 2021) could be planned to reduce worries, negative thoughts, and expectations, and increase psychological well-being.

AUTHORS' NOTE

GO, CC, VS, and LS are Ph.D. students within the European School of Molecular Medicine (SEMM).

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

AUTHOR CONTRIBUTIONS

GO, CC, and VS conceptualized the ideas presented in the article and wrote the first draft. GO, CC, VS, and LS collected the data. GO, CC, and ST performed the analysis. GO, ST, and LS edited the manuscript. RF, BP, and BD'O contributed equally to revision and edited the manuscript. RF, BP, BD'O, and GP contributed with important intellectual content. GP supervised the whole process. All authors provided feedback and approved the final version of the manuscript.

FUNDING

This work was partially supported by the Italian Ministry of Health with Ricerca Corrente and 5 × 1,000 funds. This study was partially supported by the Romeo and Enrica Invernizzi Foundation.

REFERENCES

Al Moubayed, N., Vazquez-Alvarez, Y., Mckay, A., and Vinciarelli, A. (2014). "Face-based automatic personality perception," in *Proceedings of the 22nd ACM International Conference on Multimedia*, New York, NY.

Al-Omiri, M. K., Alzoubi, I. A., Al Nazeh, A. A., Alomiri, A. K., Maswady, M. N., and Lynch, E. (2021). COVID-19 and personality: a cross-sectional multicenter study of the relationship between personality factors and COVID-19-related impacts, concerns, and behaviors. *Front. Psychiatry* 12:126. doi: 10.3389/fpsyt.2021.608730

Antonova, E., Schlosser, K., Pandey, R., and Kumari, V. (2021). Coping with COVID-19: mindfulness-based approaches for mitigating mental health crisis. *Front. Psychiatry* 12:563417. doi: 10.3389/fpsyt.2021.563417

Aschwanden, D., Strickhouser, J. E., Sesker, A. A., Lee, J. H., Luchetti, M., Stephan, Y., et al. (2021). Psychological and behavioural responses to coronavirus disease 2019: the role of personality. *Eur. J. Pers.* 35, 51–66. doi: 10.1002/per.2281

Barańczuk, U. (2019). The five factor model of personality and social support: a meta-analysis. *J. Res. Pers.* 81, 38–46. doi: 10.1016/j.jrp.2019.05.002

Brivio, E., Oliveri, S., and Pravettoni, G. (2020). Empowering communication in emergency contexts: reflections from the italian coronavirus outbreak. *Mayo Clin. Proc.* 95, 849–851. doi: 10.1016/j.mayocp.2020.03.021

Castelli, L., Di Tella, M., Benfante, A., and Romeo, A. (2020). The spread of COVID-19 in the Italian population: anxiety, depression, and post-traumatic stress symptoms. *Can. J. Psychiatry* 65, 731–732. doi: 10.1177/0706743720938598

Cecchetto, C., Aiello, M., Gentili, C., Ionta, S., and Osimo, S. A. (2021). Increased emotional eating during COVID-19 associated with lockdown, psychological and social distress. *Appetite* 160:105122. doi: 10.1016/j.appet.2021.105122

Cerami, C., Santi, G. C., Galandra, C., Dodich, A., Cappa, S. F., Vecchi, T., et al. (2020). COVID-19 outbreak in italy: are we ready for the psychosocial and economic crisis? Baseline findings from the longitudinal psycovid study. *Front. Psychiatry* 11:556. doi: 10.2139/ssrn.3569868

Cincidda, C., Pizzoli, S. F. M., Oliveri, S., and Pravettoni, G. (2021). Regulation strategies during Covid-19 quarantine: the mediating effect of worry on the links between coping strategies and anxiety. *Eur. Rev. Appl. Psychol.* 3:100671. doi: 10.1016/j.erap.2021.100671

Codagnone, C., Bogliacino, F., Gómez, C., Charris, R., Montealegre, F., Liva, G., et al. (2020). Assessing concerns for the economic consequence of the COVID-19 response and mental health problems associated with economic vulnerability and negative economic shock in Italy, Spain, and the United Kingdom. *PLoS One* 15:e0240876. doi: 10.1371/journal.pone.0240876

D'Agostino, A., Demartini, B., Cavallotti, S., and Gambini, O. (2020). Mental health services in Italy during the COVID-19 outbreak. *Lancet Psychiatry* 7, 385–387. doi: 10.1016/S2215-0366(20)30133-4

Dohrenwend, B. P., Shrout, P. E., Egri, G., and Mendelsohn, F. S. (1980). Nonspecific psychological distress and other dimensions of psychopathology: measures for use in the general population. *Arch. Gen. psychiatry* 37, 1229–1236. doi: 10.1001/archpsyc.1980.01780240027003

Durosini, I., Triberti, S., Savioni, L., and Pravettoni, G. (2021). In the eye of a quiet storm: a critical incident study on the quarantine experience during the coronavirus pandemic. *PLoS One* 16:e0247121. doi: 10.1371/journal.pone.0247121

Götmann, A., and Bechtoldt, M. N. (2021). Coping with COVID-19–Longitudinal analysis of coping strategies and the role of trait mindfulness in mental well-being. *Pers. Individ. Dif.* 175:110695.

Grossi, E., Groth, N., Mosconi, P., Cerutti, R., Pace, F., Compare, A., et al. (2006). Development and validation of the short version of the psychological General Well-Being Index (PGWB-S). *Health Qual. Life Outcomes* 4:88. doi: 10.1186/1477-7525-4-88

Guido, G., Peluso, A. M., Capestro, M., and Miglietta, M. (2015). An italian version of the 10-item big five inventory: an application to hedonic and utilitarian shopping values. *Pers. Individ. Dif.* 76, 135–140. doi: 10.1016/j.paid.2014.11.053

Johnson, S. U., Ebrahimi, O. V., and Hoffart, A. (2020). PTSD symptoms among health workers and public service providers during the COVID-19 outbreak. *PLoS One* 15:e0241032. doi: 10.1371/journal.pone.0241032

Kahneman, D., Diener, E., and Schwarz, N. (eds) (1999). *Well-Being: Foundations of Hedonic Psychology*. New York, NY: Russell Sage Foundation.

Kelly, W. E., and Miller, M. J. (1999). A discussion of worry with suggestions for counselors. *Couns. Values* 44, 55–66. doi: 10.1002/j.2161-007X.1999.tb00152.x

Kroencke, L., Geukes, K., Utesch, T., Kuper, N., and Back, M. D. (2020). Neuroticism and emotional risk during the COVID-19 pandemic. *J. Res. Pers* 89:104038. doi: 10.1016/j.jrp.2020.104038

Lasalvia, A., Bonetto, C., Porru, S., Carta, A., Tardivo, S., Bovo, C., et al. (2021). Psychological impact of COVID-19 pandemic on healthcare workers in a highly burdened area of north-east Italy. *Epidemiol. Psychiatr. Sci.* 30:e1. doi: 10.1017/S2045796020001158

Lazarus, R. S., and Folkman, S. (1984). *Stress Appraisal and Coping*. New York, NY: Springer.

Lee, S. A., and Crunk, E. A. (2020). Fear and psychopathology during the COVID-19 crisis: neuroticism, hypochondriasis, reassurance-seeking, and corona phobia as fear factors. *Omega* 2, 1–14. doi: 10.1177/0030222820949350

Masiero, M., Mazzocco, K., Harnois, C., Cropley, M., and Pravettoni, G. (2020). From individual to social trauma: sources of everyday trauma in Italy, The US And UK during the Covid-19 pandemic. *J. Trauma Dissociation* 21, 513–519. doi: 10.1080/15299732.2020.1787296

Mauri, A., Tomas, M., Ongaro, G., and Riccato, O. (2018). Perceived well-being and mindfulness practices in hospital patients. *Psicol. Della Salut.* 14, 146–159. doi: 10.3280/PDS2018-001009

Meda, N., Pardini, S., Slongo, I., Bodini, L., Zordan, M. A., Rigobello, P., et al. (2021). Students' mental health problems before, during, and after COVID-19 lockdown in Italy. *J. Psychiatr. Res.* 134, 69–77. doi: 10.1016/j.jpsychires.2020.12.045

Meyer, T. J., Miller, M. L., Metzger, R. L., and Borkovec, T. D. (1990). Development and validation of the penn state worry questionnaire. *Behav. Res. Ther.* 28, 487–495.

