CORONAVIRUS DISEASE (COVID-19): THE IMPACT AND ROLE OF MASS MEDIA DURING THE PANDEMIC

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Editorial: Coronavirus Disease (COVID-19): The Impact and Role of Mass Media During the Pandemic

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Editorial on the Research Topic

Coronavirus Disease (COVID-19): The Impact and Role of Mass Media During the Pandemic

The outbreak of the coronavirus disease 2019 (COVID-19) has created a global health crisis that had a deep impact on the way we perceive our world and our everyday lives. Not only has the rate of contagion and patterns of transmission threatened our sense of agency, but the safety measures to contain the spread of the virus also required social and physical distancing, preventing us from finding solace in the company of others. Within this context, we launched our Research Topic on March 27th, 2020, and invited researchers to address *the Impact and Role of Mass Media During the Pandemic* on our lives at individual and social levels.

Despite all the hardships, disruption, and uncertainty brought by the pandemic, we received diverse and insightful manuscript proposals. Frontiers in Psychology published 15 articles, involving 61 authors from 8 countries, which were included in distinct specialized sections, including Health Psychology, Personality and Social Psychology, Emotion Science, and Organizational Psychology. Despite the diversity of this collective endeavor, the contributions fall into four areas of research: (1) the use of media in public health communication; (2) the diffusion of false information; (3) the compliance with the health recommendations; and (4) how media use relates to mental health and well-being.

A first line of research includes contributions examining the use of media in public health communication. Drawing on media messages used in previous health crises, such as Ebola and Zika, Hauer and Sood describe how health organizations use media. They offer a set of recommendations for COVID-19 related media messages, including the importance of message framing, interactive public forums with up-to-date information, and an honest communication about what is known and unknown about the pandemic and the virus. Following a content analysis approach, Parvin et al. studied the representations of COVID-19 in the opinion section of five Asian e-newspapers. The authors identified eight main issues (health and drugs, preparedness and awareness, social welfare and humanity, governance and institutions, the environment and wildlife, politics, innovation and technology, and the economy) and examined how e-newspapers from these countries attributed different weights to these issues and how this relates to the countries' cultural specificity. Raccanello et al. show how the internet can be a platform to disseminate a public campaign devised to inform adults about coping strategies that could help children and teenagers deal with the challenges of the pandemic. The authors examined the dissemination of the program through the analysis of website traffic, showing that in the 40 days following publication, the website reached 6,090 visits.

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A second related line of research that drew the concern of researchers was the diffusion of false information about COVID-19 through the media. Lobato et al. examined the role of distinct individual differences (political orientation, social dominance orientation, traditionalism, conspiracy ideation, attitudes about science) on the willingness to share misinformation about COVID-19 over social media. The misinformation topics varied between the severity and spread of COVID-19, treatment and prevention, conspiracy theories, and miscellaneous unverifiable claims. Their results from 296 adult participants (Mage = 36.23; 117 women) suggest two different profiles. One indicating that those reporting more liberal positions and lower social dominance were less willing to share conspiracy misinformation. The other profile indicated that participants scoring high on social dominance and low in traditionalism were more willing to share both conspiracy and other miscellaneous claims, but less willing to share misinformation about the severity and spread of COVID-19. Their findings can have relevant contributions for the identification of specific individual profiles related to the widespread of distinct types of misinformation. Dhanani and Franz examined a sample of 1,141 adults (Mage = 44.66; 46.9% female, 74.7% White ethnic identity) living in the United States in March 2020. The authors examined how media consumption and information source were related to knowledge about COVID-19, the endorsement of misinformation about COVID-19, and prejudice toward Asian Americans. Higher levels of trust in informational sources such as public health organizations (e.g., Center for Disease Control) was associated with greater knowledge, lower endorsement of misinformation, and less prejudice toward Asian Americans. Media source was associated with distinct levels of knowledge, willingness to endorsement misinformation and prejudice toward American Asians, with social media use (e.g., Twitter, Facebook) being related with a lower knowledge about COVID-19, higher endorsement of misinformation, and stronger prejudice toward Asian Americans.

A third line of research addressed the factors that could contribute to compliance with the health recommendations to avoid the spread of the disease. Vai et al. studied early pre-lockdown risk perceptions about COVID-19 and the trust in media sources among 2,223 Italians (Mage = 36.4, 69.2% female). They found that the perceived usefulness of the containment measures (e.g., social distancing) was related to threat perception and efficacy beliefs. Lower threat perception was associated with less perception of utility of the containment measures. Although most participants considered themselves and others capable of taking preventive measures, they saw the measures as generally ineffective. Participants acknowledged using the internet as their main source of information and considered health organizations' websites as the most trustworthy source. Albeit frequently used, social media was in general considered an unreliable source of information. Tomczyk et al. studied knowledge about preventive behaviors, risk perception, stigmatizing attitudes (support for discrimination and blame), and sociodemographic data (e.g., age, gender, country of origin, education level, region, persons per household) as predictors of compliance with the behavioral recommendations among 157 Germans, (age range: 18–77 years, 80% female). Low compliance was associated with male gender, younger age, and lower public stigma. Regarding stigmatizing attitudes, the authors only found a relation between support for discrimination (i.e., support for compulsory measures) and higher intention to comply with recommendations. Mahmood et al. studied the relation between social media use, risk perception, preventive behaviors, and self-efficacy in a sample of 310 Pakistani adults (54.2% female). The authors found social media use to be positively related to self-efficacy and perceived threat, which were both positively related to preventive behaviors (e.g., hand hygiene, social distancing). Information credibility was also related to compliance with health recommendations. Lep et al. examined the relationship between information source perceived credibility and trust, and participants' levels of self-protective behavior among 1,718 Slovenians (age range: 18–81 years, 81.7% female). The authors found that scientists, general practitioners (family doctors), and the National Institute of Public Health were perceived as the more credible source of information, while social media and government officials received the lowest ratings. Perceived information credibility was found to be associated with lower levels of negative emotional responses (e.g., nervousness, helplessness) and a higher level of observance of self-protective measures (e.g., hand washing). Siebenhaar et al. also studied the link between compliance, distress by information, and information avoidance. They examined the online survey responses of 1,059 adults living in Germany (Mage = 39.53, 79.4% female). Their results suggested that distress by information could lead to higher compliance with preventive measures. Distress by information was also associated with higher information avoidance, which in turn is related to less compliance. Gantiva et al. studied the effectiveness of different messages regarding the intentions toward self-care behaviors, perceived efficacy to motivate self-care behaviors in others, perceived risk, and perceived message strength, in a sample of 319 Colombians (age range: 18–60 years, 69.9% female). Their experiment included the manipulation of message framing (gain vs. loss) and message content (economy vs. health). Participants judged gain-frame health related messages to be stronger and more effective in changing self-behavior, whereas loss-framed health messages resulted in increased perceived risk. Rahn et al. offer a comparative view of compliance and risk perception, examining three hazard types: COVID-19 pandemic, violent acts, and severe weather. With a sample of 403 Germans (age range: 18–89 years, 72% female), they studied how age, gender, previous hazard experience and different components of risk appraisal (perceived severity, anticipated negative emotions, anticipatory worry, and risk perception) were related to the intention to comply with behavioral recommendations. They found that higher age predicted compliance with health recommendations to prevent COVID-19, anticipatory worry predicted compliance with warning messages regarding violent acts, and women complied more often with severe weather recommendations than men.

A fourth line of research examined media use, mental health and well-being during the COVID-19 pandemic. Gabbiadini et al. addressed the use of digital technology (e.g., voice/video calls, online games, watching movies in party mode) to stay connected with others during lockdown. Participants, 465

Italians (age range: 18–73 years, 348 female), reported more perceived social support associated with the use of these digital technologies, which in turn was associated with fewer feelings of loneliness, boredom, anger, and higher sense of belongingness. Muñiz-Velázquez et al. compared the media habits of 249 Spanish adults (Mage = 42.06, 53.8% female) before and during confinement. They compared the type of media consumed (e.g., watching TV series, listening to radio, watching news) and found the increased consumption of TV and social networking sites during confinement to be negatively associated with reported level of happiness. People who reported higher levels of well-being also reported watching less TV and less use of social networking sites. Majeed et al., on the other hand, examined the relation between problematic social media use, fear of COVID-19, depression, and mindfulness. Their study, involving 267 Pakistani adults (90 female), suggested trait mindfulness had a buffer effect, reducing the impact of problematic media use and fear of COVID-19 on depression.

Taken together, these findings highlight how using different frames for mass media gives a more expansive view of its positive and negative roles, but also showcase the major concerns in the context of a pandemic crisis. As limitations we highlight the use of cross-sectional designs in most studies, not allowing to establish true inferences of causal relationships. The outcome of some studies may also be limited by the unbalanced number of female and male participants, by the non-probability sampling method used, and by the restricted time frame in which the research occurred. Nevertheless, we are confident that all the selected studies in our Research Topic bring important and enduring contributions to the understanding of how media, individual differences, and social factors intertwine to shape our lives, which can also be useful to guide public policies during these challenging times.

AUTHOR CONTRIBUTIONS

PA: conceptualization, writing the original draft, funding acquisition, writing—review, and editing. FE: conceptualization, writing—review, and editing. MP: writing—review and editing. NP: conceptualization, writing the original draft, writing—review, and editing. All authors approved the submitted version.

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BRIEF RESEARCH REPORT
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Emotional Responses and Self-Protective Behavior Within Days of the COVID-19 Outbreak: The Promoting Role of Information Credibility

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Due to changes in the information environment since the last global epidemic, high WHO officials have spoken about the need to fight not only the current COVID-19 pandemic but also the related infodemic. We thus explored how people search for information, how they perceive its credibility, and how all this relates to their engagement in self-protective behaviors in the crucial period right after the onset of COVID-19 epidemic. The online questionnaire was circulated within 48 h after the first case of COVID-19 was confirmed in Slovenia. We gathered information on participants' demographics, perception of the situation, their emotional and behavioral responses to the situation (i.e., self-protective behavior), perceived subjective knowledge, perceived credibility of different sources of information, and their level of trust. We looked into the relationships between perceived credibility and trust, and self-protective behavior of 1,718 participants and found that mass media, social media, and officials received relatively low levels of trust. Conversely, medical professionals and scientists were deemed the most credible. The perceived credibility of received information was linked not only with lower levels of negative emotional responses but also with higher adherence to much needed self-protective measures, which aim to contain the spread of the disease. While results might vary between societies with different levels of trust in relevant governmental and professional institutions, and while variances in self-protective behavior scores explained by our model are modest, even a small increase in self-protective behavior could go a long way in viral epidemics like the one we are facing today.

Keywords: COVID-19, mass communication, information credibility, negative emotions, self-protective behaviors, psychological response, health communication

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INTRODUCTION

With the emergence of social networks and their omnipresence, especially as a source of information in critical situations, the information environment has become significantly more complex since the last worldwide epidemic of H1N1 influenza. Today, people are faced with an abundance of information from various sources, many of them not credible, and the way key

information is relayed to the public has become critical (The Lancet, 2020). As result, high-ranking officials from the World Health Organization (WHO) have recently spoken about the need to fight not only the current COVID-19 pandemic but also the related infodemic. In the present research, we were thus interested in how different informational outlets (besides media, we also analyzed the communication of various officials) can shape perceptions, emotional responses, and whether credible communication can promote behavioral responses (i.e., adherence to preventive and protective measures) to the novel crisis situation.

Indeed, extant research shows that the perceived quantity and credibility of information received correlates with adherence to infection prevention behavior, e.g., frequent hand washing, avoiding close contact, etc (Etingen et al., 2013), which is crucial in fighting the spread of the disease. While media can help with promoting healthy behavior change (Sandman, 2009), this is exceedingly important in the early stages of the epidemic (Xiao et al., 2015), when the possibility of its containment is highest. Alarmist framing and intensive reporting of mass media can, on the contrary, spark fear and even hysteria (Van den Bulck and Custers, 2009), resulting in the reduced possibility of mobilizing the public (Sherlaw and Raude, 2013). Such emotions can be further amplified by prolonged exposure to negative reporting, while personal experience with the disease is limited (Brug et al., 2004; Lau et al., 2011).

The level of trust in sources of information also plays an important role in motivating the engagement in self-protective behaviors. However, results may depend on the source of information – a higher level of trust in official government communication was found to result in higher self-efficacy and hand washing. Conversely, relying on informal interpersonal information results in heightened perceived threat and avoidance behaviors (Liao et al., 2010). Additionally, the perceived credibility of various sources of information also varies greatly in the eyes of the public. For example, King et al. (2018) found that parents exhibited high levels of trust in doctors, and less so in the government during the H1N1 outbreak. In accordance with this, research on the H1N1 epidemic has shown that people were doubtful about recommendations made by the government (Teasdale and Yardley, 2011).

As government recommendations are a special form of health care communication, they are subject to harsh evaluation in terms of credibility, feasibility, and costs (Teasdale and Yardley, 2011). Nonetheless, it is crucial for people to follow those recommendations in case of a health threat. At the same time, in cases when information relayed by public health officials is deemed less credible, people can turn to online news, interpersonal networks and social media for information regarding an outbreak (Jang and Baek, 2019). These latter sources can be less trustworthy and filled with inaccurate information. Moreover, research has found that people who have consulted with their doctor are more likely to adopt self-protective behavior (Lin et al., 2018), supporting the notion that doctors have a special role in communicating information regarding self-protective behavior. Based on previous studies (e.g., King et al., 2018) on the trust in and perceived credibility of different institutions at the time of epidemics, our first hypothesis was that perceived trust and credibility would be highest for medical doctors, scientists, and medical institutions. At the same time, we expected that the trust and perceived credibility of politicians and political institutions would be lower, as previous research has shown that people tend to trust them less (King et al., 2018) and that epidemics can have a further negative impact on these perceptions (Bangerter et al., 2012; Yeung et al., 2017).

The cases of countries where COVID-19 spread rapidly are telling in how important it is for people to know (and apply) basic protective measures in order to contain the spread of the disease, especially in the critical period after the first few confirmed cases, when the possibility of containment is the highest. Hence, it seems important that crucial information about the current pandemic is communicated by credible sources – for example, health care professionals and scientists (e.g., epidemiologists, virologists). In the present study, we were thus interested in how initial perceptions and responses were formed within hours of the first confirmed case of COVID-19 in Slovenia. We also wanted to know how these responses related to the perceived trust and credibility of information sources available to the population.

The first case of COVID-19 in Slovenia was confirmed relatively late, on March 4 2020, after the disease had already spread to all neighboring countries, most notably Italy. However, the media had been covering the global spread of the disease extensively since January of that year (e.g., the online media outlet with highest reach in Slovenia published the first major article on January 9th). We thus looked into how people gathered information about the COVID-19 outbreak, how they rated the credibility of different informational outlets at the time, and what their emotional response to the threat was. Previous studies have shown that people's anxiety tends to increase sharply at the beginning of an epidemic (Cheng and Cheung, 2005). For this reason, we expected that general feelings of concern and fear of contracting COVID-19 would increase significantly after the first confirmed case of COVID-19 in Slovenia. At the same time, we were interested in the size of the change, seeing as the time span between our two points in time was only between 2 and 4 days.

Furthermore, as Slovenia was largely unaffected by previous epidemics such as SARS and H1N1, this could have resulted in lowered public awareness and knowledge about dealing with and containing the spread of infectious diseases. Thus, we were also interested in how informed people felt about the epidemic and self-protective measures and how the perceived credibility of information sources is linked to emotional responses, knowledge of self-protective behaviors, and adherence to them. Specifically, we were interested in who crucial information should be relayed by in order to boost self-protective behavior and support the effort of officials and medical professionals to contain the spread of the virus. As mentioned above, previous studies have shown that higher trust and perceived credibility are positively associated with self-protective behavior (Liao et al., 2010; Etingen et al., 2013). At the same time, it was found that trust in government and medical institutions helped reduce anxiety and that negative emotions are associated with self-protective

behavior (Cheung and Tse, 2008). In addition, studies found relationships between people's trust in institutions and their subjective knowledge of the disease at the time of the epidemic (Freimuth et al., 2014), alongside some evidence of a link between subjective knowledge and self-protective behavior. However, this link did not appear to be consistent (Leung et al., 2005).