Modersitzki, N., Phan, L. V., Kuper, N., and Rauthmann, J. F. (2020). Who is impacted? Personality predicts individual differences in psychological consequences of the COVID-19 pandemic in Germany. *Soc. Psychol. Personal. Sci* 12, 1110–1130. doi: 10.1177/1948550620952576

Monzani, D., Steca, P., Greco, A., D'Addario, M., Cappelletti, E., and Pancani, L. (2015). The situational version of the brief cope: dimensionality and relationships with goal-related variables. *Eur. J. Psychol.* 11, 295–310. doi: 10.5964/ejop.v11i2.935

Morani, S., Pricci, D., and Sanavio, E. (1999). Penn state worry questionnaire e worry domains questionnaire. Presentazione delle versioni italiane ed analisi della fedeltà. *Psicoter. Cogn. Comport.* 5, 195–209.

Olatunji, B. O., Wolitzky-Taylor, K. B., Sawchuk, C. N., and Ciesielski, B. G. (2010). Worry and the anxiety disorders: a meta-analytic synthesis of specificity to GAD. *Appl. Prevent. Psychol.* 14, 1–24.

Osimo, S. A., Aiello, M., Gentili, C., Ionta, S., and Cecchetto, C. (2021). The influence of personality, resilience, and alexithymia on mental health during COVID-19 pandemic. *Front. Psychol* 12:630751. doi: 10.3389/fpsyg.2021.630751

Pellerin, N., and Raufaste, E. (2020). Psychological resources protect well-being during the COVID-19 pandemic: a longitudinal study during the french lockdown. *Front. Psychol.* 11:590276. doi: 10.3389/fpsyg.2020.590276

Petrocchi, S., Iannello, P., Ongaro, G., Antonietti, A., and Pravettoni, G. (2021). The interplay between risk and protective factors during the initial height of the COVID-19 crisis in Italy: the role of risk aversion and intolerance of ambiguity on distress. *Curr. Psychol.* 1, 1–12. doi: 10.1007/s12144-021-01601-1

Pizzoli, S. F. M., Marzorati, C., Mazzoni, D., and Pravettoni, G. (2020). Web-based relaxation intervention for stress during social isolation: randomized controlled trial. *JMIR Ment. Health* 7:e22757. doi: 10.2196/22757

Prete, G., Fontanesi, L., Porcelli, P., and Tommasi, L. (2020). The psychological impact of COVID-19 in Italy: worry leads to protective behavior, but at the cost of anxiety. *Front. Psychol.* 11:566659. doi: 10.3389/fpsyg.2020.566659

Rettew, D. C., McGinnis, E. W., Copeland, W., Nardone, H. Y., Bai, Y., Rettew, J., et al. (2021). Personality trait predictors of adjustment during the COVID pandemic among college students. *PLoS One* 16:e0248895. doi: 10.1371/journal.pone.0248895

Roberts, B. W., Wood, D., and Caspi, A. (2008). "The development of personality traits in adulthood," in *Handbook of Personality: Theory and Research*, eds O. P. John, R. W. Robins, and L. A. Pervin (New York, NY: The Guilford Press), 375–398.

Roma, P., Monaro, M., Colasanti, M., Ricci, E., Biondi, S., Di Domenico, A., et al. (2020). A 2-month follow-up study of psychological distress among Italian people during the COVID-19 lockdown. *Int. J. Environ. Res. Public Health* 17:8180. doi: 10.3390/ijerph17218180

Rossi, A., Panzeri, A., Pietrabissa, G., Manzoni, G. M., Castelnuovo, G., and Mannarini, S. (2020). The anxiety-buffer hypothesis in the time of COVID-19: when self-esteem protects from the impact of loneliness and fear on anxiety and depression. *Front. Psychol.* 11:2177. doi: 10.3389/fpsyg.2020.02177

Rossi, R., Socci, V., Talevi, D., Niolu, C., Pacitti, F., Di Marco, A., et al. (2021). Trauma-spectrum symptoms among the Italian general population in the time of the COVID-19 outbreak. *Eur. J. Psychotraumatol.* 12:1855888. doi: 10.1080/20008198.2020.1855888

Salfi, F., Lauriola, M., Amicucci, G., Corigliano, D., Viselli, L., Tempesta, D., et al. (2020). Gender-related time course of sleep disturbances and psychological symptoms during the COVID-19 lockdown: a longitudinal study on the Italian population. *Neurobiol. Stress* 13, 100259. doi: 10.1016/j.ynstr.2020.100259

Sebri, V., Cincidda, C., Savioni, L., Ongaro, G., and Pravettoni, G. (2021). Worry during the initial height of the COVID-19 crisis in an Italian sample. *J. Gen. Psychol* 148, 327–359. doi: 10.1080/00221309.2021.1878485

Shanahan, L., Steinhoff, A., Bechtiger, L., Murray, A., Nivette, A., Hepp, U., et al. (2020). Emotional distress in young adults during the COVID-19 pandemic: evidence of risk and resilience from a longitudinal cohort study. *Psychol. Med.* 5, 1–10. doi: 10.1017/S003329172000241X

Sobkow, A., Zaleskiewicz, T., Petrova, D., Garcia-Retamero, R., and Traczyk, J. (2020). Worry, risk perception, and controllability predict intentions toward COVID-19 preventive behaviors. *Front. Psychol.* 11:3226. doi: 10.3389/fpsyg.2020.582720

Somma, A., Gialdi, G., Krueger, R. F., Markon, K. E., Frau, C., Lovallo, S., et al. (2020). Dysfunctional personality features, non-scientifically supported causal beliefs, and emotional problems during the first month of the COVID-19 pandemic in Italy. *Pers. Individ. Dif.* 165:110139. doi: 10.1016/j.paid.2020.110139

Spinhoven, P., Huijbers, M. J., Ormel, J., and Speckens, A. E. M. (2017). Improvement of mindfulness skills during mindfulness-based cognitive therapy predicts long-term reductions of neuroticism in persons with recurrent depression in remission. *J. Affect. Disord.* 213, 112–117. doi: 10.1016/j.jad.2017.02.011

Taylor, S., Landry, C. A., Paluszek, M. M., Rachor, G. S., and Asmundson, G. J. (2020). Worry, avoidance, and coping during the COVID-19 pandemic: a comprehensive network analysis. *J. Anxiety Disord.* 76:102327. doi: 10.1016/j.janxdis.2020.102327

Triberti, S., Durosini, I., and Pravettoni, G. (2021). Social distancing is the right thing to do: dark triad behavioral correlates in the COVID-19 quarantine. *Pers. Individ. Dif.* 170:110453. doi: 10.1016/j.paid.2020.110453

Vicentini, C., Bordino, V., Gardois, P., and Zotti, C. M. (2020). Early assessment of the impact of mitigation measures on the COVID-19 outbreak in Italy. *Public Health* 185, 99–101. doi: 10.1016/j.puhe.2020.06.028

Winefield, H. R., Gill, T. K., Taylor, A. W., and Pilkington, R. M. (2012). Psychological well-being and psychological distress: is it necessary to measure both? *Psychol. Well-Being Theory Res. Prac.* 2, 1–14. doi: 10.1186/2211-1522-2-3

Witt, J. K., Proffitt, D. R., and Epstein, W. (2005). Tool use affects perceived distance, but only when you intend to use it. *J. Exp. Psychol. Hum. Percept. Perform.* 31, 880–888. doi: 10.1037/0096-1523.31.5.880

Yu, Y., Zhao, Y., Li, D., Zhang, J., and Li, J. (2020). The relationship between big five personality and social well-being of chinese residents: the mediating effect of social support. *Front. Psychol.* 11:613659. doi: 10.3389/fpsyg.2020.613659

Zacher, H., and Rudolph, C. W. (2021). Big five traits as predictors of perceived stressfulness of the COVID-19 pandemic. *Pers. Individ. Dif.* 175:110694. doi: 10.1016/j.paid.2021.110694

Zheng, L., Miao, M., and Gan, Y. (2020). Perceived control buffers the effects of the COVID-19 pandemic on general health and life satisfaction: the mediating role of psychological distance. *Appl. Psychol. Health Well Being* 12, 1095–1114. doi: 10.1111/aphw.12232

Zysberg, L., and Zisberg, A. (2020). Days of worry: emotional intelligence and social support mediate worry in the COVID-19 pandemic. *J. Health Psychol.* doi: 10.1177/1359105320949935

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 18 October 2021
doi: 10.3389/fpsyg.2021.701629

Comorbid Anxiety and Depression and Related Factors Among Pregnant and Postpartum Chinese Women During the Coronavirus Disease 2019 Pandemic

Zheng Luo[1†], *Luyao Xue*[1†], *Li Ma*[1] *and Zhengkui Liu*[2,3*]

[1] *Beijing Key Laboratory of Learning and Cognition, School of Psychology, Capital Normal University, Beijing, China,* [2] *CAS Key Laboratory of Mental Health, Institute of Psychology, Chinese Academy of Sciences, Beijing, China,* [3] *Department of Psychology, University of Chinese Academy of Sciences, Beijing, China*

OPEN ACCESS

Edited by:
Fang Pan,
Shandong University, China

Reviewed by:
Elena Commodari,
University of Catania, Italy
Simone Messerotti Benvenuti,
University of Padua, Italy

***Correspondence:**
Zhengkui Liu
liuzk@psych.ac.cn

[†]*These authors have contributed equally to this work*

Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *28 April 2021*
Accepted: *09 September 2021*
Published: *18 October 2021*

Citation:
Luo Z, Xue L, Ma L and Liu Z (2021) Comorbid Anxiety and Depression and Related Factors Among Pregnant and Postpartum Chinese Women During the Coronavirus Disease 2019 Pandemic. Front. Psychol. 12:701629. doi: 10.3389/fpsyg.2021.701629

Objective: To identify the prevalence of comorbid anxiety and depression (CAD) and analyze the relationship between CAD and sociodemographic and obstetric-related variables in pregnant and postpartum Chinese women during the COVID-19 pandemic.

Methods: Participants were 2,237 pregnant and postpartum women (aged 19–47 years) who visited various medical institutions in China between February 28, 2020, and April 26, 2020. They were asked to complete an online survey assessing the anxiety and depression, obstetric characteristics, and sociodemographic variables. The women were grouped into the following categories in accordance with the Generalized Anxiety Disorder Scale-7 (GAD-7) and the Patient Health Questionnaire-9 (PHQ-9): (a) CAD, (b) "anxiety only," (c) "depression only," and (d) "no depression or anxiety." After estimating the prevalence of CAD, "anxiety only," and "depression only," we carried out chi-squared tests and multiple logistic regression analysis to examine the related factors between these groups of pregnant and postpartum Chinese women.

Results: Comorbid anxiety and depression, "anxiety only," and "depression only," occurred in 6.3, 5.8, and 3.9% of participants, respectively. The prevalence rates of CAD during the first, second, and third trimesters of pregnancy and the postpartum period were found to be 7.4, 6.5, 5.7, and 8.2%, respectively. The factors that differed among the groups were age ($p < 0.05$), marital status ($p < 0.001$), level of education ($p < 0.05$), family support ($p < 0.001$), and total live births ($p < 0.001$). "Poor family support" (odds ratio (OR): 1.90; 95% confidence interval (CI): 1.30–2.78; $p = 0.0009$) and "no birth" (OR: 1.91; 95% CI: 1.32–2.75; $p = 0.0006$) remained significant factors for the CAD group, while "poor family support" (OR: 2.16; 95% CI: 1.34–3.47; $p = 0.0015$) remained a significant factor for the "depression only" group when their results were compared to those of the "no depression or anxiety" group in the multiple logistic regression analysis.

Conclusion: Pregnant and postpartum Chinese women with poor family support and primipara are at high risk for CAD during the COVID-19 pandemic. These results support the need for targeted perinatal programs to address CAD in pregnant and postpartum women during the pandemic period.

Keywords: comorbid anxiety and depression (CAD), pregnant women, postpartum women, prevalence, related factors, COVID-19

INTRODUCTION

The novel coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was first detected in China in late December 2019. Since then, it has spread worldwide and has become a global pandemic. Quarantining and social distancing precautions implemented by countries around the world, and the uncertainty associated with the virus have reduced the quality of life of pregnant and postpartum women, who have less physical activity and more sitting time (Biviá-Roig et al., 2020). The repercussions of this have also been associated with increased mental health problems (Lebel et al., 2020; Zanardo et al., 2020; Jiang et al., 2021). Pregnant and postpartum women have reported more depression or anxiety symptoms during the COVID-19 pandemic than before the pandemic (Berthelot et al., 2020; Lebel et al., 2020; Wu et al., 2020; Zanardo et al., 2020; Chmielewska et al., 2021; Xie et al., 2021). However, it has also been reported that women who delivered during the COVID-19 pandemic had lower rates of depression than women who delivered before the COVID-19 pandemic (Pariente et al., 2020).

Jiang et al. (2021) found that between February 5, 2020, and February 28, 2020, 18.1% of pregnant women in China suffered from anxiety and 45.9% suffered from depression (Jiang et al., 2021). Likewise, Bo et al. (2021) found that 27.43% of pregnant and postpartum women in China experienced depression between February 22, 2020, and March 10, 2020. In the United States, 43.3% of the pregnant women reported moderate to severe anxiety symptoms at the end of April 2020 (Preis et al., 2020), while in Italy, 44.2% of postpartum women experienced depression between March 8, 2020, and June 15, 2020 (Ostacoli et al., 2020). A meta-analysis of 23 studies conducted with 20,569 pregnant and postpartum women during the COVID-19 pandemic found that the prevalence rates of anxiety and depression among the pregnant women were 37% (95% CI: 25–49%) and 31% (95% CI: 20–42%), respectively and the prevalence rate of depression among the postpartum women was 22% (95% CI: 15–29%) (Yan et al., 2020).

Anxiety disorders are often comorbid with depression disorder. Comorbid anxiety and depression (CAD) may have important long-term implications in pregnant and postpartum women, increasing the likelihood of poor birth outcomes and leading to greater functional impairment than depression or anxiety alone (Field et al., 2010; Ibanez et al., 2012; Farr et al., 2014; Adhikari et al., 2020). Therefore, it is vital to examine the prevalence of CAD and the related factors in pregnant and postpartum women during the COVID-19 pandemic, and on this basis, develop more effective intervention programs.

Estimates of the prevalence of CAD during pregnancy have ranged between 1.7 and 26.9% across various studies (Thiagayson et al., 2013; Falah-Hassani et al., 2017; González-Mesa et al., 2020). The prevalence rate of CAD in the first trimester of pregnancy was 9.5% in Spain and 47.6% in Turkey (González-Mesa et al., 2020). Among the Ghanaian and Ivorian women, the prevalence of CAD in the third trimester was found to be 7.7 and 12.6%, respectively (Bindt et al., 2012). It is estimated that between 6.3 and 13.4% of mothers experience postpartum CAD (Farr et al., 2014; Falah-Hassani et al., 2016; Ramakrishna et al., 2019). However, the prevalence of CAD in pregnant and postpartum women during the COVID-19 pandemic is unknown.

Several factors have been associated with CAD among pregnant women, ranging from sociodemographic- to obstetric-related factors. The sociodemographic factors include being single (Ngocho et al., 2019), lacking emotional or social support (González-Mesa et al., 2020), being in advanced maternal age (Ali et al., 2012), not being involved in family decision-making (Ali et al., 2012), and being exposed to violent experiences or domestic violence (Ali et al., 2012; Ngocho et al., 2019). Additionally, CAD is commonly correlated with lower socioeconomic status (SES) and lower levels of education in a community sample (Fichter et al., 2010). Obstetric-related factors include adverse pregnancy outcomes and not having had a live birth in the past (Ali et al., 2012). The sociodemographic risk factors associated with CAD during the postpartum period include low income, young maternal age, a lower level of education (Skipstein et al., 2010; Ramakrishna et al., 2019), inadequate partner support, and inadequate social support (Falah-Hassani et al., 2016; Ramakrishna et al., 2019). The obstetric factors associated with CAD during the postpartum period include delivering an infant at a gestation $\leq$ 27 weeks (Farr et al., 2014). Additionally, "maternal vulnerable personality" and "perceived stress" predicted a higher risk of comorbidity (Farr et al., 2014; Falah-Hassani et al., 2016; Ramakrishna et al., 2019).