In literature, there is no consensus on the relationship between trust and credibility in the realm of health-related information seeking (Sbaffi and Rowley, 2017). Though correlation has been proposed, the distinctions made in the literature are unclear. In the present research, we thus focused on both. We specifically stressed the perceived credibility of information sources related to the COVID-19 pandemic, as well as the general trust in institutions that were involved in spreading information about COVID-19 in Slovenia and abroad. We proposed and tested two structural models linking each of the constructs to self-protective behavior, which was mediated by the effect of negative emotions and subjective knowledge about the disease.

MATERIALS AND METHODS

Participants

In total, 4,000 people have responded to the survey. Of those, 2,424 gave their informed consent and 1,722 completed the survey (81.7% were women, eight stated their gender as other and were excluded from gender-differences analyses). Before data analysis, four participants were disregarded due to their age (under 18), which prevented them from providing valid consent. The analysis was therefore performed on a sample of 1,718 participants. The average age of 1,718 participants was between 18 and 81 (M = 37.95, SD = 13.76); they varied in terms of their education and resided in all statistical regions of Slovenia (most lived in the central region, which is also the most populated), but were slightly younger and more educated than Slovenian population (SiStat, 2020a,b). See **Supplementary Table 1** for a detailed demographic description of the sample.

Study Design and Procedure

Data collection for this cross-sectional study started within 48 h of the first confirmed COVID-19 case in Slovenia. The survey was hosted on a local survey hosting platform 1ka.si that complies with national and European General Data Protection Regulation, guaranteeing participants' anonymity.

The survey was posted on the department's social media accounts and targeted residents of Slovenia over the age of 18 (the age of consent). In addition, the link was shared on forums and circulated through the institute's and researchers' own mailing lists using a snowball sampling method (the survey was shared by more than 80 individuals).

As the goal of the study was to capture the public's first impressions of the outbreak, the data were collected over the weekend on March 7th and 8th – still within the first 100 h after the first case. The time window was necessary to ensure the homogeneity of data, while minimizing the influence of concurrent developments. For example, the Slovenian National Security Council was called in session on March 9th, and two of the three public universities in Slovenia suspended their operation, thereby justifying the adequacy of our decision.

Measures

The measures presented were a part of a battery of tests. We assessed the participants' perceptions of the situation, their emotional and behavioral responses to the situation (i.e., self-protective behavior), their perceived subjective knowledge and trust, as well as the perceived credibility of different sources of information (all measures are presented in the **Supplementary Material**). We also collected demographic information (age, gender, educational level, and region of residence). Additionally, we assessed the participants' objective knowledge about COVID-19 by utilizing information available on the official website of the National Institute of Public Health (NIPH). However, seeing as during this period official information was rapidly changing, we decided to omit the scores from further analyses, as it was unclear which of the answers were "correct" at the time of responding.

The selection of measures was guided by our research questions and based on both the measures used in previous epidemics, as well as the review of fast-report articles on the COVID-19 epidemic that were available at the time of planning the study. All measures were translated and, when needed, adapted to the Slovenian context of the COVID-19 epidemic using the standard forward-back translation method (two Slovenian native speakers performed independent translations from English to Slovenian; back translation to English was conducted by an expert in the language). As no psychometric data were available for used measures, we conducted a series of analyses to test their validity (see "Statistical Methods").

Emotional responses to the situation were assessed using 11 items, with participants indicating their agreement on a five-point scale. The items, relevant to the viral outbreak, were selected and adapted from various psychological tools for assessing anxiety (e.g., *Following the information about the coronavirus outbreak makes me feel nervous.*; Beck et al., 1988; Spitzer et al., 2006) and rumination (e.g., *Because of what is happening in connection to the coronavirus outbreak, I find it hard to concentrate on my work.*; Nolen-Hoeksema and Morrow, 1991).

Additionally, five items were included to assess the perception of the COVID-19 outbreak (e.g., *How do you rate the severity of COVID-19 disease today?, How did you rate the severity of COVID-19 disease before the coronavirus appeared in Slovenia?*). They measured the degree of concern and fear of contracting the disease, perceived severity, perceived possibilities of containing the spread of COVID-19, and the amount of thinking about the disease using a six-point scale corresponding to the question (e.g., *1 – not severe at all, 6 – very severe*). Those items were adapted from Li et al. (2020). As the study had a cross-sectional design, participants were asked to assess their perceptions retrospectively (before the first confirmed case of COVID-19 in Slovenia), and their current perceptions (after the first confirmed case).

Participants' perceived subjective knowledge about COVID-19, about symptoms and about self-protective behaviors was measured using three items. Participants indicated their agreement on a five-point scale (e.g., *I think I know the symptoms*

and the course of the COVID-19 disease). Actual engagement in self-protective behavior was assessed using 10 items with a three-point scale (*does not apply to me*, *partly applies to me*, and *totally applies to me*). Different self-protective behaviors (e.g., *more frequent hand washing*, *less frequent touching of one's face*, *avoiding crowds*, etc.) were identified using guidelines posted on the NIPH and WHO websites. We also included some behaviors that are not efficient in preventing the spread of the virus (e.g., *buying a supply of food or health supplies*), but were identified by NIPH as frequent among the population.

Following previous studies on health-related self-protective behavior in the realm of vaccination (Gust et al., 2005; Jolley and Douglas, 2014), we assessed the participants' overall trust in different institutions (*How would you rate your trust in the following people and institutions in general, unrelated to the reporting on coronavirus: politics, Ministry of Health, NIPH, the health care system, general practitioners, scientists, mass media and social media*). We also assessed the perceived credibility of information about the COVID-19 outbreak received from different spokespersons in the media (*Please rate how credible you find the information about the coronavirus that you received in the media from: Ministry of Health representatives, NIPH representatives, Medical chamber representatives, medical doctors, scientists, journalists*). Both were assessed using a five-point scale. Participants were also asked where they gather information about COVID-19 (*TV, radio, newspapers, online news portals, social media*).

Statistical Methods

First, data were screened for missing variables – between 0 and 1.9% of data was missing with observed variables. In analyses where groups were compared or single-item measures were used, the participants with missing data were excluded. When computing scales, missing values were imputed with the item medians. In confirmatory factor analyses and structural equation modeling, case-wise maximum likelihood estimation was applied. Data were analyzed in R using psych (Revelle, 2019), WRS2 (Mair and Wilcox, 2019), and lavaan (Rosseel, 2012) packages. The reliabilities of the scales were assessed using Revelle's omega and in scales, comprising two items, using Spearman–Brown coefficient which is more appropriate for such cases (Ayearst and Bagby, 2010; Eisinga et al., 2012).

As items assessing emotional responses had been drawn from various measures, we ran an exploratory factor analysis (EFA), using half of the sample (n = 853) to explore the homogeneity of collected data. Since various solutions were not clear, we retained only one factor, which explained 40% of the variance, and included items measuring degrees of nervousness, concern, feelings of hopelessness, and problems with concentration. The factor was then tested using confirmatory factor analysis (CFA) with the second half of the sample (n = 854), which supported the proposed solution [MLR estimator, $\chi^2(2) = 15.83$, $p < 0.001$, CFI = 0.98, TLI = 0.94, RMSEA = 0.09 (95% CI = 0.05–0.13), SRMR = 0.03; see **Supplementary Table 2** for factor loadings]. The resulting scale had sufficient reliability ($\omega = 0.73$).

Using the same procedure, a three-factor solution for self-protective behaviors was supported: personal hygiene (frequent hand washing, not touching one's face, $\rho = 0.55$), social contacts (avoiding close contact, avoiding any contact, not leaving one's home, not attending mass events, not traveling, $\omega = 0.91$), and the preparatory behaviors factor (stocking on food and supplies, stocking on health supplies, $\rho = 0.47$). See **Supplementary Table 3** for factor loadings.

To test whether the perceived trust in different representatives and institutions and perceived credibility of information relayed by different spokespersons was affected by an underlying perceptual clustering (e.g., reporting less trust in all institutions perceived as political), we again ran – in each case – EFA followed by CFA. Based on parallel analysis, the EFA (minimum residual factoring method and oblimin rotation) for the perceived trust suggested the retention of three factors, explaining 59% of the variance in scores. The three factors are public institutions (politics in general, the Ministry of Health, the National Institute of Public Health, $\omega = 0.87$), professionals (doctors, the healthcare system as a whole, scientists, $\omega = 0.78$), and media (traditional mass media and social media, $\rho = 0.50$). Subsequent CFA exhibited adequate fit [MLR; $\chi^2(16) = 88.96$, $p < 0.001$, CFI = 0.97, TLI = 0.95, RMSEA = 0.08 (95% CI = 0.06–0.10), SRMR = 0.04, see also **Supplementary Table 4**].

EFA for the perceived credibility of information – ran with the same specifications as above – suggested a two-factor solution. The perception of the credibility of information sources might be explained by two factors – perceived as professionals (doctors, scientists, and medical chamber representatives, $\omega = 0.85$) and perceived as non-professionals/officials (journalists, representatives of Ministry of Health, representatives of NIPH, $\omega = 0.83$) – these account for 66% of the variance in scores. Again, CFA supported the proposed solution [MLR; $\chi^2(7) = 40.54$, $p < 0.001$, CFI = 0.98, TLI = 0.96, RMSEA = 0.09 (95% CI = 0.07–0.12), SRMR = 0.04, see also **Supplementary Table 5**].

Ethics Approval Statement

All procedures performed in studies that involved human participants were in accordance with the ethical standards of the institutional research committee (Ethics Commission of the Faculty of Arts, University of Ljubljana, no. 181-2020) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

RESULTS

The participants reported some degree of concern and fear of contracting COVID-19 even before the first Slovenian case of COVID-19 was confirmed. The reported severity of the disease and perceived possibilities of containing its spread before it reached Slovenia were rated at about the midpoint (see **Table 1**), with females being slightly more afraid and perceiving the disease as more severe.

Within 2 days of the first confirmed Slovenian case of COVID-19, however, our participants reported a significant change in all the assessed perceptions. During this period, they were more

TABLE 1 | Mean scores and gender differences for perceptions of different aspects of COVID-19 before and after the first confirmed case with changes in perceptions after the first confirmed case in Slovenia.

	Before the first case in Slovenia				After the first case in Slovenia				Change after the first case	
	M_{male} (SD)	M_{female} (SD)	*W*	*p*	M_{male} (SD)	M_{female} (SD)	*W*	*p*	*t*(*df*)*	*d*
Worrying	2.25 (1.36)	2.32 (1.35)	199,050	0.26	3.01 (1.52)	3.36 (1.50)	178,200	< 0.001	−31.35 (1014)	0.47
Severity	3.10 (1.46)	3.31 (1.39)	186,540	0.01	3.42 (1.45)	3.77 (1.38)	178,760	< 0.001	−16.95 (1014)	0.22
Containing	3.23 (1.59)	3.22 (1.50)	206,460	0.97	3.06 (1.63)	3.04 (1.59)	205,200	0.89	4.91 (1012)	0.08
Fear of contracting	2.07 (1.31)	2.31 (1.38)	184,540	0.01	2.67 (1.52)	3.22 (1.60)	164,790	< 0.001	−26.82 (1013)	0.40
Thinking	2.94 (1.48)	2.92 (1.44)	207,640	0.90	3.85 (1.55)	4.03 (1.51)	192,450	0.07	−31.53 (1015)	0.49

*Due to non-normal distribution of the variables, Mann–Whitney test was used for calculating gender differences and Yuan–Welch test for repeated measures was used for calculating changes after the first confirmed case. All items were rated on a five-point scale. *All ps < 0.001.*

concerned and afraid, thinking more about the disease, perceived it as more severe, and rated the chances of its containment as worse, regardless of gender (see **Table 1**). However, gender differences emerged in the extent of the change – females reported, on average, more than one whole point of change in concern (see **Table 1**). The presence of negative emotions was also higher in females (M = 2.71, SD = 0.97) than males [M = 2.54, SD = 0.95; t(447, 03) = -2.84, p = 0.005]. At the same time, females reported higher subjective knowledge of self-protective behavior and exhibited more self-protective behavior than males (see **Table 2**).

TABLE 2 | Mean scores and gender differences for subjective knowledge about self-protective behaviors and and engagement in self-protective behaviors.

	M_{male} (*SD*)	M_{female} (*SD*)	*W*	*p*
Subjective knowledge	4.08 (1.01)	4.25 (0.91)	189,650	0.01
Personal hygiene	2.08 (0.64)	2.28 (0.60)	172,400	< 0.001
Social contacts	1.65 (0.59)	1.79 (0.58)	178,400	< 0.001
Preparing	1.32 (0.54)	1.43 (0.57)	185,330	< 0.001

Items were rated on a three-point scale (1, not at all; 2, partly; 3, completely); due to non-normal distribution of the variables, Mann-Whitney test was used.

In terms of gathering information about COVID-19, most participants used online news portals as their source (74.1%), followed by television news (65.7%) and social media (61.0%). Around half (55.3%) of the participants used the official webpage of the NIPH, where all official information is gathered in the style of WHO. Lastly, radio and health care professionals were the source of information for a minority of the participants (27.7 and 11.0%, respectively).

Unrelated to the current COVID-19 outbreak, people generally trusted scientists the most, followed by their general practitioners. The health care system and NIPH received midline scores, while politics and social media were rated the lowest (see **Table 3**). Similarly, participants viewed the information they received about COVID-19 from scientists and doctors as most credible, while information relayed by journalists, representatives of the Ministry of Health (MoH) and Medical chamber was perceived as less credible (see **Table 3**). There were no significant gender differences in perceived credibility, and only small differences in trust in politics (W = 225,660, p = 0.02) and scientists (W = 225,220, p = 0.02); in both cases, males reported a slightly higher level of trust (0.18 and 0.12 points, respectively). Moreover, we observed a notable correlation between general trust and the perceived credibility of information

TABLE 3 | Overall trust in various institutions and perceived credibility of information recieved by various sources.

	N	*M*	*SD*	Mdn	Skew	Kurt	SE
Trust							
Politics	1,701	1.96	1.06	2	0.91	0.12	0.03
Ministry of Health	1,703	2.75	1.18	3	0.07	−0.83	0.03
NIPH	1,702	3.15	1.29	3	−0.25	−0.97	0.03
Health care system	1,698	3.00	1.15	3	−0.16	−0.71	0.03
GPs	1,699	3.60	1.15	4	−0.57	−0.40	0.03
Scientists	1,697	3.81	1.07	4	−0.85	0.34	0.03
Mass media	1,698	2.38	1.01	2	0.30	−0.40	0.02
Social media	1,697	1.99	0.90	2	0.66	0.11	0.02
Credibility							
Journalists	1,694	2.81	1.01	3	−0.03	−0.34	0.02
MoH representatives	1,693	3.16	1.10	3	−0.17	−0.59	0.03
NIPH representatives	1,693	3.43	1.18	4	−0.41	−0.65	0.03
Medical chamber representatives	1,689	3.18	1.11	3	−0.20	−0.55	0.03
Medical doctors	1,687	3.52	1.04	4	−0.43	−0.22	0.03
Scientists	1,691	3.86	1.00	4	−0.77	0.30	0.02

received from MoH ($r = 0.71$, $p < 0.001$), NIPH ($r = 0.80$, $p < 0.001$), and medical doctors ($r = 0.54$, $p < 0.001$). Further correlation was found between trust in the health care system and the perceived credibility of medical chamber representatives ($r = 0.58$, $p < 0.001$) and medical doctors ($r = 0.57$, $p < 0.001$), between trust in science and the perceived credibility of scientists ($r = 0.67$, $p < 0.001$), and finally between trust in mass media and the perceived credibility of journalists in reporting about COVID-19 ($r = 0.63$, $p < 0.001$).

Two structural models were tested using R package lavaan (Rosseel, 2012) to explore how trust and perceived credibility of news sources are linked to self-protective behavior (see **Figure 1** for the model, containing credibility, and **Supplementary Figure 1** for the model containing trust scores). The model with credibility scores exhibited good fit to the data. It suggested that the perceived credibility of news relayed by medical professionals and scientists is linked to lower negative emotions and higher subjective knowledge of self-protective behaviors. Subjective knowledge is in turn linked to higher engagement in self-protective behaviors, and so is the experience of negative emotions. The model explained roughly 9% of personal hygiene, 8% of preparatory, and 12% of social contact behavior (see **Figure 1**).