The main objective of this study was to identify the prevalence of CAD among pregnant and postpartum Chinese women during the COVID-19 pandemic and analyzing the relationship between CAD and sociodemographic and obstetric-related factors.

METHOD

Participants and Procedures

The study was conducted in Wuhan, Beijing, Lanzhou, and other cities in China between February 28, 2020, and April 26, 2020, as a part of the WeChat psychological crisis intervention program aimed at helping the Chinese perinatal women to cope with stress during the COVID-19 pandemic. Perinatal women who visited medical institutions for regular perinatal examinations were invited to scan QR codes with their mobile phones to complete a set of study questionnaires for assessing their anxiety and depression levels and sociodemographic and obstetric characteristics. The inclusion criteria were women at any stage of pregnancy or within 8 weeks after delivery, over 18 years of age, not infected with SARS-CoV-2, and being able to read and write in Chinese. The exclusion criteria were women who failed to complete the questionnaire or refused to participate in the survey. Ethical approval for the study was obtained from the Institutional Review Board of the Institute of Psychology, Chinese Academy of Sciences. The women participated in the study voluntarily and provided their informed consent.

Measurement

Anxiety

The Generalized Anxiety Disorder Scale-7 (GAD-7) was used to detect generalized anxiety disorder (GAD) (Spitzer et al., 2006). GAD-7 is a unidimensional questionnaire that uses a 4-point Likert scale, with responses ranging from 0 (not at all) to 3 (nearly every day). The scale has shown to be a reliable and valid measure for perinatal women (Simpson et al., 2014; Zhong et al., 2015); the suggested cutoff of 7 was used to identify the probable cases of anxiety (Zhong et al., 2015). The Cronbach's alpha for the current study was found to be 0.92.

Depression

The 9-item Patient Health Questionnaire-9 (PHQ-9) was used to identify depressive symptoms in accordance with the DSM-IV major depressive episode criteria (Kroenke et al., 2001). The PHQ-9 is a single-factor, 4-point Likert scale, with responses ranging from 0 (not at all) to 3 (nearly every day) and severity scores ranging from 0 to 27. The scale was validated among perinatal women; a cutoff score of 10 was used to identify the probable cases of depression (Sidebottom et al., 2012; Davis et al., 2013). Satisfactory internal consistency was obtained in this study (Cronbach's alpha = 0.86).

Sociodemographic and Obstetric Characteristics

The sociodemographic characteristics included age (<25/25–35/> 35), marital status (single/married), level of education (senior high school and below/college and above), annual family income (<80,000 RMB/80,000–300,000 RMB/>300,000 RMB), household cohabitants (only husband/others), and family support. Family support was assessed by asking women to indicate the extent of care and support they received from family members, choosing between two options: "poor support" or "good support." Obstetric characteristics included total live births (none/≥1) and weeks of pregnancy or postpartum.

Statistical Analysis

The data were analyzed using SPSS 23.0 (IBM, Armonk, NY). An indicator variable for probable comorbid anxiety and depression (CAD) was constructed using the cutoff points for the GAD-7 (7) and the PHQ-9 (10), as noted above. Participants above the threshold values for both depression and anxiety were categorized as having "CAD," while participants meeting the threshold value for either anxiety or depression were categorized as having "anxiety only" or "depression only." Participants who do not meet both the threshold values were categorized as having "no anxiety or depression." Descriptive statistics were used to summarize the data. Univariate ANOVAs were used to compare the differences of GAD-7 and PHQ-9 scores among CAD, the "anxiety only," the "depression only," and the "no anxiety or depression" groups. Significance was set at $p < 0.0083$ using the Bonferroni correction for six multiple comparisons. The overall prevalence of CAD, "anxiety only," and "depression only," as well as their prevalence in the first, second, and third trimesters of pregnancy and the postpartum period were calculated. Chi-squared tests were used to compare the frequency differences. The significance was set at $p < 0.0167$ using the Bonferroni correction for three multiple comparisons or at $p < 0.0125$ for four multiple comparisons, as appropriate.

Cross-tabulation was used to determine the frequency distribution of all variables (pregnancy or postpartum were treated as a dichotomous variable). Comparisons among the four groups were performed using chi-squared tests. The significance was set at $p < 0.0042$ using the Bonferroni correction for 12 multiple comparisons, or at 0.0028 for 18 multiple comparisons as appropriate. Multiple logistic regression analysis was conducted to test how the sociodemographic and obstetric-related variables were associated with the four groups. The significance threshold was set at $p < 0.0017$, using the Bonferroni correction for 30 multiple comparisons. Multicollinearity among the predictors was checked using tolerance and variance inflation factor (VIF) statistics (Shrestha, 2020). No evidence of multicollinearity with any tolerance limits <0.1 or VIF limits >10 was signified ($1 \leq$ tolerances ≤ 63.74, $1.02 \leq$ VIFs ≤ 1.11).

RESULTS

The final participants included 2,237 pregnant or postpartum women, ranging in age from 19 to 47 years (M = 30.25, SD = 3.99). Of the participants, 445 were in the first trimester, 557 in the second, 1,138 in the third, and 97 in the postpartum period. Geographically, 776 were from Hubei (of these, 769 lived in Wuhan), 828 were from Beijing, 552 were from Gansu, 54 were from Hebei, and 27 were from other provinces. Seventeen women were reported to have a history of mental illness. **Table 1** presents the sociodemographic and obstetric characteristics of the entire sample.

The mean Generalized Anxiety Disorder Scale-7 (GAD-7-score) value in the comorbid anxiety and depression (CAD) group was 10.94 (SD = 4.08, range = 7–21). The 25th, 50th, and 75th percentiles were 7, 10, and 14, respectively. The mean value of the Patient Health Questionnaire-9 (PHQ-9) scores for

TABLE 1 | Sociodemographic and obstetric characteristics in the whole sample.

Characteristics	*n*(%)	Characteristics	*n*(%)
Age		Cohabitants in household	
<25	129 (5.8)	Only husband	1,068 (47.7)
25–35	1,871 (83.6)	Others	1,169 (52.3)
>35	237 (10.6)	Family support	
Marital status		Poor	603 (27.0)
Single	42 (1.9)	Good	1,634 (73.0)
Married	2,195 (98.1)	Total live births	
Level of education		None	858 (38.4)
Senior high school and below	206 (9.2)	≥1	1,379 (61.6)
College and above	2,031 (90.8)	Pregnancy or postpartum	
Annual family income		Pregnancy	2,140 (95.7)
<80,000 RMB	708 (31.6)	Postpartum	97 (4.3)
80,000–300,000 RMB	1,255 (56.1)		
> 300,000 RMB	274 (12.2)		

CAD was 14.55 (SD = 3.79, range = 10 – 27), and the 25th, 50th, and 75th percentiles were 11, 14, and 17, respectively. The mean values of the GAD-7 and PHQ-9 scores of the "anxiety-only" group were 7.75 (SD = 1.44, range = 7–16) and 6.95 (SD = 1.96, range = 0–9), respectively. In the "depression only" group, the mean values were 3.79 (SD = 1.98, range = 0–6) and 12.61 (SD = 3.15, range = 10–27); in the "no anxiety or depression" group, the mean values were 1.43 (SD = 1.80, range = 0–6) and 3.41 (SD = 2.73, range = 0–9). Univariate ANOVAs showed significant differences between the GAD-7 and PHQ-9 scores of the groups (F_{GAD-7} [3, 2233] = 1314.82, $p < 0.001$, $\eta^2 = 0.64$; F_{PHQ-9} [3, 2233] = 1297.63, $p < 0.001$, $\eta^2 = 0.64$). The Bonferroni's *post-hoc* tests revealed significant differences in the GAD-7 and PHQ-9 scores among all groups. In general, the CAD group had the highest GAD-7 score, followed by the "anxiety only," the "depression only," and the "no anxiety or depression" groups. The CAD group had the highest PHQ-9 score, followed by the "depression only," the "anxiety only," and the "no anxiety or depression" groups.