DISCUSSION

One of our research interests was the impact of the first confirmed case of COVID-19 in Slovenia on the general level of concern and fear of contracting the virus. We expected that the general feeling of concern and fear of contracting COVID-19 would be consistent with previous research (e.g., Cheng and Cheung, 2005) and increase significantly after the first confirmed case. In line with this, our results have shown that within 2 days of the first confirmed case, participants reported a significant change in all perceptions assessed. The participants reported that they were now more worried and anxious, thought more about the disease, perceived it as more severe and assessed the chances of containing the disease as worse than before the first confirmed Slovenian case of COVID-19. As this was a cross-sectional study, perceptions for the time before the first Slovenian case of COVID-19 were reported retrospectively. This may have lowered the accuracy of reporting, as participants, influenced by their concurrent emotional state, may have given biased reports. However, the length between our points in time was short (between 2 and 4 days), so the extent of the possible bias is likely not great.

Most participants searched for information online, either through mass or social media. At the same time, they exhibited relatively low levels of trust in either of these sources. The same goes for politicians and public institutions. This is consistent with our hypothesis that the trust in and perceived credibility of politicians and political institutions will be lower, as previous research has shown that people tend to trust them less (King et al., 2018). In addition, studies from various countries have shown that this trust tends to decrease even further in times of epidemics (Bangerter et al., 2012; Yeung et al., 2017). Interestingly, NIPH was clustered perceptually by the participants to the same factor as politics and exhibited relatively low levels of trust and perceived credibility. This is especially problematic, as measures they propose could be perceived as less useful, feasible, and worth following (Teasdale and Yardley, 2011), while they should in theory be the most credible and professionally sound. Conversely, information provided by medical professionals and scientists was rated as most credible, suggesting that crucial information should perhaps be communicated by them.

This is especially important in the early phases of the outbreak, when medical staff is not yet preoccupied with caring for people who have contracted the disease, and when self-protective measures are most efficient (Xiao et al., 2015; Lin et al., 2018). Moreover, our results support previous findings (Etingen et al., 2013) about the relation between perceived credibility and behavioral actions. In summary, future policy change should include the optimization of communication channels by emphasizing the role of professionals in communication. Of special importance is online communication, where people gather most information about the spread of the disease and learn of various protective measures. Specifically, in the case of NIPH, by designing a professional body, the officials should underline their professional credentials when appearing in media, increase their presence on social media, and include the voice of medical practitioners in their press releases. In later stages, however, the relaying of information could be passed to scientists relevant to the situation.

Previous research (e.g., Cheung and Tse, 2008; Liao et al., 2010; Etingen et al., 2013; Freimuth et al., 2014) has shown significant relationships between perceived credibility and trust, emotions, subjective knowledge, and self-protective behavior. In our study, we proposed and tested two structural models that explain the role of perceived credibility of information sources and perceived trust in various institutions that are engaged in the communication related to the epidemic. The model that exhibited better fit was the proposed model, which linked the perceived credibility of information sources to engagement in self-protective behaviors via negative emotions and perceived knowledge of self-protective measures. This suggests that information relayed by credible sources can lead to lower levels of negative emotional responses, which can be important as epidemics are emotionally taxing. Even though the variances in self-protective behavior scores explained by our model are modest, even a small boost in engagement in self-protective behaviors could go a long way in viral epidemics like the one we are faced with today and help lower the number of infected people (aka flattening of the curve).

The structural model, which included trust in various institutions, exhibited worse fit. The reason for this could partly be that trust was assessed in general, whereas credibility of information sources was assessed directly in connection to the epidemic situation. Even though trust and credibility in our study were strongly linked with each other, the difference between assessing them could be the reason for the lower predictive value of the model including trust.

The research was conducted in the early stages of the epidemic. At that point, emotional responses might not have been as severe as in the later stages. Additionally, the perceived importance

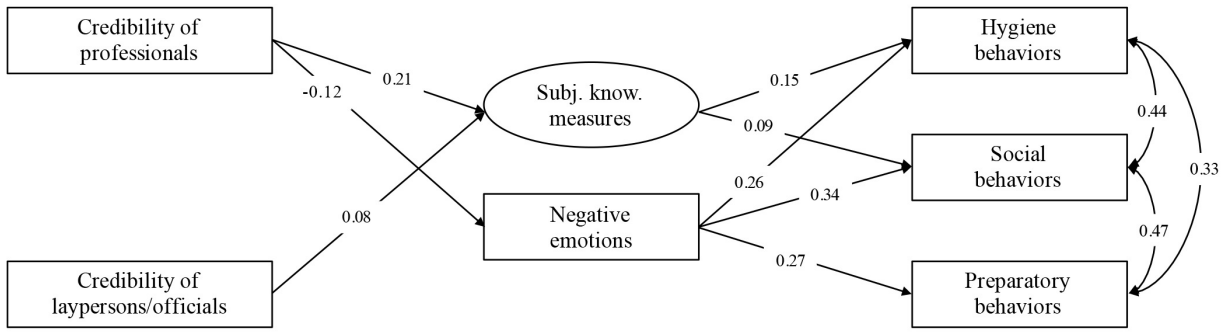

FIGURE 1 | Model for predicting the adherence to self-protective behaviors from perceived credibility of informational sources via subjective knowledge of proposed measures and negative emotions [$\chi^2(9) = 49.94$, $p < 0.001$, CFI = 0.97, TLI = 0.93, RMSEA = 0.06 (95% CI = 0.04–0.07), SRMR = 0.03, BIC = 17080.69; MLR estimator]; all paths significant at $p < 0.05$.

of adhering to protective measures, along with the intensity of reporting on said measures, could be much lower, which could result in lower correlations. However, as the study was only conducted in Slovenia, it should be perceived as a case study. The results may not be easily transferable to other societies, especially those where governments receive high levels of trust or use different means of informing the public. In future studies, our findings should thus be cross-culturally validated, and explored in later stages of the epidemic.

Furthermore, our study has some limitations in terms of sampling – the sample was slightly younger than the average age of the Slovenian population (43.5 years; SiStat, 2020b), and the percentage of people with tertiary education was higher than the national average (SiStat, 2020a). This, coupled with the fact that data were collected online, could mean that the sample is biased in terms of information literacy and stated sources of information. The study could also not reach some of the most vulnerable groups in the current epidemic (e.g., the elderly). However, during the epidemic, other means of data collection are less feasible, and specific groups likely differ from the general population in terms of their perceptions, responses, but also needs (e.g., stricter protective measures). While females were also overrepresented in the sample, they were similar to males in terms of demographics, and no differences were observed in perceived trust and credibility of information sources. As the context of the study deviated significantly from the everyday, measures used were not validated beforehand, which could cause concern in terms of validity. While the reliabilities of used scales were adequate (Ayearst and Bagby, 2010), especially the scales comprising two items could be expanded with additional items in order to ensure higher confidence in obtained scores. Besides cross-cultural validation and comparisons of perceived credibility of informational sources, and key officials in pandemic situations, more detailed qualitative or mixed-methods studies would also contribute to better understanding of collective perceptions and adherence to self-protective measures.

Effective health communication – or even communication that is perceived by people to be effective in terms of credibility – remains crucial in adopting protective measures and fighting misinformation. This conclusion has several potential implications for health communication practice. In early stages of communication, medical professionals and scientists have a higher credibility potential, suggesting they should be intensively included in public communication and disseminate important health-related information and advice on proper protective measures. Moreover, our results suggest that such communication could be effective in positively reframing the pandemic situation. It would serve as a protective factor in an emotionally taxing environment, where isolation measures have left people without interpersonal contact, uncertain and afraid as to what the future might hold for them, in terms of both health and their financial status.

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 Ethics Commission of the Faculty of Arts, University of Ljubljana (No. 181-2020). Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

KH and KB conducted the literature review. ŽL conducted the analyses and interpreted the data. ŽL and KH drafted the manuscript. KB provided the critical feedback. All authors contributed to study design, data collection, and read the final version of the manuscript and approved it for publication.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.01846/full#supplementary-material

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BRIEF RESEARCH REPORT
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Social Distancing and Stigma: Association Between Compliance With Behavioral Recommendations, Risk Perception, and Stigmatizing Attitudes During the COVID-19 Outbreak

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Introduction: Following behavioral recommendations is key to successful containment of the COVID-19 pandemic. Therefore, it is important to identify causes and patterns of non-compliance in the population to further optimize risk and health communication.

Methods: A total of 157 participants [80% female; mean age = 27.82 years (*SD* = 11.01)] were surveyed regarding their intention to comply with behavioral recommendations issued by the German government. Latent class analysis examined patterns of compliance, and subsequent multinomial logistic regression models tested sociodemographic (age, gender, country of origin, level of education, region, and number of persons per household) and psychosocial (knowledge about preventive behaviors, risk perception, stigmatizing attitudes) predictors.

Results: Three latent classes were identified: *high compliance* (25%) with all recommendations; *public compliance* (51%), with high compliance regarding public but not personal behaviors; and *low compliance* (24%) with most recommendations. Compared to high compliance, low compliance was associated with male gender [relative risk ratio (*RRR*) = 0.08 (0.01; 0.85)], younger age [*RRR* = 0.72 (0.57; 0.93)], and lower public stigma [*RRR* = 0.21 (0.05; 0.88)]. Low compliers were also younger than public compliers [*RRR* = 0.76 (0.59; 0.98)].

Discussion: With 25% of the sample reporting full compliance, and 51% differing in terms of public and personal compliance, these findings challenge the sustainability of strict regulatory measures. Moreover, young males were most likely to express low compliance, stressing the need for selective health promotion efforts. Finally, the positive association between public stigma and compliance points to potential othering effects of stigma during a pandemic, but further longitudinal research is required to examine its impact on health and social processes throughout the pandemic.

Keywords: COVID-19, stigma, public health, risk communication, latent class analysis, infection prevention, cross-sectional

INTRODUCTION

The current outbreak of the coronavirus SARS-CoV-2 and the associated disease, COVID-19, is transfixing the world with over 2 million confirmed infections by April 16, 2020[1]. In addition to its physical threat, this outbreak also causes psychological distress, anxiety, and depression (Wang et al., 2020). Moreover, research on the coronavirus-associated SARS pandemic in 2002/2003 points to potentially long-lasting adverse consequences, such as depression, stigmatization, diminished quality of life, and post-traumatic stress (Ko et al., 2006; Lee et al., 2006; Siu, 2008; Gardner and Moallef, 2015).

To contain infectious diseases like COVID-19, experts and government officials alike recommend a series of preventive behaviors, such as hand hygiene, and avoidance behaviors, such as social distancing or (voluntary) quarantine (e.g., Glass et al., 2006; Durham and Casman, 2012; Ding, 2014; Karimi et al., 2015; Weston et al., 2018; Lewnard and Lo, 2020). Previous simulations and current reports affirm that a combination of all strategies has the greatest success rates in containing the disease (Kelso et al., 2009; Kupferschmidt and Cohen, 2020). And yet, successful containment depends on adequate public compliance. While predictors of compliance can be explicated via a behavior theory (e.g., the theory of planned behavior; Ajzen, 1991), and they are well-documented for certain health behaviors (e.g., adherence in chronical illness; Rich et al., 2015), far less is known about compliance in pandemics.

To date, several studies have identified perceived personal risk (i.e., susceptibility, anticipated severity, and anticipatory worry) and knowledge of adaptive behaviors as facilitators of compliance (c. Tang and Wong, 2003, 2005; Cheng and Ng, 2006; Leppin and Aro, 2009; Kwok et al., 2020), although an explicit theoretical framework is often missing (Bish and Michie, 2010). Moreover, barriers to adherence (i.e., non-compliance) have received less attention presumably due to preventive and avoidance behaviors being very easy to carry out.

In a review of 26 studies on preventive behaviors in pandemics (Bish and Michie, 2010), however, compliance rates varied greatly, for example, between 4% for wearing a mask, 41.3% for "one or more specific actions" (Brug et al., 2004), and up to 95% for quarantine (Blendon et al., 2004). Despite the variety of illnesses, time frames, populations, and research methods in these studies, a general implication seems to be that a substantial proportion of the population does not adhere to the recommended behaviors. Composite measures of preventive behaviors revealed even lower compliance: 30.7% of a representative sample in Singapore practiced six or more out of eight (Quah and Hin-Peng, 2004), 48.7% in Hong Kong practiced five or more out of seven (Leung et al., 2003), and 37.8% in England practiced one or more out of three measures (Rubin et al., 2009).

In this respect, a qualitative study on (non)compliance with SARS quarantine identified ethical (e.g., civic duty), legal (e.g., monetary sanctions), and social (e.g., peer pressure) reasons to publicly comply with quarantine, while acceptance of quarantine differed markedly within households and private environments (Cava et al., 2005). Another study also identified practical issues (e.g., disposal of used tissues), selfishness, and responsibility shift (Morrison and Yardley, 2009) as core barriers to compliance. Responsibility shift refers to the belief that infected persons are particularly responsible for (not) spreading the illness, thus protecting others, whereas healthy persons are responsible for protecting themselves from becoming infected, leading to a shift in personal priorities in protective behaviors depending on one's infection status.

Moreover, sociodemographic variables gender and age (i.e., male, younger age) consistently predicted non-compliance (Leung et al., 2003; Tang and Wong, 2003). This might be connected to a generally lower risk perception, particularly a lower perceived susceptibility, in young males (De Zwart et al., 2009). Regarding educational attainment, higher levels of education have been discussed as barriers to as well as facilitators of behavioral compliance in different populations (Leung et al., 2003; Tang and Wong, 2005; De Zwart et al., 2009; Bish and Michie, 2010).

To capture the existing heterogeneity in (non)compliance, this study utilizes a latent class approach (Collins and Lanza, 2010). Latent classes are often used to analyze behavioral patterns in non-communicable diseases, such as substance use (e.g., Tomczyk et al., 2015, 2016). However, to our knowledge, only one study applied latent class analysis to population behaviors following a novel virus outbreak [i.e., influenza A (H7N9)] in Hong Kong (Liao et al., 2015), despite the method's statistical advantages in modeling behavioral patterns (e.g., flexibility, integration of measurement error). Liao et al. (2015) identified three latent classes of behavioral compliance, namely, moderate hygiene compliance (moderate personal hygiene, low avoidance behaviors), good hygiene compliance (high personal hygiene, low avoidance), and vigilance (high hygiene and avoidance). Moderate hygiene compliance was the largest class (about 50% of the sample) and was significantly associated with male gender, lower age, poor education, and lower risk perception, thus stressing the need for selective prevention and health promotion.

Finally, the current study also focuses on stigmatizing attitudes in the context of compliance due to the impact of stigma on fear, psychosocial stress, and social rejection during infectious diseases, such as SARS (Sim and Chua, 2004; Lee et al., 2005; Ko et al., 2006; Siu, 2008). Stigmatization can occur at different levels (e.g., individual, social, structural) and is connected to social identity processes (Tajfel and Turner, 1986; Bandura, 1998, 2004; Link and Phelan, 2001), where in-groups (i.e., individuals or groups that a person identifies with) and out-groups (i.e., individuals or groups a person does not identify with) are constructed based on certain characteristics (e.g., profession, illness symptoms). Out-groups are subsequently devaluated, for instance, by being labeled irresponsible or dangerous. This devaluation can further lead to verbal discrimination or interpersonal violence (Parker and Aggleton, 2003; Corrigan et al., 2004). Moreover, public stigma comprises support for a restriction of public opportunities (e.g., vote, utilize health care) for the devaluated out-group, in this instance, symptomatic and/or

[1]https://coronavirus.jhu.edu/

infected persons. In fact, survivors of the SARS epidemic experienced blame and social rejection (Lee et al., 2005; Mak et al., 2006), while persons of Asian descent reported victimization, regardless of their personal infection status (Zheng et al., 2005). These experiences of being blamed and ostracized oftentimes outlasted the epidemic and were associated with continued psychosocial stress (Brug et al., 2004; Siu, 2008; Jiang et al., 2009). In addition, an increase in influenza infections also corresponded to an increase in stigmatizing attitudes (e.g., a lack of trust, increased hostility) in previous research (Williams and Gonzalez-Medina, 2011).

Furthermore, qualitative studies argue that anticipated stigma might even prohibit personal preventive behaviors during infectious diseases, such as wearing masks, to avoid future stigmatization (Siu, 2008; Jiang et al., 2009); this hypothesis is supported by cross-sectional, quantitative research (Leppin and Aro, 2009). Similarly, perceived differences in responsibility for personal (healthy persons) and public protection (infected persons) during a pandemic (Morrison and Yardley, 2009) might reinforce stigma-associated social identity processes and increase the salience of group differences.

In sum, stigmatization might differentially affect behavioral compliance. On the one hand, it might be beneficial from a prevention perspective by fostering social distancing toward and isolation of infected people, primarily by stigmatizing persons and defining them as a relevant out-group (so-called *othering*; see Deacon, 2006). On the other hand, it might reduce compliance with official recommendations among stigmatized and/or infected persons due to fear of social isolation, stress, or discrimination (Williams and Gonzalez-Medina, 2011; Smith and Hughes, 2014). Therefore, to investigate compliance and the role of stigmatization during pandemics, this exploratory study aims to:

1. Examine patterns of intentions to comply with behavioral recommendations to contain the COVID-19 pandemic in the German population via latent class analysis.
2. Inspect the role of stigma in non-compliance while considering sociodemographic differences, risk perception, and knowledge of adaptive behaviors.
3. Explore intercultural similarities and differences of compliance by focusing on the German population, whereas previous research mostly focused on Asian populations.

METHODS

Sample

Via an online survey, a community sample of 157 German adults [80% female; M (SD)$_{age}$ = 27.82 (11.01)] provided information about their knowledge of preventive measures, risk perception, intentions to comply with official behavioral recommendations and guidelines as well as their stigmatizing attitudes toward people suffering from COVID-19. Participants received gift vouchers (€5) as incentives. The survey was conducted via convenience sampling between March 13 and March 27 by placing online advertisements on social media, for instance, on Facebook. During this time, far-reaching social isolation measures were implemented in Germany, for instance, restricting public meetings to two people (except for households) and establishing guidelines for a safety distance of 1.5–2.0 m in public spaces. In addition, behavioral recommendations on personal hygiene and avoidance behaviors were repeatedly and consistently issued by the government. The study procedure included informed consent in alignment with the Declaration of Helsinki and received ethical approval by a local ethics committee (BB 169/18).

Measures

Sociodemographic data comprised age, gender [1 (*female*), 2 (*male*)], country of origin [0 (*Germany*), 1 (*other*)], level of education [0 (*lower secondary education*), 1 (*higher secondary education*, i.e., university entry level), 2 (*tertiary education*, e.g., bachelor's degree)], region [0 (*rural*, i.e., up to 100,000 inhabitants), 1 (*urban*, i.e., more than 100,000 inhabitants)], and number of persons in one's household [continuous; recoded as 1 (*1*), 2 (*2*), 3 (*3 or more*)]. For analysis purposes, categorical variables were dummy-coded.

Measures of stigmatizing attitudes were adapted from previous research on mental health stigma, assessing support for discrimination (Schomerus et al., 2007, 2019) with three items ("Persons with COVID-19 should not be allowed to hold public office," "Persons with COVID-19 should not be allowed to have a driver's license," "If persons with COVID-19 do not consent to medical treatment, they should receive compulsory treatment"), and blame (Corrigan et al., 2006; Schomerus et al., 2019) with four items (e.g., "Persons with COVID-19 are to blame for their problems") rated on a five-point scale each, from 1 (*don't agree at all*) to 5 (*agree completely*). Support for discrimination (Cronbach's $\alpha = 0.71$) and blame ($\alpha = 0.73$) showed satisfactory internal consistency.

Risk perception comprised two items representing cognitive and affective aspects of perceived risk, namely, perceived susceptibility ("How likely will you become infected?"; 0 to 100%) and anticipated fear ["How afraid would you feel if you became infected?"; 1 (*not at all*) to 5 (*very*)].

Intentions to comply with official recommendations were assessed by asking participants how likely [1 (*not at all*) to 5 (*very*)] they would follow the following nine recommendations: (1) covering mouth and nose with flexed elbow or tissue when coughing or sneezing; (2) avoid handshakes; (3) avoid touching one's face (i.e., eyes, nose, and mouth) as much as possible; (4) dispose of used tissue immediately and securely; (5) frequent ventilation; (6) increased hand hygiene; (7) stay at home when sick/symptomatic; (8) avoid personal contact to symptomatic persons; (9) avoid mass events. Since strictly following these recommendations is the safest way to contain further spreading of the infection, we recoded items to reflect likelihood of compliance [1 (*very high likelihood*), 0 (*other*)]. These nine indicators were then subjected to latent class analysis. In addition, a single item measuring subjective knowledge of adaptive behaviors was rated from 1 (*very low*) to 5 (*very high*). All measures are listed in **Supplementary Table S1**.

Statistical Analysis

Following an inspection of missing data and descriptive data analysis, latent class models were computed to examine patterns of (non)compliance in the population. Subsequent multinomial logistic regression models inspected sociodemographic and psychosocial predictors of compliance patterns. Descriptive data analysis was performed with Stata 15.1 (StataCorp, 2017), and latent class models and multinomial logistic regression models were computed with Mplus 7.4 (Muthén and Muthén, 1998–2015). All analyses were based on $\alpha = 0.05$.

We estimated latent class models of compliance via robust maximum likelihood estimation with 2,000 sets of random start values. The estimation process started with two latent classes (indicating full compliance and non-compliance), the number of latent classes was subsequently increased up to five, while comparing model fit between models. Model selection considered overall model fit, parameter sparseness, classification quality, and theoretical tenability (Nylund et al., 2007; Tomczyk et al., 2016, 2018). As an overall fit measure, the bootstrapped likelihood ratio test (BLRT) compared the estimated model to a model with one less class: a significant value indicated better fit of the current model. To achieve reliable estimates, we chose 50 random starts with 50 bootstrap draws for each comparison. The Akaike Information Criterion (AIC) and the sample size-adjusted Bayes Information Criterion (BIC) indicated sparseness of the model; a lower value meant a sparser model. Average latent class probabilities (AL) and entropy demonstrated classification quality that is the differentiation between latent classes. Values range between 0 and 1; the closer to 1, the better the fit; an entropy of at least 0.6 pointed to reliable estimates (Asparouhov and Muthén, 2014). Finally, latent classes needed to be interpreted based on the literature and theoretical background. Therefore, the best latent class solution was selected on statistical criteria as well as content validity.

Using the three-step approach (Asparouhov and Muthén, 2014), we calculated multinomial logistic regressions to predict compliance patterns by sociodemographic data and psychological variables (stigmatizing attitudes, risk perception, and subjective knowledge). For each regression model, relative risk ratios (RRRs) including 95% confidence intervals were reported as effect sizes.

RESULTS

Descriptive Statistics

Missing data were low (37 missing values; 0.01% overall) and equally distributed among variables, suggesting missing at random. Therefore, complete cases were analyzed for descriptive statistics (Schafer, 1999; Dong and Peng, 2013), while full information maximum likelihood was used for latent class estimation. The sample was predominantly female, most persons did not have a migration background, and about a fifth lived in single households. Due to the very high level of education, the variable "education" was dichotomized for further analysis [1 (*tertiary*), 0 (*secondary*)]. Intentions to comply were mixed but particularly low for immediate disposal of used tissues, frequent ventilation, and reduced hand-to-face contact (**Table 1**).

Latent Class Models

Model fit criteria for latent class models are printed in **Table 2**. While entropy and information criteria were in favor of a model with four classes, the difference to a three-class model was only marginal (ΔAIC = 0.04; ΔSSABIC = 1.14), and according to the BLRT, the latter was preferable. Moreover, a fourth class would have been very small (n = 6; 4.8%) with similar conditional response probabilities to class 1 of the three-class model. Since it also showed good entropy and latent class separation (ALCP > 0.8) compared to the remaining models, the three-class model was chosen. The following descriptions of

TABLE 1 | Overview of mean values and relative frequencies of sociodemographic data, risk perception, knowledge, intentions to comply with recommendations, and stigmatizing attitudes in a German community sample (complete cases with listwise deletion; N = 154–157).

Variable	*M* (*SD*) or *N* (%)
Age (range: 18–77)	27.82 (11.01)
Gender	
Female	124 (80.0)
Male	31 (20.0)
Level of education	
Lower secondary	4 (2.6)
Higher secondary	91 (59.0)
Tertiary	59 (38.3)
Region	
Rural	105 (73.2)
Urban	42 (26.8)
Country of origin	
Germany	150 (95.5)
Other	7 (4.5)
Persons in one's household	
One	30 (19.5)
Two	63 (38.9)
Three or more	61 (39.6)
Support for discrimination (range: 1–5)	2.50 (0.82)
Blame (range: 1–5)	1.42 (0.54)
Risk perception	
Susceptibility (range: 1–100%)	62.17 (20.27)
Fear (range: 1–5)	3.11 (1.05)
Subjective knowledge about adaptive behaviors (range: 1–5)	3.80 (0.76)
Intentions to comply with behavioral recommendations (very high)	
(1) Covering mouth and nose when coughing or sneezing	144 (91.7)
(2) Avoid handshakes	121 (77.6)
(3) Avoid touching one's face as much as possible	28 (17.8)
(4) Dispose of used tissue immediately and securely	81 (52.3)
(5) Frequent ventilation	55 (35.3)
(6) Increased hand hygiene	113 (72.9)
(7) Stay at home when sick	128 (81.5)
(8) Avoid personal contact to symptomatic persons	124 (79.0)
(9) Avoid mass events	128 (81.5)

TABLE 2 | Model fit criteria for latent class models of intentions to comply with behavioral recommendations regarding infection prevention in a German community sample (N = 157).

	2 classes	3 classes	4 classes	5 classes
Free parameters	19	29	39	149
BLRT	77.28***	**29.01*** **	20.41	15.46
AIC	1423.81	1414.80	**1414.76**	1419.42
SSABIC	1421.74	1411.64	**1410.50**	1414.07
Entropy	0.60	0.70	**0.74**	0.74
ALCP	0.89	0.86	1.00	0.85
	0.88	0.81	0.82	0.77
		0.91	0.90	0.85
			0.80	1.00
				0.84

*BLRT, bootstrapped likelihood ratio test; AIC, Akaike Information Criterion; SSABIC, sample size-adjusted Bayes Information Criterion; ALCP, average latent class probabilities. ***$p < 0.001$; fit criteria indicating the best model are printed in bold.*

latent class counts and proportions are based on most likely latent class membership.

The first class was labeled "low compliance" (n = 37; 24%), with low to moderate intentions to comply with most recommendations except for covering one's mouth and nose when sneezing or coughing. The second class was labeled "high compliance" (n = 40; 25%), with high probabilities of following most recommendations and moderate compliance with reducing hand-to-face contact. Finally, the third class, "public compliance" (n = 80; 51%), had high intentions regarding compliance with public and avoidance behaviors (e.g., social distancing) but low intentions regarding personal behaviors (i.e., avoidance of face contact, tissue disposal, frequent ventilation). Conditional response probabilities for each class can be seen in **Figure 1**.

Multinomial logistic regression compared sociodemographic data, stigmatizing attitudes, knowledge, and risk perception between latent classes (**Table 3**). To complement multinomial models, detailed descriptive comparisons of latent classes are provided in **Supplementary Table S2**. Compared to high compliance (class 2), low compliance (class 1) was associated with being male [RRR = 0.08 (0.01; 0.85)], younger [RRR = 0.72 (0.57; 0.93)], and expressing lower support for discrimination [RRR = 0.21 (0.05; 0.88)], whereas public compliance (class 3) and high compliance did not differ on sociodemographic data, stigmatizing attitudes or risk perception, although support for discrimination was considerably lower in public compliers than in high compliers [RRR = 0.27 (0.06; 1.21); p = 0.09]. Furthermore, low compliers were significantly younger [RRR = 0.76 (0.59; 0.98)] than public compliers and, by trend, were less fearful of a possible infection [RRR = 0.46 (0.20; 1.06); p = 0.07].

DISCUSSION

As one of the first studies examining patterns of (non)compliance with behavioral recommendations in the general population during the COVID-19 pandemic, this study revealed that only a quarter of the surveyed German population expressed intentions to fully comply with recommendations, while a majority (about 51%) intended to follow some public actions but was less willing to enact personal hygiene behaviors (i.e., swift disposal of tissues, reduction of hand-to-face contact, ventilation). Young males were significantly less likely to comply with recommendations, and aspects of public stigma were also linked to compliance intentions.

In a virus outbreak, such as the COVID-19 pandemic, personal hygiene and social distancing in the general population are paramount to containment of the illness (Wu et al., 2006; Karimi et al., 2015; Weston et al., 2018). And yet, only a minority was ready to comply with the main recommendations, with 25% reaching high compliance in this sample and similar, albeit slightly higher, proportions of 30.7% (Quah and Hin-Peng, 2004), 37.8% (Williams and Gonzalez-Medina, 2011), and 48.7% (Lee et al., 2005) in previous studies. Since Germany was not affected by previous pandemics (e.g., H1N1, SARS) as strongly as Hong Kong, for instance, and measures like wearing face masks are not as common in Europe (e.g., Rubin et al., 2009), we assume the lack of familiarity with such strict preventive measures to be responsible for this lower level of compliance.

Patterns and Predictors of Non-compliance

To further explore cultural differences of compliance during a pandemic and connect our findings to previous research, we compare our findings (Germany) to Liao et al. (2015), who analyzed latent classes of behavior patterns in Hong Kong during a virus outbreak. They also identified three latent classes, with the class *moderate hygiene* being the largest group, followed by *good hygiene* and *vigilance*. Moreover, younger males, persons with lower educational attainment, and lower risk perception were also more likely to belong to the moderate hygiene class (i.e., exhibit low compliance), similar to our findings. This trend of older persons and females reporting higher risk perception and willingness to perform preventive behaviors was consistently found in a variety of health risks (Flynn et al., 1994), among them also pandemics (Bish and Michie, 2010; Kwok et al., 2020), presumably due to a higher perceived susceptibility in these groups. Since older people have a higher risk of manifesting COVID-19 symptoms (Davies et al., 2020), which was promulgated via mass media reports, this might have led to lower susceptibility perceptions among younger people. Across cultures and scenarios, young males tend to report lower risk perception and compliance intentions. By corroborating these associations in the context of COVID-19, our findings stress the need for selective prevention targeting young males to improve their compliance and thereby public health.

Despite these similarities, we observed differing intentions regarding personal hygiene behaviors but overall high intentions to comply with avoidance behaviors, in contrast to Liao et al. (2015). While studies in other Western countries, that is, Canada (Toronto) and the United States (Blendon et al., 2004), also indicated high compliance with quarantine and social distancing strategies, it should be noted that avoidance measures are

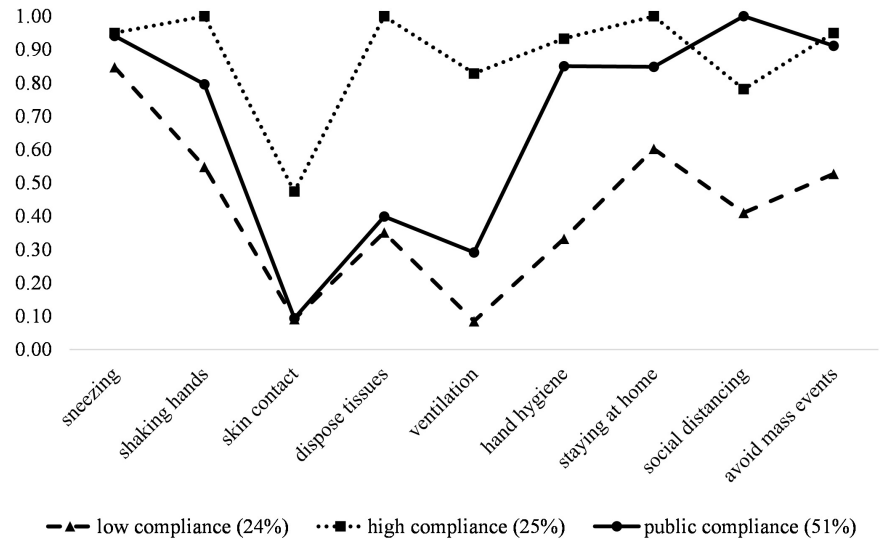

FIGURE 1 | Conditional response probabilities and latent class proportions of three latent classes of (non)compliance with behavioral recommendations regarding infection prevention in a German community sample (*N* = 157). The probabilities correspond to the dichotomized likelihood of complying with recommendations [0 (*not at all likely* to *quite likely*); 1 (*very likely*)], thus a higher probability indicates higher compliance.