The prevalence of CAD, "anxiety only," and "depression only," was 6.3% (n = 142), 5.8% (*n* = 130), and 3.9% (n = 87), respectively. Chi-squared tests showed that the three groups had significant differences in prevalence ($\chi^2 = 13.98$, $p < 0.05$). Bonferroni's multiple comparison test revealed that the prevalence of CAD was higher than expected, and that of the "depression only," group was lower than expected. The prevalence rates of CAD, "anxiety only," and "depression only," during the first, second, third trimesters of pregnancy and the postpartum period were 7.4, 6.5, 5.7, 8.2%; 3.4, 5.6, 6.6, 9.3%; and 7.0, 5.2, 2.2, 2.1%, respectively. Chi-squared tests showed significant rate differences in CAD, anxiety only, and depression only among the four time points ($\chi^2_{CAD} = 46.00$, $p < 0.001$; $\chi^2_{anxiety} = 82.06$, $p < 0.001$; $\chi^2_{depression} = 24.77$, $p < 0.001$). Bonferroni's multiple comparison test revealed that the prevalence of "anxiety only" in the first trimester of pregnancy was lower than expected and that in the third trimester was higher than expected. The prevalence of "depression only," in the first trimester of pregnancy was higher than expected, and that in the third trimester was lower than expected.

Table 2 summarizes the frequency differences of age, marital status, level of education, annual family income, household cohabitants, family support, total live births, and pregnancy or postpartum among the CAD, the "anxiety only," the "depression only," and the "no anxiety or depression" groups. Chi-squared tests showed that the four groups had significant frequency differences in age ($p < 0.05$), marital status ($p < 0.001$), level of education ($p < 0.05$), family support ($p < 0.001$), and total live births ($p < 0.001$).The Bonferroni's multiple comparison test revealed that the proportion of women under 25 years of age in the "depression only" group, the rates of single and no birth in the CAD and the "depression only" group, and the rates of poor family support in the CAD, the "anxiety only," and the "depression only" groups were higher than those in the "no anxiety or depression" group. Bonferroni's multiple comparison test did not reveal significant frequency differences in the level of education among the four groups.

The results of the multiple logistic regression analysis showed that family support and total live births significantly predicted CAD (**Table 3**). Specifically, poor family support and no births were associated with a higher probability of membership in the CAD group than in the "no anxiety or depression" group. Meanwhile, poor family support was associated with a higher probability of membership in the "depression only" group than in the "no anxiety or depression" group.

DISCUSSION

In this study, the prevalence of comorbid anxiety and depression (CAD), "anxiety only," and "depression only," were 6.3, 5.8, and 3.9%, respectively, in a sample of pregnant and postpartum Chinese women during the coronavirus disease 2019 (COVID-19) pandemic. The prevalence of CAD during the first, second, and third trimesters of pregnancy and postpartum period were 7.4, 6.5, 5.7, and 8.2%, respectively. Our results are similar to those reported in previous non-COVID-19 studies. For example, Thiagayson et al. (2013) found a 5% prevalence rate of CAD among high-risk pregnant Singaporean women. A meta-analysis by Falah-Hassani et al. (2017) found that the prevalence of comorbid anxiety symptoms and mild to severe depressive symptoms was 9.5% during pregnancy and 8.2% after delivery in normal situations. Our findings suggest that the COVID-19 pandemic may have no specific impact on perinatal CAD in China. One possible explanation may be that extended families are common in China. Pregnant and postpartum women are generally valued and cared for by their families. Another possible reason is that a significant number of people may work from home and have the opportunity to better support their partners. Quarantining during the COVID-19 pandemic may have a limited effect on pregnant and postpartum women. Furthermore, compared to the prevalence of anxiety and depression in pregnant and postpartum Chinese women during the COVID-19 pandemic in previous studies (e.g., Bo

TABLE 2 | Sociodemographic and obstetric characteristics of participants in comorbid anxiety and depression (CAD), "anxiety only," "depression only," and "no anxiety or depression" groups.

Characteristics	CAD *n* (%)	Anxiety only *n* (%)	Depression only *n* (%)	No anxiety or depression *n* (%)	χ^2	*p*
Age						
<25	13 (9.2)$_{a,b}$	8 (6.2)$_{a,b}$	11 (12.6)$_{b}$	97 (5.2)$_{a}$	12.68	0.048
25–35	113 (79.6)$_{a}$	111 (85.4)$_{a}$	68 (78.2)$_{a}$	1,579 (84.1)$_{a}$		
>35	16 (11.3)$_{a}$	11 (8.5)$_{a}$	8 (9.2)$_{a}$	202 (10.8)$_{a}$		
Marital status						
Single	8 (5.6)$_{a}$	2 (1.5)$_{a,b}$	5 (5.7)$_{a}$	27 (1.4)$_{b}$	20.00	< 0.001
Married	134 (94.4)$_{a}$	128 (98.5)$_{a,b}$	82 (94.3)$_{a}$	1,851 (98.6)$_{b}$		
Level of education						
Senior high school and below	21 (14.8)$_{a}$	18 (13.8)$_{a}$	9 (10.3)$_{a}$	158 (8.4)$_{a}$	10.19	0.02
College and above	121 (85.2)$_{a}$	112 (86.2)$_{a}$	78 (89.7)$_{a}$	1,720 (91.6)$_{a}$		
Annual family income						
<80,000 RMB	59 (41.5)	46 (35.4)	38 (43.7)	565 (30.1)	18.50	0.06
80,000–300,000 RMB	72 (50.7)	64 (49.2)	42 (48.3)	1,077 (57.3)		
> 300,000 RMB	11 (7.7)	20 (15.4)	7 (8.0)	236 (12.6)		
Cohabitants in household						
Only husband	71 (50.0)	67 (51.5)	36 (41.4)	894 (47.6)	2.47	0.48
Others	71 (50.0)	63 (48.5)	51 (58.6)	984 (52.4)		
Family support						
Poor	56 (39.4)$_{a}$	47 (36.2)$_{a}$	35 (40.2)$_{a}$	465 (24.8)$_{b}$	29.20	< 0.001
Good	86 (60.6)$_{a}$	83 (63.8)$_{a}$	52 (59.8)$_{a}$	1,413 (75.2)$_{b}$		
Total live births						
None	72 (50.7)$_{a}$	57 (43.8)$_{a,b}$	45 (51.7)$_{a}$	684 (36.4)$_{b}$	20.36	< 0.001
≥1	70 (49.3)$_{a}$	73 (56.2)$_{a,b}$	42 (48.3)$_{a}$	1,194 (63.6)$_{b}$		
Pregnancy or postpartum						
Pregnancy	134 (94.4)	121 (93.1)	85 (97.7)	1,800 (95.8)	3.70	0.30
Postpartum	8 (5.6)	9 (6.9)	2 (2.3)	78 (4.2)		

Frequencies with different subscripts in the same row represent significantly different values based on Bonferroni's multiple comparison test.

et al., 2021; Jiang et al., 2021), the prevalence of anxiety and depression in our study is relatively low. One reason for this difference may be the time difference in data collection. Two previous studies (Bo et al., 2021; Jiang et al., 2021) were carried out from February 2020 to early March 2020, when the COVID-19 epidemic peaked in China. Our study was conducted between February 28, 2020, and April 26, 2020. In particular, 98.5% of the participants were surveyed after March 10, 2020. At that time, the situation in the Chinese Mainland had been stabilized and controlled and the daily figure of new cases had remained in single digit since mid-March. Another reason may be the different measurement tools and cutoff values used. For example, Bo et al. (2021) used the same scale (PHQ-9) to measure depression, as in our study; however, Bo et al. used a lower cutoff score.