TABLE 3 | Multinomial logistic regression of latent classes of intentions to comply with behavioral recommendations regarding infection prevention in a German community sample (*N* = 157).

Predictor	Public compliance (class 3) vs. high compliance (class 2)			Low compliance (class 1) vs. high compliance (class 2)			Low compliance (class 1) vs. public compliance (class 3)		
	RRR	95% CI		RRR	95% CI		RRR	95% CI	
Age	0.95	0.87	1.04	**0.72***	0.57	0.93	**0.76***	0.59	0.98
Gender (ref. male)	0.38	0.05	3.16	**0.08***	0.01	0.85	0.22	0.02	1.90
Level of education (ref. secondary)	1.20	0.12	11.68	2.82	0.41	19.58	0.44	0.03	6.60
Region (ref. rural)	3.00	0.36	24.95	3.39	0.37	30.75	0.37	0.02	5.67
Country of origin (ref. Germany)	0.54	0.08	3.67	0.25	0.03	1.76	5.19	0.53	50.83
Persons per household (ref. One)									
Two	3.40	0.68	17.13	0.52	0.07	4.16	1.00	0.18	5.49
Three or more	0.15	0.01	4.12	1.11	0.03	41.84	1.60	0.02	119.22
Support for discrimination	0.27	0.06	1.21	**0.21***	0.05	0.88	0.77	0.12	5.06
Blame	0.94	0.24	3.67	1.46	0.33	6.39	1.55	0.28	8.66
Risk perception									
Susceptibility	1.01	0.97	1.04	1.03	0.99	1.06	1.02	0.97	1.06
Fear	1.74	0.61	4.96	0.80	0.34	1.89	0.46	0.20	1.06
Subjective knowledge	0.46	0.13	1.67	0.25	0.05	1.26	0.55	0.08	3.84

*RRR, relative risk ratio; 95% CI, 95% confidence interval. Significant coefficients are printed in bold; *p < 0.05.*

generally easier to implement than specific preventive behaviors that require personal action (Bish and Michie, 2010). Therefore, it is possible that in this early phase of the COVID-19 outbreak in Germany, personal responsibility was not as salient in the general population. This might be connected to the lack of familiarity with pandemics and appropriate preventive action in the German population. Nevertheless, personal preventive actions may yet increase over time, coinciding with an increase in vigilance, knowledge, and positive attitudes, if supported by concerted action, as suggested by previous SARS outbreak trajectories (Leung et al., 2003, 2005).

To concur, in their analysis of repeated cross-sectional surveys, Liao et al. (2015) observed fairly stable behavioral patterns (i.e., robust latent classes) across time but an increase in public vigilance and perceived threat throughout the epidemic (i.e., an increase in latent class proportions in favor of vigilance). To foster vigilance, the media and governmental institutions are therefore urged to provide clear guidance, openly communicate and justify new measures to increase trust, and strengthen self-efficacy at early stages of a pandemic, as shown in previous health crises (e.g., Seeger, 2006; Bean et al., 2015; Jha et al., 2018).

Non-compliance and Stigmatizing Attitudes

In addition to compliance patterns, this study also examined the impact of stigmatizing attitudes on intentions to comply with behavioral recommendations. While Williams and Gonzalez-Medina (2011) connected an increase in influenza infections to an increase in stigmatizing attitudes, in this study, blame was low (mean = 1.42 on scale of 1–5) and did not predict compliance. Instead, support for discrimination was significantly associated with higher compliance intentions. Drawing on social psychiatric research, this type of discrimination might be described as *intentional structural discrimination*, where a worldview is actively supported that restricts patients' rights (by law), for example, regarding their opportunities to vote or to hold public office (Corrigan et al., 2004, 2006; Schomerus et al., 2007). In the context of COVID-19, a support for discrimination implies a desired restriction of access to sociopolitical resources for infected persons.

As a result, while high compliance represents law-abiding and theoretically desirable behavior, its connection to discrimination, particularly in this highly educated sample, is noteworthy. In line with the reasoning behind selfishness and responsibility shift in confronting the SARS pandemic (Morrison and Yardley, 2009), a support for discrimination might indicate a way to maximize differences between relevant in-groups (i.e., responsible, healthy) and out-groups (i.e., irresponsible, reckless) to affirm social identity status (Tajfel and Turner, 1986; Link and Phelan, 2001) and – at least symbolically – reduce the risk of infection. Since blame did not differ between latent classes and was generally low, we assume that in this sample, stigma facilitated othering but not discriminatory action (Deacon, 2006). Although this hypothesis requires further research in larger, longitudinal samples using more elaborate measures of stigmatizing attitudes, it is clearly in line with evidence-based demands of a more nuanced debate of the functional properties of stigmatization and its connection to discrimination in infectious diseases (Deacon, 2006).

Strengths and Limitations

Finally, this study is not without limitations, as the sample is a small convenience sample that is not representative of the German population. In fact, the sample was highly educated, predominantly female, and mostly without migration background. However, we still observed substantial heterogeneity in intentions, despite females and highly educated persons being generally more likely to report high compliance in previous studies. In addition, this study was cross-sectional and exploratory and used short but validated measures of core constructs, hence, effects of risk perception, for example, were not fully explored. Components like anticipatory worry could also affect compliance intentions and should be studied in more detail (Leppin and Aro, 2009). Furthermore, items measuring stigmatizing attitudes were adapted to COVID-19 for this study, therefore, a thorough psychometric validation is necessary. Moreover, we did not assess other important factors that might be connected to (non)compliance, such as ethnicity, interpersonal contact with infected persons, or trust in the government. Finally, we captured behavioral intentions, but we did not assess actual behaviors, as the pandemic had just reached the German population, and official recommendations were first issued at the beginning of data collection. Therefore, future studies should also focus on behavioral performance. When investigating the connection between compliance intentions and behavioral performance, health behaviors models like the theory of planned behavior should be applied to incorporate relevant intermediary variables, such as self-efficacy (Ajzen, 1991; Bish and Michie, 2010). Overall, more comprehensive, longitudinal, and experimental studies are necessary to validate our findings in the context of COVID-19 in diverse populations. Nevertheless, we think this study provides an important look at patterns of compliance at early stages of the COVID-19 outbreak and impactful sociodemographic and attitudinal factors, such as support for discrimination, that underline the need for selective preventive action.

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 Ethics Committee of the University Medicine Greifswald, University Medicine Greifswald. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

ST, MR, and SS contributed to the conception and design of the study. ST and MR were responsible for the data collection and statistical analysis. ST wrote the first draft of the manuscript. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.01821/full#supplementary-material

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Development and Early Implementation of a Public Communication Campaign to Help Adults to Support Children and Adolescents to Cope With Coronavirus-Related Emotions: A Community Case Study

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Epidemics and pandemics can traumatically impact the emotional wellbeing of adults, children, and adolescents in diverse ways. This impact can be reduced by applying a range of evidence-based coping strategies. Based on previous research, we created a pamphlet-based communication campaign designed to assist adults to provide support for young people confronted with emotional distress associated with the pandemic caused by the novel coronavirus [severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)] and the related disease [coronavirus disease (COVID-19)] in 2020. We developed a pamphlet describing the common emotions children and adolescents report feeling in the face of disasters and the coping strategies that have proven effective in mitigating them. The target population was adults who interact with children and adolescents in both formal and informal settings. The pamphlet included basic information on this specific emergency, emotions that might be commonly experienced, and coping strategies for dealing with negative emotions. The aim of this paper is to describe the planning, development, and implementation of the campaign. First, we monitored how the media gave visibility to the campaign during the 40 days following the release of the pamphlet: it potentially reached a large audience at a national and international level through at least 216 media channels included the HEMOT® (Helmet for EMOTions) website. Second, Google Analytics™ data from the HEMOT® website enabled us to examine the characteristics of the visitors to the website and the behavior of those who viewed the pamphlet. More than 6,000 visitors, most from Europe followed by the Americas, visited the website in the first 40 days after the pamphlet publication. The webpage including the pamphlet obtained over 6,200 views, most directly or *via* other websites. A cluster analysis suggested that the access to the webpage did not mirror the trend concerning the new cases of COVID-19 in Italy (which increased during the central phase of the campaign) or worldwide

(which continued to increase across the 40 days). Third, data gathered with a convenience sample of adults who had consulted the pamphlet provided a perspective on the comprehensibility of the messages conveyed by the pamphlet and on the utility for children and adolescents. The process we have demonstrated in this example could be replicated in different communities and settings to respond to the spread of the COVID-19 or to respond to other widespread or more localized disasters.

Keywords: coronavirus, emotions, coping strategies, communication campaign, children, adolescents

INTRODUCTION

Epidemics and pandemics constitute public health problems that can have a highly traumatic impact on people's psychological functioning (Ko et al., 2006; Goodwin et al., 2011; Prati et al., 2011; Vaughan, 2011; Galea et al., 2020; Kwok et al., 2020; Shigemura et al., 2020; Xiang et al., 2020). This is especially true for children and adolescents, whose vulnerability depends on their level of cognitive and emotional development (Kar, 2009; Bouffet et al., 2020). To our knowledge, no studies have yet addressed their emotional reactions during epidemics and/or pandemics. Health professionals have a range of evidence-based techniques for teaching young people strategies to overcome negative feeling (Flay et al., 2005; Gottfredson et al., 2018). Nevertheless, if emergencies occur, lay adults need rapid access to simple tools to assist young people cope with the situation (Galea et al., 2020; Horesh and Brown, 2020; Xiang et al., 2020).

Therefore, we developed a communication campaign to help adults support children and adolescents cope with negative emotions during a public health emergency of international concern (PHEIC) and, in particular, the pandemic related to the spreading of the novel coronavirus [severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)] and the related disease [coronavirus disease (COVID-19)] in 2020. The campaign was promoted within the HEMOT® project (Helmet for EMOTions), a larger project focused on emotional preparedness related to disasters. In the context of quite an amount of misinformation being circulated, it was important to develop reliable and authoritative sources relying on scientific literature (Bouffet et al., 2020).

BACKGROUND AND RATIONALE

Psychological Consequences of Epidemics/Pandemics

Epidemics and pandemics can be classified as biological natural disasters (EM-DAT, 2020). Traumatic consequences of natural disasters include impaired health (e.g., cardiovascular ailments), psychopathology (e.g., posttraumatic stress disorder and depression), and negative emotional impact (e.g., anxiety, fear, and anger), both for primary victims experiencing the events directly and for secondary victims indirectly affected through media exposure (Galambos, 2005; Neria et al., 2008; Furr et al., 2010; Masten and Osofsky, 2010; Fergusson and Boden, 2014; Galea et al., 2020). In the case of COVID-19, media coverage can amplify secondary traumatization (Garfin et al., 2020). Psychopathologic symptoms such as depression have been documented for pandemics such as the severe acute respiratory syndrome (SARS; Ko et al., 2006) and in the case of COVID-19 (Wang et al., 2020). One of the few studies focusing on the psychosocial consequences of COVID-19 reported around 6% of Chinese adults experiencing anxiety and 17% experiencing depression during February 2020. This underlines the need for mental health support in such situations (Wang et al., 2020). However, for most disasters, the traumatic consequences are a result of the disaster itself, while for COVID-19 the traumatic impact is amplified by the measures, such as social distancing, used to limit the spreading of the virus (Galea et al., 2020).

Other studies described the emotional impact of different infectious diseases. Fear and anxiety are the most salient emotions during an influenza outbreak, followed by anger and sadness (Kim and Niederdeppe, 2013). Studies on infectious diseases such as the swine flu pandemic, the avian influenza, and the SARS also show that fear, regret, and worry are associated with attempts to keep free from the disease along with managing the disruptions to normal life (Goodwin et al., 2011; Prati et al., 2011; Vaughan, 2011; Karademas et al., 2012; Manabe et al., 2012). However, excessive levels of fear can transform into panic and have serious detrimental effects, like the so-called "SARS phobia" (Cheng and Tang, 2004).

To our knowledge, little specific data on how the COVID-19 has affected people's emotional reactions and the ways they cope with them have been published (Kwok et al., 2020; Wang et al., 2020). The salience of emotions such as fear has been evidenced by the rapid creation of instruments like the Fear of COVID-19 Scale (Ahorsu et al., 2020). Fear, with distorted perceptions of risk, could contribute to negative societal behaviors and serious public mental health concerns linked to COVID-19 (Shigemura et al., 2020).

Coping and Epidemics/Pandemics

A psychological process helping to diminish the traumatic impact of a disaster is "coping," a multi-component construct referring to all the actions marshaled to face stressful events (Skinner et al., 2003). During and after disasters, children can use a large variety of coping strategies to feel better. A meta-analysis (Raccanello et al., 2020a) examined the relation between coping strategies used after a disaster and indicators of persistent traumatic symptoms or positive changes over time among children and adolescents. In that study, we coded coping strategies into three categories (**Table 1**) according to the developmental classification of Zimmer-Gembeck and Skinner (2011), with each

TABLE 1 | Functions of coping strategies (Zimmer-Gembeck and Skinner, 2011), labels used in the pamphlet, and description.

Adaptive function	Coping strategies	Label used in the pamphlet	Description
Problem-focused strategies	Problem-solving	Try to solve the problem	Concentrating on the problem, aiming at changing the situation to find a solution
	Information-seeking/giving	Talk about facts	Searching for information and giving information
	Helplessness	Give up	Giving up, being passive or confused in front of the requests
	Escape	Ignore reality	Avoiding the problem, through behaviors or cognitions
Relation-focused strategies	Self-reliance	Understand and express your emotions	Counting on oneself, through emotional expression and regulation
	Support-seeking/giving	Receive and give help	Seeking/giving social, concrete, emotional, and/or instrumental support
	Delegation	Put the responsibility on to others	Assigning the responsibility of the solution to others, complaining or self-pitying
	Social isolation	Isolate yourself from others	Disengaging from or refusing social interactions
Priority-focused strategies	Accommodation	Take some time to focus on other things	Adapting smoothly to alternatives and focusing on positive aspects
	Negotiation	Adapt	Seeking new alternatives, such as finding compromises and allocating priorities
	Submission	Continue to think negatively	Giving up, ruminating, or having a rigid attitude
	Opposition	Ignore the recommended safety plans	Rejecting collaboration or doing the contrary as regards requests

category corresponding to different adaptive functions, and including two related strategies and their opposites. One set, termed "problem-focused strategies", involves problem-solving and information-seeking/giving in contrast to feeling helpless and seeking escape. This approach helps individuals to adapt their behaviors to the environmental constraints they face. The second set was called "relation-focused strategies" and it involves self-reliance and support-seeking/giving in contrast to delegation and social isolation. These revolve around endeavors to build reliance among and between people caught up in the disaster. The third category, "priority-focused strategies", features accommodation and negotiation in contrast with submission and opposition. These actions are organized around efforts to "trade" options to reach one's own goals. This meta-analysis has confirmed the expected efficacy of these strategies in mitigating the negative effects of disasters, and its results were further confirmed relating earthquakes (Raccanello et al., 2020a). It showed that strategies incorporating escape, delegation, social isolation, and opposition were positively linked with traumatic symptoms, while problem-solving and support-seeking actions were positively linked with indicators of positive change (e.g., self-efficacy and understanding of emotions). Submission was ambiguously related to both negative and positive indicators.

These data are in line with studies involving adults in pandemics such as the swine flu, indicating that anxiety is negatively related to problem-focused strategies (i.e., problem-solving, cognitive restructuring, social support-seeking, active distraction, and humor) and positively to emotion-focused strategies (i.e., self-blame, other blame, rumination, wishful thinking, emotional containment, emotional expression, cognitive distraction, and passive resignation; Taha et al., 2014). However, another study focused on swine flu indicated, ambiguously, that both negative and positive emotions were associated with strategies such as information-seeking and that positive emotions were related to relational trust (Kim and Niederdeppe, 2013). A further study indicated that using different coping strategies buffered the negative influence of SARS-related stressful events on perceived general health, but that using avoidant strategies was positively related to developing psychological symptoms such as somatization, obsessive-compulsive, depressive, and anxiety symptoms (Main et al., 2011). These previous studies can be linked to the observation that the ability to recognize, understand, and regulate one's emotions offers a potential protection factor against the traumatic impact of disasters and, in particular, of pandemics (Denham, 1998).

The Present Study

In line with this literature, we identified the contents of the campaign using a preliminary model of emotional preparedness for disasters that incorporates developmental changes, developed within the PrEmT project, "Emotional Prevention and Earthquakes with primary school children" (Raccanello et al., 2019, 2020b,c). The model is supported by data derived from an evidence-based intervention which involved primary school children. The data revealed an increase in children's semantic knowledge regarding earthquake-related coping strategies for those children who participated to the intervention compared to the participants belonging to a control group. The model takes into account the interactions between the perception of sensory stimuli, working memory elaboration, and enactment of behaviors. In particular, it describes how affect can impair the psychological functioning during an earthquake, on the basis of the literature which supports the bi-directional relations between emotions and perception, memory, and enactment of behaviors. It focuses on possible emotions that could be felt during and just after an emergency situation and on coping strategies useful to manage them. The key relevance of this model for disaster preparedness concerns the relation between the encoded semantic knowledge and its retrieval when an

emergency occurs. If relevant knowledge on how to behave safely and cope with one's emotions has been incorporated in advance of an emergency, receiving a message based on validated persuasion models is likely to increase one's probability of becoming resilient in the face of adversities.

The aim of this paper is to describe the planning, development, and implementation of a mechanism for providing psychological tips for dealing with the emotions young people might feel in response to the coronavirus pandemic. A pamphlet was designed to provide direction for adults who needed to give emotional support to children and adolescents during the PHEIC and the pandemic triggered by the SARS-CoV-2 and the related COVID-19 in 2020. It was initially targeted to Italian and English speakers, but it was then extended to a variety of other languages. In the literature, previous findings on pamphlets' efficacy as a psycho-educational resource are lacking, with some exceptions. Most of them are focused on the efficacy of pamphlets addressed to adults. For example, Shah et al. (2018) tested a pamphlet on health and mood addressing people older than 55 years, in order to increase their will to be screened for depression. Garcia et al. (2010) developed an educational pamphlet to increase knowledge on oncological children's nutrition addressed to low-literacy caregivers. Other researchers found that a pamphlet on proper antibiotic use was more efficacious for increasing knowledge of parents who consulted it compared to a control group who did not consult any material, although it was less efficacious than an animated video (Schnellinger et al., 2010). Interestingly, some authors (King et al., 2003) documented that children and adolescents' readability of pamphlets concerning mental health is satisfactory when it is characterized by: signaling devices (such as titles, subtitles, and introductory statements) and pronoun references, substitutions, and connectives, to guarantee global and local coherence; unity, such as focus on a single topic; audience appropriateness; definition of technical words; incorporation of questions; and attention to specific attributes of typography variables such as font size, type of print, and color.

We monitored the campaign during the 40 days following the release of the pamphlet, from the 28th February to the 7th April 2020. First, we traced how the media gave visibility to the campaign (aim 1). Second, we used Google Analytics™ data from the HEMOT® website, from which the pamphlet could be downloaded, to assess the characteristics of the visitors and their behavior, also relating the number of views with the number of new cases of COVID-19 in Italy and worldwide (aim 2). Third, about one week after the 40-day period, we recruited a convenience sample to evaluate the perceived comprehensibility and utility of the pamphlet (aim 3).

DESCRIPTION OF THE CASE

The novel coronavirus is a virus identified for the first time in China on 9th January 2020 (EpiCentro, 2020b; World Health Organization, 2020b). Its official name is SARS-CoV-2, while the name of the related disease is COVID-19, as announced on 11th February 2020, respectively, by the International Committee on Taxonomy of Viruses (ICTV; World Health Organization, 2020a) and by the World Health Organization, WHO. The diffusion of COVID-19 led the WHO to declare a PHEIC on 30th January 2020 (World Health Organization, 2020d). A PHEIC is "an extraordinary event determined to constitute a public health risk to other states through the international spread of disease and to potentially require a coordinated international response" (World Health Organization, 2016, p. 9). On 11th March 2020, the WHO declared a pandemic, an even more extraordinary event which "occurs when a new influenza virus emerges and spreads around the world, and most people do not have immunity" (World Health Organization, 2020c).

Setting

In Italy, the first two cases of COVID-19 were certified on 30th January 2020 (EpiCentro, 2020a). Since then, a sequence of ordinances and decrees (Presidenza del Consiglio dei Ministri, 2020) introduced measures to limit the spreading of the virus, resulting in severe constraints on freedom of people including increases in social distancing. Measures pertaining to "lockdown" were extended, involving 11 municipalities in the regions of Lombardia and Veneto (from 23rd February 2020); then the region of Lombardia with 14 provinces in the regions of Veneto, Emilia-Romagna, Piemonte, and Marche (from 8th March 2020); and then the whole Italy (from 9th March 2020). Schools were closed beginning on 24th February 2020. When the process evaluation of this campaign ended, all these measures were still present.

On 28th February (which was the day in which the pamphlet was released), in Italy, a total of 888 people had been reported infected. Of these, 412 were in isolation at home, 409 in hospital (64 of them in intensive care units, ICU), 46 recovered, and 21 had died (Protezione Civile, 2020). On 7th April (which was the last day of monitoring of the campaign), in Italy, a total of 135,586 people had been reported infected. Of these, 61,557 were in isolation at home, 32,510 in hospital (3,792 in ICU), 24,392 recovered, and 17,127 had died (Ministero della Salute, 2020a). Worldwide, on 7th April, there had been 1,214,973 confirmed cases since the beginning of the outbreak, 67,841 deaths, and 208 countries, areas, or territories with cases (Ministero della Salute, 2020b). Children represented less than 5% of the diagnosed cases, and they had milder symptoms compared to adults (Ludvigsson, 2020). We represented in **Supplementary Figure 1** the daily number of new cases of COVID-19 in Italy and worldwide as reported in the Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (Dong et al., 2020; numbers higher than 1,000 are rounded to the nearest 1,000).

Collaborative Partnerships

The campaign was carried out by a multi-disciplinary team with a strong psychological orientation within the HEMOT® project. The HEMOT® project focuses on emotional preparedness in case of disasters, by conducting research and developing training programs for children, adolescents, and adults.

The multi-disciplinary nature of HEMOT® led to collaborative partnerships with teachers who checked the clarity of the message and with the University of Verona and the Civil

Protection of the Veneto Region. The latter was actively involved in managing the emergency caused by the novel coronavirus in the local territory of the Veneto region during 2020. Both organizations authorized the inclusion of their logos in the pamphlet.

MATERIALS AND METHODS

Target Population

The target population consisted of adults who might come into contact with young people during the emergency. It was important to reach this population as quickly and as extensively as possibly because one of the first actions taken to limit the spreading of the virus was the closing of schools, placing on family members and carers the task of explaining the emergency and the related mitigation measures.

In the beginning, the campaign addressed Italian and English speakers. We progressively translated the pamphlet into another 15 languages, i.e., Arabic, Croatian, Finnish, French, German, Greek, Lingala, Moldavian, Norwegian, Portuguese, Romanian, Sinhalese, Spanish, Swahili, and Swedish.

Campaign Content

We developed the content of the campaign by adapting training on emotional management previously tested with children within the PrEmT project (Raccanello et al., 2019, 2020b,c). First, we identified the message to be conveyed by the pamphlet (**Appendix**). The title of the pamphlet focused people's attention on the problem, i.e., the *public health emergency*, on possible solutions, i.e., referring to *psychological tips*, and on the final target audience, i.e., *children and adolescents*. The pamphlet was divided into three sections with basic information on the problem, emotions that could be experienced, and coping strategies. The contents of the first section relating to the questions *What is a coronavirus?* and *What is a public health emergency?* included the definitions used by WHO (World Health Organization, 2016, 2020a,c). When the pamphlet was released, WHO had not declared a pandemic yet. As part of the pamphlet design, we included an image representing the novel coronavirus.

The second section introduced by the question *Which emotions can we feel?* included both verbal labels and drawings of faces representing emotions that might be felt during a PHEIC. There was a statement suggesting that people can feel three basic negative emotions, i.e., fear, sadness, and anger, but that it would be *great to continue to feel emotions such as relaxation and enjoyment*. The choice of the emotions was based on the PrEmT training and on the literature on disasters (Raccanello et al., 2019, 2020b,c), specifically on epidemics and pandemics (Goodwin et al., 2011; Prati et al., 2011; Vaughan, 2011; Karademas et al., 2012; Manabe et al., 2012; Kim and Niederdeppe, 2013), and it was confirmed by a pool of six experts in psychology (among whom there were a primary school teacher and three parents). We presented both verbal labels and faces for two reasons. First, the presentation of drawings could facilitate the recognition of the corresponding emotions. Second, this was in line with the media richness theory, according to which combining information presented as text and drawings would facilitate effective communication (Hsieh and Tseng, 2017).

The faces had been drawn *ad hoc* within the PrEmT project and had been tested for validity in a pilot phase (Raccanello et al., 2020c). The pilot involved 233 second and fourth-graders in a naming task, in which we had shown the five faces and asked to produce a label that described each emotion being illustrated. Most children had reported the appropriate label for the basic emotions (fear: 75.11%; sadness: 90.13%; anger: 98.71%; enjoyment: 95.71%), while the percentage of correct responses was somewhat lower for relaxation (59.23%). This is consistent with the fact that calm/relaxation is not a basic emotion for which there is a unique correspondence between facial expression and emotion (Ekman, 1992, 1993). But given the key role of this emotion for emergency-related situations, it was appropriate to include it. For ethical issues, the faces were balanced for gender (male and female) and ethnic origin (European, Asiatic, and African).

The third section of the pamphlet presented tips for responding to the question *How can we cope with fear, sadness, and anger?* We rephrased the names of the 12 coping strategies and their three corresponding functions to increase their comprehensibility in general, but especially for children (**Table 1**). We used the label *Look for solutions* for problem-focused strategies; *Seek and give support* for relation-focused strategies; and *Understand what is important* for priority-focused strategies. We distinguished strategies considered adaptive in the literature (*Dos*) from strategies usually not adaptive (*Don'ts*), stating in the pamphlet that individual and contextual factors can play a role for influencing their adaptivity (Zimmer-Gembeck and Skinner, 2011). For each category, we inserted two/three examples. Some examples were general and pertained to any disaster (e.g., *Talk about how you feel* among *Dos*; *Panic* among *Don'ts*), while others related specifically to quarantine or social distancing due to the coronavirus emergency (e.g., *Do the right things*, *for example*, *washing your hands frequently* among *Dos*; *Ignore the regulations from the Ministry of Health* among *Don'ts*). We identified the examples deductively adapting items from the HEMOT® web application developed within the PrEmT training and inductively through content analysis by six experts in psychology.

The pamphlet concluded by inviting people to invent new ways to cope with negative emotions. It highlighted that the efficacy of coping strategies can vary according to different cases, i.e., individual characteristics, contexts, and also at different times in the same contexts (Zimmer-Gembeck and Skinner, 2011).

Campaign Dissemination

The campaign was disseminated through formal and informal communication channels. The formal channels were both internal and external to the University of Verona. On 28th February 2020, we uploaded the pamphlet within the HEMOT® website (see the following section). The press office of the University of Verona published an article on the campaign in the online UnivrMagazine and sent a press release to external media. We, then, contacted other media directly. We also asked the School Office of the Veneto region to disseminate the campaign in the Veneto region. From 23rd March to 1st April 2020, we also

disseminated the link from which the pamphlet could be downloaded among students from the University of Verona, within a research. Informal channels included a variety of personal contacts and social networks such as Facebook, Twitter, or LinkedIn and instant-messaging technologies such as WhatsApp, Telegram, or others. We monitored the diffusion of the pamphlet through a search conducted daily using the Google Chrome™ browser.

Website Monitoring

Within the website HEMOT®[1], we created a dedicated webpage to upload the pamphlet[2]. The HEMOT® website is aimed at disseminating all the activities pertaining to the HEMOT® project. It was created using WordPress, a free and open-source content management system. The menu on the homepage includes these links: Home, Mission, and Latest News. The pamphlet was accessible from the Latest News tab. The website also includes five other pages, i.e., Our Team, About Us, Copyright & Disclaimer, The Project in Brief, and Selected Publications. The website is in English and the corresponding domain was registered during June 2019.

Monitoring the Google Analytics™ data related to the HEMOT® website gave us the opportunity to gather data on how visitors behaved and their location (Kirk et al., 2012; Crutzen et al., 2013). Google Analytics™ data contain no personally identifiable information (Kirk et al., 2012). We examined the following measures.

Measures

Characteristics of the Visitors of the Website

We assessed: (a) the number of users who had initiated at least one session during the 40 days following the publication of the webpage on coronavirus-related pamphlet (28th February–7th April 2020) and the number of users of the 40 previous days (19th January–27th February 2020); (b) the location of users between 28th February and 7th April 2020.

Behavior of the Visitors of the Webpage Containing the Coronavirus-Related Pamphlet

Between 28th February and 7th April 2020, we collected data on: (a) the total of pageviews, including repeated views of a single page, and the average time on page, i.e., the average time users spent viewing the page; (b) the location of the users that viewed the webpage; (c) traffic sources, indicating where visitors came from: direct traffic (i.e., directly to the webpage), referrals (i.e., through links at other websites), social traffic (i.e., through links in social networks), and organic search (i.e., after a search engine query).

Perceived Comprehensibility and Utility of the Pamphlet

We recruited a convenience sample of 144 adults (M_{age} = 32.9 years, *SD* = 13.6; 83% females); 21.5% of them had sons and/or daughters under 18 years old; 27.1% worked with children and/or adolescents (as a teacher, educator, etc.). In conducting this part of the study, we followed the ethical standards of the American Psychological Association, presenting the consent form. Specifically, all the adults gave their written authorization for the participation to the research and for data treatment according to the European regulations (679/2016, art. 13). In addition, the software used for the data gathering guarantees ethical standards and data protection through HTTPS security protocols. HTTPS enables encrypted communication and a secure connection between a remote user and our web server. We recruited the participants involving people to whom we had previously sent the pamphlet (e.g., students from the University of Verona, and teachers and parents to whom we had sent directly the pamphlet). We administered an online survey beginning one week after the 7th April 2020 (it could be completed during the following week). We assessed perceived comprehensibility of the pamphlet by adapting questions reported in the psychological literature (e.g., Atkin and Freimuth, 2001; i.e., *How clear is the message conveyed by the pamphlet?*) and utility for children and/or adolescents (i.e., *How useful is the message conveyed by the pamphlet for children and/or adolescents?*). Responses had to be rated on a five-point scale (1 = *not at all* and 5 = *very much*). Despite possible limitations of single-item measures (e.g., low variance and reduced validity measuring a complex construct), previous studies support their reliability and, thus, their utility in situations where surveys need to be as brief as possible (Goetz et al., 2006).

RESULTS

Monitoring of Dissemination Through the Media

The pamphlet was accessed both in Italy and abroad. Between 28th February and 7th April 2020, the pamphlet was advertised by 12 Italian newspapers (e.g., Il Sole 24 Ore, L'Arena, and Il Mattino di Padova) and one American newspaper, i.e., The New York Times. Moreover, it was mentioned within the Italian television program "Primus inter pares" on TV7 Triveneta. The pamphlet was also promoted through a variety of school and university channels. In Italy, the School Office of the Veneto region advertised the campaign through its website devoted to all the head teachers of preschool, primary, and secondary schools in the Veneto region. This led to the uploading of messages relating to the pamphlet in at least 84 school/university websites or Facebook pages in Veneto and other Italian regions. Abroad, reference to the pamphlet appeared in at least 34 school/university websites or Facebook pages, mostly in the United States of America. Other websites (n = 22) or social network pages (n = 59) managed by a variety of professionals such as psychotherapists, psychologists, doctors, pediatricians, physiotherapists, and institutions such as municipalities and associations referred to the pamphlet, both in Italy and abroad. Finally, the pamphlet was cited in a scientific paper published by *Pediatric Blood & Cancer*, that included it in a list of 17 reliable sources for recommendations for pediatric and oncology

[1]https://www.hemot.eu/

[2]https://www.hemot.eu/2020/02/28/public-health-emergency/

agencies regarding COVID-19 (Bouffet et al., 2020). To sum up, the pamphlet was advertised through at least 215 media channels, excluded the HEMOT® website.