Meanwhile, the present study found that the prevalence of CAD remained unchanged during the perinatal period. The prevalence of "anxiety only" in the first trimester of pregnancy was lower, and that in the third trimester, it was higher. These findings differ from those of earlier studies. For example, a meta-analysis by Falah-Hassani et al. (2017) showed that the prevalence of comorbid anxiety symptoms and mild to severe depressive symptoms decreased between the first and third trimesters of pregnancy. Skouteris et al. (2009) found that anxiety was the lowest in late pregnancy compared to the middle pregnancy and postpartum. Our findings may be due to the COVID-19 pandemic since this is a period of high stress. Additional research is required to better understand CAD changes over time in pregnant and postpartum women. Meanwhile, the study found that the prevalence of "depression only," in the first trimester of pregnancy was higher and that in the third trimester, it was lower, which was consistent with previous findings; that is, the depressive symptoms decreased between the first and third trimesters of pregnancy (Dipietro et al., 2008; Bunevicius et al., 2009; Figueiredo and Conde, 2011).

Factors associated with CAD include marital status, family support, and total live births. We also found that these factors were associated with ""depression only" and "anxiety only"" groups which may reflect many similarities among them. Actually, many researchers believe that anxiety and depression are overlapping syndromes (Hranov, 2007), and anxiety, depression, and comorbidity represent sequential stages of the same disorder (Liebowitz et al., 1990; Schoevers et al., 2005). According to the results of the multiple logistic regression analysis, only family support and total live births were related to CAD among pregnant and postpartum Chinese women during

TABLE 3 | Predictors of participants in comorbid anxiety and depression (CAD) group vs."anxiety only," depression only," and "no anxiety or depression" groups.

	CAD vs. anxiety only				CAD vs. depression only				CAD vs. No anxiety or depression			
	B(SE)	*p*	OR	95%CI	B(SE)	*p*	OR	95%CI	B(SE)	*p*	OR	95%CI
Age												
<25 vs. >35	−0.29 (0.63)	0.65	0.75	[0.22, 2.56]	−0.65 (0.64)	0.31	0.52	[0.15, 1.81]	−0.09 (0.42)	0.83	0.91	[0.40, 2.08]
25–35 vs. >35	−0.55 (0.43)	0.20	0.58	[0.25, 1.34]	−0.22 (0.47)	0.64	0.80	[0.32, 2.03]	−0.31 (0.29)	0.29	0.74	[0.42, 1.30]
Marital status (single vs. married)	1.35 (0.82)	0.10	3.86	[0.78, 19.22]	0.19 (0.62)	0.76	1.21	[0.36, 4.06]	1.21 (0.44)	0.01	3.37	[1.43, 7.92]
Level of education (senior high school and below vs. college and above)	−0.04 (0.37)	0.91	0.96	[0.47, 1.97]	0.52 (0.44)	0.24	1.68	[0.71, 4.01]	0.43 (0.27)	0.10	1.54	[0.91, 2.60]
Annual family income												
<80,000 RMB vs. > 300,000 RMB	0.88 (0.44)	0.05	2.42	[1.01, 5.76]	−0.05 (0.54)	0.93	0.96	[0.33, 2.77]	0.50 (0.35)	0.16	1.65	[0.83, 3.29]
80,000–300,000 RMB vs. > 300,000 RMB	0.80 (0.42)	0.06	2.23	[0.97, 5.10]	0.09 (0.53)	0.87	1.09	[0.39, 3.08]	0.30 (0.34)	0.37	1.35	[0.69, 2.64]
Cohabitants in household (only husband vs. others)	−0.06 (0.25)	0.83	0.95	[0.57, 1.56]	0.41 (0.29)	0.15	1.51	[0.86, 2.64]	0.10 (0.18)	0.96	1.10	[0.71, 1.45]
Family support (poor vs. good)	0.08 (0.27)	0.76	1.09	[0.64, 1.84]	−0.13 (0.30)	0.67	0.88	[0.49, 1.58]	0.64 (0.19)	**0.0009**	1.90	[1.30, 2.78]
Total live births (none vs. ≥ 1)	0.21 (0.26)	0.41	1.24	[0.74, 2.06]	0.08 (0.29)	0.77	1.09	[0.62, 1.92]	0.65 (0.19)	**0.0006**	1.91	[1.32, 2.75]
Pregnancy or postpartum (pregnancy vs. postpartum)	0.23 (0.52)	0.66	1.26	[0.46, 3.47]	−1.00 (0.82)	0.22	0.37	[0.08, 1.82]	−0.50 (0.40)	0.20	0.61	[0.28, 1.31]
	Anxiety only vs. No anxiety or depression				**Depression only vs. No anxiety or depression**				**Anxiety onlyvs. Depression only**			
	B(SE)	*p*	OR	95%CI	B(SE)	*p*	OR	95%CI	B(SE)	*p*	OR	95%CI
Age												
<25 vs. > 35	0.19 (0.50)	0.70	1.21	[0.46, 3.23]	0.56 (0.51)	0.28	1.74	[0.64, 4.77]	−0.36 (0.69)	0.60	0.70	[0.18, 2.70]
25–35 vs. > 35	0.24 (0.33)	0.48	1.27	[0.66, 2.44]	−0.09 (0.39)	0.83	0.92	[0.42, 1.99]	0.32 (0.50)	0.52	1.38	[0.51, 3.71]
Marital status (single vs. married)	−0.14 (0.75)	0.86	0.87	[0.20, 3.83]	1.03 (0.54)	0.06	2.79	[0.98, 7.97]	−1.16 (0.88)	0.19	0.31	[0.06, 1.74]
Level of education (senior high school and below vs. college and above)	0.48 (0.28)	0.09	1.61	[0.92, 2.80]	−0.09 (0.38)	0.82	0.92	[0.44, 1.93]	0.56 (0.46)	0.22	1.75	[0.72, 4.29]
Annual family income												
<80,000 RMB vs. > 300,000 RMB	−0.38 (0.30)	0.20	0.68	[0.38, 1.22]	0.55 (0.43)	0.21	1.73	[0.74, 4.04]	−0.93 (0.51)	0.07	0.40	[0.15, 1.08]
80,000–300,000 RMB vs. > 300,000 RMB	−0.50 (0.27)	0.07	0.61	[0.36, 1.04]	0.22 (0.42)	0.61	1.24	[0.54, 2.85]	−0.72 (0.49)	0.15	0.49	[0.19, 1.28]
Cohabitants in household (only husband vs. others)	0.07 (0.19)	0.73	1.07	[0.74, 1.55]	−0.40 (0.23)	0.09	0.67	[0.43, 1.06]	0.47 (0.29)	0.11	1.59	[0.90, 2.82]
Family support (poor vs. good)	0.56 (0.20)	0.01	1.75	[1.18, 2.61]	0.77 (0.24)	**0.0015**	2.16	[1.34, 3.47]	−0.21 (0.31)	0.49	0.81	[0.45, 1.48]
Total live births (none vs. ≥ 1)	0.43 (0.19)	0.03	1.54	[1.05, 2.26]	0.56 (0.24)	0.02	1.75	[1.11, 2.78]	−0.13 (0.30)	0.66	0.88	[0.49, 1.57]
Pregnancy or postpartum (pregnancy vs. postpartum)	−0.73 (0.38)	0.05	0.48	[0.23, 1.01]	0.50 (0.74)	0.50	1.64	[0.39, 6.95]	−1.23 (0.81)	0.13	0.29	[0.06, 1.43]

The significant results using Bonferroni's correction are in boldface.

the COVID-19 pandemic. First, poor family support leads to an increased risk of CAD and depression only. This result is in line with previous research (Falah-Hassani et al., 2016; Ngocho et al., 2019; Ramakrishna et al., 2019; González-Mesa et al., 2020). Family support can serve as an interpersonal resource for pregnant and postpartum women, helping them cope with multiple additional physical and psychological stresses during the COVID-19 pandemic. According to the buffering model, interpersonal resources can act as a buffer to reduce the harm of stressful events in individuals (Cohen and Wills, 1985). Pregnant and postpartum women with sufficient family support had more resources available to respond to their own needs and help them navigate the COVID-19 pandemic. They received support and care from their husbands or mothers-in-law, which helped them meet their need for affiliation, develop a calm attitude, and remain positive. Therefore, pregnant and postpartum women with family support had lower odds of developing CAD and "depression only." Conversely, women with less family support had higher odds of developing CAD and "depression only."