Website Monitoring

Indicators From Google Analytics™

We examined the following indicators from Google Analytics™ linked to the HEMOT® website.

Characteristics of the Visitors of the Website

During the 40 days following the publication of the webpage with the coronavirus-related pamphlet, 6,090 users visited the website. The number of visitors increased massively compared to the number of users in the previous 40 days (n = 44). Between 28th February and 7th April 2020, the location of the majority of website users was Italy (67.60% were Italian, while 32.40% were non-Italian), as expected. But the campaign also had an impact at the international level: 75.29% of the users came from Europe (including Italy); 22.45% from Americas; 1.24% from Asia; 0.68% from Oceania; and 0.01% from Africa. The location of 0.33% of users was not identified.

Behavior of the Visitors of the Webpage Hosting the Coronavirus-Related Pamphlet

The total pageviews of the webpage with the pamphlet was 6,236, with an average time on page of 2 min and 58 s. Peaks in the number of users (i.e., higher than 200 users per day) were associated with specific events (**Supplementary Figure 1**), i.e., the dissemination through The New York Times and the School Office of the Veneto region (2nd–5th March 2020); the first work day after the decree which extended the "lockdown" to Lombardia and other 14 provinces (9th March 2020); the dissemination to the participants in the research on coronavirus-related emotions at the University of Verona (25th, 30th March, and 1st April 2020). As regards the users' locations during the three waves of views, most users came from Europe (respectively, 96.32, 89.81, and 91.59%), followed by Americas (3.42, 10.19, and 8.09%); during the first and third waves, a lower percentage of users came from Oceania (0.13 and 0.19%) and Asia (0.13 and 0.19%). However, across the whole period, the users came from many parts of the world (**Supplementary Figure 2**). On the whole, users arrived at that page through four channels. Direct traffic led to 59.49% of the visits in the webpage, referrals to 33.45%, organic search to 4.73%, and social traffic to 2.33%.

Daily Pageviews and Daily New Cases

In addition, we examined the relation between the number of daily pageviews of the webpage with the pamphlet from 28th February to 7th April 2020 and the number of daily new cases in Italy and worldwide in the same period (Dong et al., 2020; **Supplementary Figure 1**). In order to explore these relations, first, we calculated the correlations between the three measures and, second, we conducted a k-mean cluster analysis (MacQueen, 1967) and generalized linear models (GLMs) with the R software (R Core Team, 2020).

Correlations Between Daily Pageviews and Daily New Cases

There was a significant correlation between the number of daily pageviews and the number of daily new cases in Italy (r = −0.39, p = 0.012). The correlation was moderate and negative, indicating that, on the whole, the number of daily pageviews decreased while the cases unluckily increased as time passed. Another significant correlation emerged between the number of daily new cases in Italy and worldwide (r = 0.71, p < 0.001). In this case, the correlation was strong and positive, suggesting that, even if Italy was one of the first European countries to be interested by COVID-19, the trend of its new cases was in line with what was happening worldwide.

Cluster Analysis on Daily Pageviews and Daily New Cases

To examine deeper these relations, we ran a k-mean cluster analysis. We considered the number of daily pageviews and the number of daily new cases in Italy and worldwide, in order to identify whether the days from 28th February to 7th April 2020 could be grouped into different phases with similar characteristics. Even if the extant literature does not report standard rules for determining the minimum sample size for conducting cluster analyses (Mooi and Sarstedt, 2011), Formann (1984) suggested a minimum of 2^k cases, with k as the number of variables included to form the clusters. We used three variables, i.e., the number of daily pageviews and the number of daily new cases in Italy and worldwide. In our case, the minimum sample size resulted eight, indicating that our sample size was adequate. Therefore, we ran the k-mean cluster analysis on the 40 days.

We used three different methods to determine the number of clusters, namely the elbow method (Bholowalia and Kumar, 2014), the average silhouette method (Rousseeuw, 1987), and the gap statistic method (Tibshirani et al., 2001). The elbow and the gap statistic methods indicated that the best-fitting solution had three clusters, while the average silhouette method indicated that it had two clusters. Given that the two-cluster solution explained 85.3% of the variance and the three-cluster solution explained 95.1% of the variance, we chose the three-cluster solution. The first cluster, named Time 1, grouped the 20 days from 28th February to 18th March; the second cluster, named Time 2, grouped the 7 days from 19th March to 25th March; and the third cluster, named Time 3, grouped the 13 days from 26th March to 7th April. The three clusters are represented in **Figure 1**.

Generalized Linear Models on Clusters

In order to describe how the three clusters were characterized in terms of the number of daily pageviews and the number of daily new cases, we conducted three GLMs separately for each measure (**Figure 2**). In each model, we included clusters (Time 1, Time 2, and Time 3) as the between-factor fixed effect and each measure (number of daily pageviews, number of daily new cases in Italy, and number of daily new cases worldwide) as count dependent variables. We utilized the Poisson family and the log link-function. We used Bonferroni correction for *post hoc* tests, and we calculated effect sizes in terms of Cohen's d. The level of significance was p < 0.05.

The GLM on the number of daily pageviews revealed a significant effect of clusters, $\chi^2(2, N = 40) = 563.82$, $p < 0.001$. *Post hoc* tests indicated that pageviews were higher, $z = 12.97$, $p < 0.001$, $d = 0.48$, for Time 1 ($M = 201.65$, $SD = 213.21$) compared to Time 2 ($M = 124.14$, $SD = 153.95$), and they were higher, $z = 4.37$, $p < 0.001$, $d = 0.19$, for Time 2 compared to Time 3 ($M = 102.62$, $SD = 97.83$).

Also the GLM on the number of daily new cases in Italy yielded a significant effect of clusters, $\chi^2(2, N = 40) = 33{,}215.00$, $p < 0.001$. *Post hoc* tests indicated that new cases were lower, $z = -156.06$, $p < 0.001$, $d = 1.15$, for Time 1 ($M = 1{,}747.90$, $SD = 1{,}323.06$) compared to Time 2 ($M = 5{,}528.57$, $SD = 601.98$), while they were higher, $z = 24.75$, $p < 0.001$, $d = 0.16$, for Time 2 compared to Time 3 ($M = 4{,}707.69$, $SD = 947.33$). However, new cases for Time 3 were higher, $z = 147.79$, $p < 0.001$, $d = 0.99$, than new cases for Time 1.

Finally, clusters resulted significant also in the GLM on the number of daily new cases worldwide, $\chi^2(2, N = 40) = 1{,}069{,}313.00$, $p < 0.001$. *Post hoc* tests indicated that new cases were lower, $z = -502.98$, $p < 0.001$, $d = 1.68$, for Time 1 ($M = 6{,}825.00$, $SD = 5{,}571.82$) compared to Time 2 ($M = 36{,}771.43$, $SD = 8{,}239.89$), and lower, $z = -302.99$, $p < 0.001$, $d = 0.67$, for Time 2 compared to Time 3 ($M = 72{,}161.54$, $SD = 7{,}704.17$).

To sum up, during the first part of the campaign (Time 1), the daily pageviews were high while the numbers of daily new cases, both in Italy and worldwide, were quite low; during the central part of the campaign (Time 2), the daily pageviews decreased while the numbers of daily new cases increased; during the last part of the campaign (Time 3), the daily pageviews further decreased, along with a slight diminishment of the daily new cases in Italy and an increase worldwide.

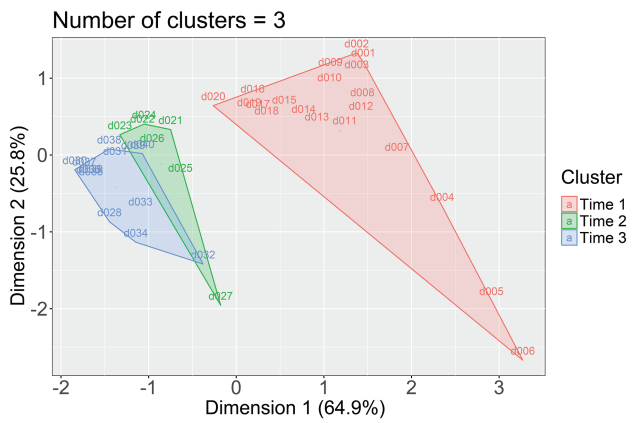

FIGURE 1 | Plot of the three clusters (Time 1, Time 2, and Time 3). Dimension 1 explained 64.9% of the variance; dimension 2 explained 25.8% of the variance.

Perceived Comprehensibility and Utility of the Pamphlet

Concerning comprehensibility, 30.56% of the participants evaluated the pamphlet as very clear, 52.08% as clear, and 17.36% as moderately clear. Moreover, 22.22% of them evaluated it as very useful, 48.61% as useful, 24.31% as moderately useful, and 4.86% as a little useful.

DISCUSSION AND CONCLUSIONS

Discussion of Main Findings

We addressed a public health problem of extreme relevance worldwide in 2020 – the pandemic for which a vaccine or anti-viral treatment had not yet been found at the time in which we conducted the public communication campaign described in this paper. The total traumatic impact of the COVID-19 in terms of loss of human lives, economic changes, and consequences for mental health were still undetermined and potentially very severe. A previously inconceivable uncertainty about the future had suddenly emerged. At both the individual and social levels, negative emotional reactions pervaded communities around the world. This can be stated on the basis of personal experience and anecdotal knowledge, given that scarce data were available to document it at the time of writing. But lessons could be learned from previous research on the consequences of other traumatic events and on the ways used by people to cope successfully with them, specifically findings about epidemics and pandemics different

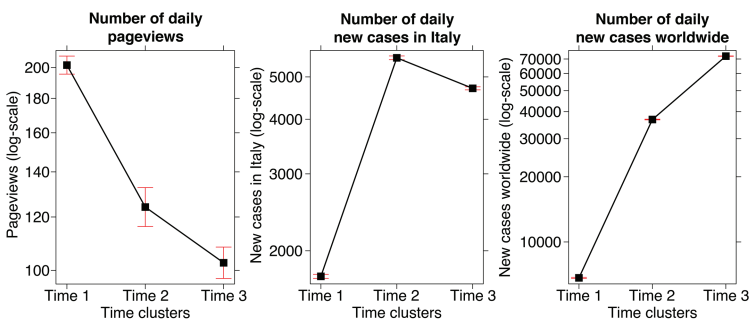

FIGURE 2 | Representation of the three clusters (Time 1, Time 2, and Time 3) concerning the number of daily pageviews of the page of the pamphlet in the HEMOT® website, the number of daily new cases in Italy, and the number of daily new cases worldwide, according to the results of the *k*-means cluster analysis. For each graph, the *y*-axis is represented on a logarithmic scale, and the bars are the 95% confidence intervals.

from this one (Cheng and Tang, 2004; Ko et al., 2006; Goodwin et al., 2011; Main et al., 2011; Prati et al., 2011; Vaughan, 2011; Karademas et al., 2012; Manabe et al., 2012; Kim and Niederdeppe, 2013; Taha et al., 2014). Meanwhile, an increasing number of studies on COVID-19 are still in progress (Ahorsu et al., 2020; Galea et al., 2020; Garfin et al., 2020; Horesh and Brown, 2020; Kwok et al., 2020; Shigemura et al., 2020; Wang et al., 2020; Xiang et al., 2020), mirroring the need for urgent research on this topic (Bouffet et al., 2020; Galea et al., 2020; Horesh and Brown, 2020; Xiang et al., 2020).

We were able to plan and implement the campaign described in this article with such a tight schedule, thanks to previous research that we have been conducting to foster disaster-related emotional preparedness among children and adolescents (Raccanello et al., 2019, 2020b,c). Mapping the diffusion of the pamphlet through the media indicated that the campaign was capable of reaching the target population both at a national level and at an international level, through at least 216 media channels including the HEMOT® website. The use of Google Analytics™ data related to the HEMOT® website enabled us to examine characteristics of the visitors of the website and their behavior on the webpage carrying the coronavirus-related pamphlet. More than 6,000 visitors, most from Europe (particularly, Italy) followed by the Americas, visited the website in the first 40 days after the pamphlet publication. The webpage including the pamphlet obtained over 6,200 views, most directly or *via* other websites. The visits were in three waves; most visitors in each wave came from Europe; however, the percentage of visitors from the Americas increased in the second and third waves, mirroring the growing relevance of the problem for those continents. Moreover, the exam of the correlations between the number of daily views of the webpage with the pamphlet and the number of daily new cases in Italy and worldwide suggested the existence of different trends concerning the three measures. Across time, the number of pageviews decreased while the number of new cases in Italy increased, mirroring what was happening worldwide. It is worth noting that the campaign began spreading the pamphlet through the HEMOT® website; however, the following dissemination was prompted also by a variety of other media, independently from the original source. In addition, a cluster analysis enabled us to identify whether the trends relating to pageviews and new cases could be grouped according to specific characteristics. Our findings revealed that the first 40 days of the campaign could be divided into three phases, long 20, 7, and 13 days, respectively. Across the three clusters, the number of daily pageviews decreased; the number of daily new cases in Italy increased from Time 1 to Time 2 while it decreased from Time 2 to Time 3; and the number of daily new cases worldwide continued to increase. We could speculate that the general decrease in pageviews from Time 1 to Time 3, despite the increases in new cases, could be due to a variety of reasons. It does not necessarily mean that the campaign lost its capabilities of reaching people or that people were so overwhelmed that they stopped searching in the Internet for psychological resources. It could be due for example to the overload of daily information spread worldwide related to COVID-19. Alternatively, it could be linked to the fact that many sources independent from our website disseminated the pamphlet, and we had not the possibility to trace them. In the future, it could be useful to verify if this trend is typical of other psychological campaigns of public interest or whether the main source of dissemination remains the most consulted source also in the long-term. Finally, data gathered with a convenience sample of adults who had consulted the pamphlet gave evidence of the clarity of the message conveyed and of the utility of the pamphlet for children and adolescents.

Therefore, these data on the evaluation of the campaign supported its utility. Given the potentially dramatic open-ended implications of the COVID-19 diffusion, future implementation and dissemination of this campaign could be replicated in the same way in different communities and settings. Also, it could be replicated for different public health problems. The experience with this campaign underlines the importance of developing techniques based on demonstrated scientific principles and translating them into forms that can be rapidly deployed in the event of an emergency.

Limitations and Future Directions

This campaign suffers from several limitations. First, we know that interventions on emotional competence should be tested against the standards of evidence-based research (Flay et al., 2005; Gottfredson et al., 2018) and that they need time and more elaborated activities to increase the probability of changing people's knowledge, attitudes, and behaviors. Future interventions could also be focused not only on emotions and coping strategies but also on related cognitions and behaviors. Moreover, we did not gather data for assessing the direct impact of the campaign on people's knowledge and behaviors. However, the much reduced time for releasing the pamphlet to respond promptly to a sudden need due to the unexpected emergency prevented us from respecting all the principles suggested by a scientifically driven persuasion model within health communication. In addition, future materials to be disseminated and interventions should be differentiated, whether possible, according to the specific characteristics of the final addressees, such as age (e.g., for children, adolescents, etc.). In our case, this was not possible, given the urgency of the situation. However, in order to take into account such differences, the pamphlet targeted parents, teachers, etc., as adults who can act as privileged mediators (Masten and Osofsky, 2010) between specific information (given through the pamphlet) and final users. Finally, we highlight that the pamphlet, by being released early in the pandemic, might have received more attention than it would have later, if there were competing sources of information on the same topic, and that is was not possible to monitor in details its dissemination. On the whole, we realize that circulating information is only part of the challenge.

Conclusion

Finding out how people respond to the information is vitally important, and this should be examined carefully in further studies. Future campaigns could also learn lessons from our

experience in this case community study and include these elements to increase their success.

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 participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

DR, GV, ER, VB, RH, and RB contributed to conception and design of the study and of the pamphlet. DR, GV, and RB organized the database. GV, ER, VB, RH, and RB wrote sections of the manuscript DR wrote the first draft of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/article/10.3389/fpsyg.2020.02184/full#supplementary-material

SUPPLEMENTARY FIGURE 1 | Number of daily pageviews for the webpage dedicated to the pamphlet, number of daily new cases of coronavirus disease (COVID-19) in Italy and worldwide, from 28th February to 7th April 2020.

SUPPLEMENTARY FIGURE 2 | Geographic heat map on the number of pageviews for the webpage dedicated to the pamphlet from 28th February to 7th April 2020 worldwide.