Moreover, consistent with Ali et al. (2012), women without a history of live births were at an increased risk of CAD. The first pregnancy is a stressful period (Morse et al., 2000) because the mother has to adjust not only to her role transition, but also faces multiple stressors, including the need to ensure her health and safety and that of her fetus, and coping with the physical fatigue and the changing body shape. Primiparas may lack coping skills. Therefore, "no birth" was found to be a predictor of CAD among pregnant and postpartum Chinese women during the COVID-19 pandemic.

Although our findings make a valuable contribution to the existing literature, some limitations should be noted. First, our results may have limited generalizability, as our sample had higher average education and income level and might not be representative of pregnant and postpartum women in China. Second, *a priori* power analysis had not been performed to calculate the sample size, which may pose a potential challenge in maintaining a statistical power. Meanwhile, the number of postpartum women was relatively small. Third, our study used a cross-sectional design and lacked a control group representing the general population or pregnant and postpartum women before the pandemic, which limited our ability to assess the specific or actual influence of the COVID-19 pandemic on CAD in pregnant and postpartum women. Fourth, we did not have control for the general medical conditions of women and fetuses/newborns. Fifth, the data were collected *via* self-report, which may have affected the validity of the study. Finally, although our study focused on sociodemographic and obstetric-related characteristics, it may not have fully encompassed the sociodemographic and obstetric-related variables associated with CAD. Future studies should investigate this further, using a more diverse sample to expand the scope of the current survey.

Despite these limitations, the present findings show that pregnant and postpartum Chinese women with poor family support and primipara are at high risk for CAD during the COVID-19 pandemic. These findings can guide policymakers toward allocating resources; they may also help primary care practitioners provide timely services to pregnant and postpartum women at an increased risk of CAD during the pandemic period.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Institutional Review Board of Institute of Psychology, Chinese Academy of Sciences. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

ZLu and ZLi: study design, critical revision of the manuscript, and approval of the final version for publication. ZLu, LX, and LM: analysis and interpretation of data. ZLu and LX: drafting of the manuscript. All authors contributed to the article and approved the submitted version.

FUNDING

This research was supported by the Shenzhen-Hongkong Institute of Brain Science-Shenzhen Fundamental Research Institutions (NYKFKT2020002) the Beijing Social Science Fund Project [18JYB013].

ACKNOWLEDGMENTS

We thank Wei Qian and Yongjie Zhou for their outstanding work in organizing data collection, writing review and editing.

REFERENCES

Adhikari, K., Patten, S. B., Williamson, T., Patel, A. B., Premji, S., Tough, S., et al. (2020). Neighbourhood socioeconomic status modifies the association between anxiety and depression during pregnancy and preterm birth: a community-based Canadian cohort study. *BMJ. Open* 10:e031035. doi: 10.1136/bmjopen-2019-031035

Ali, N. S., Azam, I. S., Ali, B. S., Tabbusum, G., and Moin, S. S. (2012). Frequency and associated factors for anxiety and depression in pregnant women: a hospital-based cross-sectional study. *Sci. World J.* 11, 1–9. doi: 10.1100/2012/653098

Berthelot, N., Lemieux, R.,Garon,B. J., Drouin,M. C., and Martel, É.,and Maziade, M. (2020). Uptrend in distress and psychiatric symptomatology in pregnant women during the COVID-19 pandemic. *Acta. Obstet. Gynecol. Scand.*99:13925. doi: 10.1111/aogs.13925

Bindt, C., Appiah-Poku, J., TeBonle, M., Schoppen, S., Feldt, T., Barkmann, C., et al. (2012). Antepartum depression and anxiety associated with disability in

African women: Cross-sectional results from the CDS study in Ghana and Côte d'Ivoire. *PloS ONE* 7:e48396. doi: 10.1371/journal.pone.0048396

Biviá-Roig, G., La Rosa, V. L., Gómez-Tébar, M., Serrano-Raya, L., Amer-Cuenca, J. J., Caruso, S., et al. (2020). Analysis of the impact of the confinement resulting from COVID-19 on the lifestyle and psychological wellbeing of Spanish pregnant women: An internet-based cross-sectional survey. *Int. J. Env. Res. Pub. He.* 17:5933. doi: 10.3390/ijerph17165933

Bo, H., Yang, Y., Chen, J., Zhang, M., Li, Y., Zhang, D., et al. (2021). Prevalence of depressive symptoms among pregnant and postpartum women in China during the COVID-19 pandemic. *Psychosom. Med.* 83, 345–350. doi: 10.1097/PSY.0000000000000904

Bunevicius, A., Kusminskas, L., Pop, V. J., Pedersen, C. A., and Bunevicius, R. (2009). Screening for antenatal depression with the Edinburgh Depression Scale. *J. Psychosom. Obst. Gyn*. 30, 238–243. doi: 10.3109/01674820903230708

Chmielewska, B., Barratt, I., Townsend, R., Kalafat, E., van der Meulen, J., Gurol-Urganci, I., et al. (2021). Effects of the COVID-19 pandemic on maternal and perinatal outcomes: a systematic review and meta-analysis. *Lancet Glob. Health* 15, e759–e772. doi: 10.1016/S2214-109X(21)00079-6

Cohen, S., and Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychol. Bull.* 98, 310–357. doi: 10.1037/0033-2909.98.2.310

Davis, K., Pearlstein, T., Stuart, S., O'Hara, M., and Zlotnick, C. (2013). Analysis of brief screening tools for the detection of postpartum depression: Comparisons of the PRAMS 6-item instrument, PHQ-9, and structured interviews. *Arch. Women Ment.Hlth.* 16, 271–277. doi: 10.1007/s00737-013-0345-z

Dipietro, J. A., Costigan, K. A., and andSipsma, H. L. (2008). Continuity in self-report measures of maternal anxiety, stress, and depressive symptoms from pregnancy through two years postpartum. *J.Psychosom.Obst. Gyn*. 29, 115–124. doi: 10.1080/01674820701701546

Falah-Hassani, K., Shiri, R., and Dennis, C. (2016). Prevalence and risk factors for comorbid postpartum depressive symptomatology and anxiety. *J. Affect. Disorders* 198, 142–147. doi: 10.1016/j.jad.2016.03.010

Falah-Hassani, K., Shiri, R., and Dennis, C. (2017). The prevalence of antenatal and postnatal co-morbid anxiety and depression: a meta-analysis. *Psychol. Med*. 47, 2041–2053. doi: 10.1017/S0033291717000617

Farr, S. L., Dietz, P. M., O'Hara, M. W., Burley, K., and Ko, J. Y. (2014). Postpartum anxiety and comorbid depression in a population-based sample of women. *J. Wom. Health* 23, 120–128. doi: 10.1089/jwh.2013.4438

Fichter, M. M., Quadflieg, N., Fischer, U. C., and Kohlboeck, G. (2010). Twenty-five-year course and outcome in anxiety and depression in the Upper Bavarian Longitudinal Community Study. *Acta. Psychiat. Scand*. 122, 75–85. doi: 10.1111/j.1600-0447.2009.01512.x

Field, T., Diego, M., Hernandez-Reif, M., Figueiredo, B., Deeds, O., Ascencio, A., et al. (2010). Comorbid depression and anxiety effects on pregnancy and neonatal outcome. *Infant Behav. Dev*. 33, 23–29. doi: 10.1016/j.infbeh.2009.10.004

Figueiredo, B., and Conde, A. (2011). Anxiety and depression symptoms in women and men from early pregnancy to 3-months postpartum: parity differences and effects. *J. Aff. Disorders* 132, 146–157. doi: 10.1016/j.jad.2011.02.007

González-Mesa, E., Kabukcuoglu, K., Blasco, M., Körükcü, O., Ibrahim, and N., González-Cazorla, A., et al. (2020). Comorbid anxiety and depression (CAD) at early stages of the pregnancy. a multicultural cross-sectional study. *J. Aff. Disorders* 270, 85–89. doi: 10.1016/j.jad.2020.03.086

Hranov, L. G. (2007). Comorbid anxiety and depression: illumination of a controversy. *Int. J. Psychiat. Clin.* 11, 171–189. doi: 10.1080/13651500601127180

Ibanez, G., Charles, M. -A., Forhan, A., Magnin, G., and Thiebaugeorges, O., Kaminski, M., et al. (2012). Depression and anxiety in women during pregnancy and neonatal outcome: data from the EDEN mother–child cohort. *Early Hum. Dev*. 88, 643–649. doi: 10.1016/j.earlhumdev.2012.01.014

Jiang, H., Jin, L., Qian, X., Xiong, X., La, X., Chen, W., et al. (2021). Maternal mental health status and approaches for accessing antenatal care information during the COVID-19 epidemic in China: cross-Sectional Study. *J. Med. Internet Res.* 23(1): e18722. doi: 10.2196/18722

Kroenke, K., Spitzer, R. L., and Williams, J. B. (2001). The PHQ-9: validity of a brief depression severity measure. *J. Gen. Intern. Med.* 16, 606–613. doi: 10.1046/j.1525-1497.2001.016009606.x

Lebel, C., MacKinnon, A., Bagshawe, M., Tomfohr-Madsen, L., and Giesbrecht, G. (2020). Elevated depression and anxiety symptoms among pregnant individuals during the COVID-19 pandemic. *J. Aff. Disorders*277, 5–13. doi: 10.1016/j.jad.2020.07.126

Liebowitz, M. R., Hollander, E., Schneier, F., Campeas, R., Fallon, B., Welkowitz, L., et al. (1990). Anxiety and depression: discrete diagnostic entities? *J. Clin Psychopharmacol.*10, 615–665. doi: 10.1097/00004714-199006001-00012

Morse, C. A., Buist, A., and Durkin, S. (2000). First-time parenthood: Influences on pre- and postnatal adjustment in fathers and mothers. *J. Psychosom. Obst. Gyn.* 21, 109–120. doi: 10.3109/01674820009075616

Ngocho, J. S., Watt, M. H., Minja, L., Knettel, B. A., Mmbaga, B. T., Williams, P. P., et al. (2019). Depression and anxiety among pregnant women living with HIV in Kilimanjaro region. *PloS ONE* 14:e0224515. doi: 10.1371/journal.pone.0224515

Ostacoli, L., Cosma, S., Bevilacqua, F., et al. (2020). Psychosocial factors associated with postpartum psychological distress during the Covid-19 pandemic: a cross-sectional study. *BMC Pregn. Childb.* 20:703. doi: 10.1186/s12884-020-03399-5

Pariente, G., Wissotzky Broder, O., Sheiner, E., LanxnerBattat, T., Mazor, E., Yaniv Salem, S., et al. (2020). Risk for probable post-partum depression among women during the COVID-19 pandemic. *Arch. Women. Men.t Hlth.* 23, 767–773. doi: 10.1007/s00737-020-01075-3

Preis, H., Mahaffey, B., Heiselman, C., and andLobel, M. (2020). Pandemic-related pregnancy stress and anxiety among women pregnant during the COVID-19 pandemic. *Am. J. Obstet. Gynecol. MFM.* 20:100155. doi: 10.1016/j.ajogmf.2020.100155

Ramakrishna, S., Cooklin, A. R., and Leach, L. S. (2019). Comorbid anxiety and depression: a community-based study examining symptomology and correlates during the postpartum period. *J. Reprod. Infant Psyc.*37, 468–479. doi: 10.1080/02646838.2019.1578870

Schoevers, R. A., Deeg,D. J. H., and van Tilburg, W., Beekman, A. T. F. (2005). Depression and generalized anxiety disorder: co-occurrence and longitudinal patterns in elderly patients. *Am. J. Geriatr. Psychiatr.*13, 31–39. doi: 10.1097/00019442-200501000-00006

Shrestha, N. (2020). Detecting multicollinearity in regression analysis. *Am. J. Appl. Math. Stat.* 8, 39–42. doi: 10.12691/ajams-8-2-1

Sidebottom, A. C., Harrison, P. A., Godecker, A., and Kim, H. (2012). Validation of the Patient Health Questionnaire (PHQ)-9 for prenatal depression screening. *Arch. Wom. Ment. Health.* 15, 367–374. doi: 10.1007/s00737-012-0295-x

Simpson, W., Glazer, M., Michalski, N., Steiner, M., and Frey, B. N. (2014). Comparative efficacy of the generalized anxiety disorder 7-item scale and the edinburgh postnatal depression scale as screening tools for generalized anxiety disorder in pregnancy and the postpartum period. *Can. J. Psychiatr.* 59, 434–440. doi: 10.1177/070674371405900806

Skipstein, A., Janson, H., Stoolmiller, M., and Mathiesen, K. S. (2010).Trajectories of maternal symptoms of anxiety and depression. a 13-year longitudinal study of a population-based sample. *BMC Public Health* 10:589. doi: 10.1186/1471-2458-10-589

Skouteris, H., Wertheim, E. H., Rallis, S., Milgrom, J., and Paxton, S. J. (2009). Depression and anxiety through pregnancy and the early postpartum: an examination of prospective relationships. *J. Affect. Disorders* 113, 303–308. doi: 10.1016/j.jad.2008.06.002

Spitzer, R. L., Kroenke, K., Williams, J. B. W., and andLöwe, B. (2006). A brief measure for assessing generalized anxiety disorder. *AMA. Arch. Intern. Med.* 166:1092. doi: 10.1001/archinte.166.10.1092

Thiagayson, P., Krishnaswamy, G., Lim, M. L., Sung, S. C., Haley, C. L., Fung, D. S. S., et al. (2013). Depression and anxiety in Singaporean high-risk pregnancies - prevalence and screening. *Gen. Hosp. Psychiatr.* 35, 112–116. doi: 10.1016/j.genhosppsych.2012.11.006

Wu, Y., Zhang, C., Liu, H., Duan, C., Li, C., Fan, J., et al. (2020). Perinatal depressive and anxiety symptoms of pregnant women during the coronavirus disease 2019 outbreak in China. *Am. J. Obstetr. Gynecol.*223:240. doi: 10.1016/j.ajog.2020.05.009

Xie, M., Wang, X., Zhang, J., and Wang, Y. (2021). Alteration in the psychologic status and family environment of pregnant women before and during the COVID-19 pandemic. *Int. J. Gynecol. Obstet.* 153, 71–75. doi: 10.1002/ijgo.13575

Yan, H., Ding, Y., and Guo, W. (2020). Mental health of pregnant and postpartum women during the coronavirus disease 2019 pandemic: a systematic review and meta-analysis. *Front. Psychol.* 11:617001. doi: 10.3389/fpsyg.2020.617001

Zanardo, V., Manghina, V., Giliberti, L., Vettore, M., Severino, L., and and Straface, G. (2020). Psychological impact of COVID-19 quarantine measures in northeastern Italy on mothers in the immediate postpartum period. *Int. J.Gynaecol. Obstet*. 150, 184–188. doi: 10.1002/ijgo.13249

Zhong, Q.-Y., Gelaye, B., Zaslavsky, A. M., Fann, J. R., Rondon, M. B., and Sánchez, S. E., et al. (2015). Diagnostic validity of the Generalized Anxiety Disorder-7(GAD-7) among pregnant women. *PloS ONE* 10:e0125096. doi: 10.1371/journal.pone.0125096

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's Note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Advantages of publishing in Frontiers

OPEN ACCESS
Articles are free to read for greatest visibility and readership

FAST PUBLICATION
Around 90 days from submission to decision

HIGH QUALITY PEER-REVIEW
Rigorous, collaborative, and constructive peer-review

TRANSPARENT PEER-REVIEW
Editors and reviewers acknowledged by name on published articles

Frontiers
Avenue du Tribunal-Fédéral 34
1005 Lausanne | Switzerland

Visit us: www.frontiersin.org
Contact us: frontiersin.org/about/contact

REPRODUCIBILITY OF RESEARCH
Support open data and methods to enhance research reproducibility

DIGITAL PUBLISHING
Articles designed for optimal readership across devices

FOLLOW US
@frontiersin

IMPACT METRICS
Advanced article metrics track visibility across digital media

EXTENSIVE PROMOTION
Marketing and promotion of impactful research

LOOP RESEARCH NETWORK
Our network increases your article's readership