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Conflict of Interest: RH was employed by the company Environmetrics Pty Ltd. The remaining 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.

APPENDIX

HEMOT® Helmet for EMOTions | UNIVERSITÀ di VERONA | Dipartimento di SCIENZE UMANE | UNIVR IL SAPERE A COLORI

PUBLIC HEALTH EMERGENCY:

PSYCHOLOGICAL TIPS FOR CHILDREN AND ADOLESCENTS' EMOTIONS

Coronavirus and public health emergency: words for grown-ups that can scare everybody, including younger people. Below, some ways to help children and adolescents to understand and cope with related emotions.

WHAT IS CORONAVIRUS?

It is a new type of virus that is spreading around the world.
The scientists called it SARS-CoV-2.

WHAT IS A PUBLIC HEALTH EMERGENCY?

It is an extraordinary event which threatens the health of people that live in different parts of the world through the spread of disease that requires the coordination of different states and countries. The spread of the COVID-19 led World Health Organization to declare a state of public health emergency of international concern in 2020.

WHICH EMOTIONS CAN WE FEEL?

We can feel emotions such as…

FEAR **SADNESS** **ANGER**

However, it would be great to continue to feel emotions such as…

RELAXATION **ENJOYMENT**

HOW CAN WE COPE WITH FEAR, SADNESS, AND ANGER?

LOOK FOR SOLUTIONS

Don't	Do
× **Give up**	✓ **Take steps to help solve the problem**
- Stop looking for solutions.	- Do the right things (for example washing your hands frequently).
- Think that you can't do anything.	- Follow advice from experts.
× **Ignore reality**	✓ **Talk about facts**
- Pretend that there is no emergency.	- Look for information from reliable sources.
- Listen to rumours.	- Give correct, clear, and comprehensible information.

SEEK AND GIVE SUPPORT

Don't	Do
× **Put all the responsibility on to others**	✓ **Understand and express your emotions**
- Complain too much.	- Talk about how you feel.
- Panic.	- Be calm.
× **Isolate yourself from others**	✓ **Receive and give help**
- Withdraw into yourself.	- Help and reassure those around you.
- Be selfish.	- Collaborate with others.
- Interrupt contacts with others.	- Communicate with friends and family face-to-face or by phone and internet.

UNDERSTAND WHAT IS IMPORTANT

Don't	Do
× **Continue to think negatively**	✓ **Take some time to focus on other things**
- Overthink about the emergency.	- Keep yourself busy (for example playing or studying).
- Think that the safety measures (for example the quarantine) are not useful.	- Spend some time thinking about positive things
× **Ignore the recommended safety plans**	✓ **Adapt**
- Ignore the regulations from the Ministry of Health.	- Change the ways you do things if necessary.
- Blame others.	- Remember that following the rules protects everybody's health.

*There are many ways to **cope with fear**, **sadness**, and **anger**:*
we can choose case by case the ways that function better and also invent new ones!

Created by Daniela Raccanello, Giada Vicentini, Roberto Burro, Veronica Barnaba, Emmanuela Rocca, and Erminia Dal Corso
HEMOT® (Helmet for EMOTions, www.hemot.eu), Department of Human Sciences, University of Verona
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frontiers in Psychology

BRIEF RESEARCH REPORT
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Factors Predicting Willingness to Share COVID-19 Misinformation

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We conducted a preregistered exploratory survey to assess whether patterns of individual differences in political orientation, social dominance orientation (SDO), traditionalism, conspiracy ideation, or attitudes about science predict willingness to share different kinds of misinformation regarding the COVID-19 pandemic online. Analyses revealed two orthogonal models of individual differences predicting the willingness to share misinformation over social media platforms. Both models suggest a sizable role of different aspects of political belief, particularly SDO, in predicting tendencies to share different kinds of misinformation, predominantly conspiracy theories. Although exploratory, results from this study can contribute to the formulation of a socio-cognitive profile of individuals who act as vectors for the spread of scientific misinformation online, and can be useful for computationally modeling misinformation diffusion.

Keywords: conspiracy theories, COVID-19, misinformation, social media, political orientation

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INTRODUCTION

Currently, the world is experiencing a global pandemic of SARS-CoV-2, the virus causing the COVID-19 disease (World Health Organization, 2020). Scientific and medical information concerning the virus is being discovered and relayed quickly in efforts to inform the general public and policymakers about how best to respond. The demand for information related to COVID-19 is high, creating a prime environment for misinformation to spread.

The information environment surrounding the pandemic affords an opportunity to study the spread of scientific misinformation on social media platforms. We explored whether different patterns of individual differences predict the inclination to share different kinds of misinformation about a salient socio-cultural scientific topic. For the purposes of the present research, we limited our focus to individual differences in propensity toward conspiracy ideation, attitudes toward science, and facets of political ideology. Each of these individual differences has been previously found to relate either to the endorsement of misinformation or to how people respond to health threats from pathogens, as will be briefly described below.

MISINFORMATION DIFFUSION ONLINE

Research on the diffusion of information online consistently finds that misinformation diffuses faster and reaches broader audiences than correct information (del Vicario et al., 2016; Vosoughi et al., 2018). Exploring information sharing over social media platforms can facilitate the scientific understanding of the spread of misinformation. Here, we focus on factors associated

with willingness to disseminate misinformation online. It is important to note that spreading misinformation does not need to be indicative of a deliberate attempt to deceive nor does spreading misinformation necessarily stem from a person being gullible. Sharing misinformation online can occur under a variety of other circumstances, such as when people post a link to an article to try and generate discussion among their social network or to draw attention to a misinformed claim as being misinformed. The current work does not focus on the specific motivations people may have for sharing misinformation, but rather the overall willingness to share claims regarding the current COVID-19 pandemic that happens to be untrue or unverifiable over social media.

Prior research investigating who shares misinformation on social media suggests that older individuals and people who are more politically conservative tend to share more political misinformation online relative to younger individuals, liberals, or moderates (Guess et al., 2019). Additionally, individuals who tend to gravitate toward conspiracy narratives on social media platforms are more likely to positively engage with – in the form of "likes," sharing, and commenting – misinformation claims than are individuals who gravitate toward scientific narratives (Bessi et al., 2015). Much of the recent research examining the spread of specific information and misinformation over social media has focused on sharing political information, mostly surrounding elections (e.g., Buchanan and Benson, 2019; Guess et al., 2019; Mosleh et al., 2020). However, relatively scant research has examined how these platforms are used for sharing and spreading information on specific scientific topics. By focusing on COVID-19 misinformation, the present research contributes to understanding the spread of misinformation on a specific scientific topic, albeit a scientific topic that has come to intersect with politics.

INDIVIDUAL DIFFERENCES PERTAINING TO MISINFORMATION

Conspiracy theorists typically posit explanations for large-scale events that contradict official or expert explanations (Goertzel, 1994). They tend to be distrustful of recognized legal or scientific cultural authorities. This distrust of authority is so pervasive in conspiracy ideation that people inclined to believe conspiracies will accept mutually exclusive conspiracy theories more than the official account of a major socio-cultural event (Wood et al., 2012). On social media, groups focused on disseminating conspiracy-related content – frequently framed as trying to inform people of news not covered by the mainstream news – tend to be more active than groups focused on disseminating scientifically informed content (Bessi et al., 2015). Accordingly, we are investigating the influence of individual differences in conspiracy ideation on willingness to share misinformation.

Researchers have found that belief in conspiracies correlates with the rejection of science and endorsement of pseudoscience (Lewandowsky et al., 2013a,b; Lobato et al., 2014; van der Linden, 2015; Lobato and Zimmerman, 2019) and to a general attitude toward science as lacking credibility (Hartman et al., 2017). Misinformation pertaining to how COVID-19 spreads, how susceptible different groups are, and what kinds of treatment or prevention methods are effective can emerge and spread from individuals who are antagonistic toward rigorous scientific investigation or those with financial or other incentives at odds with scientific rigor. Relatedly, information and misinformation about COVID-19 that is being disseminated frequently takes the form of empirical claims or interpretations of the results of preliminary empirical investigations (e.g., the headline "Some Blood Types May Be Slightly More Susceptible to COVID-19, Paper Suggests" from Bowler, 2020). Therefore, understanding who is likely to spread misinformation about a scientific topic requires assessing attitudes about science in general.

Because the COVID-19 pandemic represents a pathogen threat, research on individual difference factors related to pathogen threat responses is relevant. Convergent studies provide evidence that political conservatives are relatively more disgust-prone than are liberals, an affective response theorized to functionally relate to pathogen avoidance (Inbar et al., 2012; Terrizzi et al., 2013). Tybur et al. (2016) conducted a large multinational study to compare two theoretical accounts of the apparent positive correlation between pathogen sensitivity and political conservatism. According to one account of this relationship, which Tybur and colleagues call a "traditional norms" account, some cultural traditions and behavioral norms (particularly surrounding food preparation) arise because they help neutralize threats posed by pathogens. Under this model, the link between pathogen sensitivity and political conservatism is driven largely by adherence to the traditional moral values and lifestyles of the in-group. A distinct intergroup account of the relationship between political views and pathogen stress response, which Tybur and colleagues call an "out-group-avoidance" account, posits that over time individuals develop resistance to local pathogens but remain vulnerable to pathogens borne by out-group members. Under this account, the relationship between pathogen sensitivity and political views is driven primarily by ideologies favoring hierarchical social stratification, termed social dominance orientation (SDO; Pratto et al., 2013), that place out-groups in subordinate positions. Tybur et al. (2016) tested both accounts in cross-cultural research spanning 30 nations, finding support for the traditional norms account over the out-group-avoidance account. Although inclinations toward social dominance and adherence to traditionalism are both associated with political conservatism, pathogen-avoidance responses appear to be driven more by traditionalism than social dominance. Here, we include both measures of SDO and traditionalism to explore their relative contributions to the spread of health-related misinformation in the midst of a global pandemic.

In sum, prior research provides evidence that interrelated dispositions may be related to conspiracy ideation, negative attitudes toward science, and political ideology. Further, these factors may also predict willingness to share misinformation. The goal of the present exploratory research is to begin characterizing the socio-cognitive profile of individuals likely to spread misinformation online. To achieve this goal, we questioned individuals about their willingness to share

COVID-19 misinformation over social media platforms and took measures of their inclination to conspiracy ideation, their attitudes toward science, and their political ideology along several dimensions. Materials, data, and study preregistration documents are available on the Open Science Framework: https://osf.io/ytsr8/.

MATERIALS AND METHODS

Participants

We recruited 404 participants *via* Amazon's Mechanical Turk, comparable to other research on credulity about hazard claims (e.g., Samore et al., 2018). We removed data on the basis of preregistered criteria: incomplete responses to the dependent measure or individual difference measures, completing the study in less than 2 min, and failure to respond or nonsensical response to an open-ended question asking them to describe the study. The final sample, after exclusions, was 296 participants (M_{age} = 36.23, SD_{age} = 10.96; 178 men, 117 women, 1 other). Participants were paid $0.75USD for participation.

Materials

We used fact-checking sites, such as Snopes.com and FactCheck.org, to create an *ad hoc* measure of peoples' willingness to share misinformation about COVID-19 over social media. Eighteen actual claims, either verified to be untrue or unverifiable, that have been made regarding COVID-19 were presented to participants. For each claim, participants used a slider to indicate how likely they would be to share that claim over their social media accounts. The slider bar ranged from scores of 0 to 100, with anchors of "Definitely not share," "Less likely to share," "More likely to share," and "Definitely share" located at the 0, 33, 66, and 100 marks, respectively. We calculated mean scores for participants' willingness to share misinformed claims about COVID-19. The items selected for this scale were *a priori* categorized as claims regarding: (a) severity and spread of COVID-19 (α = 0.91), (b) treatment and prevention of COVID-19 (α = 0.92), (c) COVID-19 conspiracy theories (α = 0.89), and (d) miscellaneous incorrect or unverifiable claims (α = 0.78). **Table 1** details the sets of claims and categorization scheme. The categorization scheme utilized in the current work was based on the categorization structure of claims from the originating fact-checking sites and was conducted by two authors. For example, Snopes.com created multiple webpages for fact-check coronavirus claims (available here: https://www.snopes.com/collections/new-coronavirus-collection/). The categorization scheme in this study was inspired by categorizations used on Snopes.com: "Origins and Spread," "Treatment and Prevention," and "Conspiracy Theories." We build on this by including a "Miscellaneous" category which includes claims from diverse categories on the Snopes collection webpage, such as "Media and Entertainment" or "Prophecies and Predictions."

Individual Difference Measures

We measured participants' disposition toward conspiracy ideation with the Conspiracy Mentality Questionnaire (α = 0.83; Bruder et al., 2013). Participants rated their level of certainty about various statements on an 11-point Likert scale (0% – *Certainly Not* to 100% – *Certain*). This five-item measure includes statements such as "I think there are secret organizations that greatly influence political decisions."

We measured participants' general attitudes toward science with the Credibility of Science Scale (CoSS; α = 0.94; Hartman et al., 2017). This six-item measure asks participants to respond on a 7-point Likert Scale (1 = *Disagree Very Strongly*; 7 = *Agree Very Strongly*) to statements such as "People trust scientists a lot more than they should." The CoSS is scored such that higher scores represent less favorable views of science as credible.

We used a modified version of the Political Issues Index (α = 0.76; Dodd et al., 2012; Holbrook et al., 2018) as a proxy for where participants generally fall on the liberal-to-conservative political spectrum. This 20-item measure lists socio-political

TABLE 1 | COVID-19 misinformation claims used in the study.

Severity/Spread	1. Health experts predicted the new coronavirus could kill 65 million people.
	2. Chinese doctors confirmed that African people are "genetically resistant" to new coronavirus.
	3. Warmer weather will inhibit the spread of the new coronavirus.
	4. The novel coronavirus COVID-19 is more deadly than any known pathogen.
	5. Only the elderly and people with preexisting medical conditions can catch the coronavirus.
	6. People with Type-A blood are more susceptible to COVID-19.
Treatment/ Prevention	7. Taking a few sips of water every 15 min will prevent the new coronavirus from entering your windpipe and lungs.
	8. If you can hold your breath without coughing, discomfort, stiffness, or tightness, your lungs do not suffer from fibrosis and therefore you have no COVID-19 infection.
	9. Mass vaccination for COVID-19 in the African country of Senegal was started April 8th and the first seven children who received it died on the spot.
	10. Lemon Juice Tea has been shown to cure COVID-19.
Conspiracies	11. Democrats in New York stashed ventilators in a warehouse in an effort to make the COVID-19 pandemic worse.
	12. The COVID-19 virus is a chimera. It includes SARS, an already weaponized coronavirus, along with HIV genetic material and possibly flu virus.
	13. Donald Trump owns stock in a company the CDC uses for COVID-19 tests.
	14. 5G cellular service technology is linked to the cause of the coronavirus.
	15. COVID-19 was created in a virology lab as a potential bioweapon, but accidentally got released before it had been fully studied by its creators.
Miscellaneous	16. Sales of Corona beer dropped sharply in early 2020 because consumers mistakenly associated the brand name with the new coronavirus.
	17. Idris Elba and other celebs have been paid to say they have coronavirus.
	18. Nostradamus predicted the COVID-19 pandemic.

issues (e.g., "Same-sex marriage," "Reduce business regulations," and "Right to abortion"), and participants indicate whether they *Agree*, *Disagree*, or are *Uncertain* about the issue. The Political Issues Index is scored from −1 to 1, reverse-scoring agreement with the traditionally liberal items, such that lower values represent greater alignment with traditionally liberal policy positions, and higher values represent greater alignment with traditionally conservative policy positions ("Uncertain" responses are scored as zero).

We used the SDO short form (α = 0.74; Pratto et al., 2013) to measure approval of social hierarchies. Participants respond to this four-item measure by using a 7-point Likert scale (1 = *Extremely Oppose*; 7 = *Extremely Favor*) to indicate how much they reject or support statements concerning social hierarchies and egalitarianism. An example item is "Superior groups should dominate inferior groups."

We used the six-item Traditionalism subscale from the Authoritarian-Conservatism-Traditionalism scale (α = 0.83; Duckitt et al., 2010) to measure participants' valuation of traditional moral systems and lifestyles and resistance to modern challenges to such traditional values and lifestyles. Participants responded on a 7-point Likert scale (1 = *Strongly Disagree*; 7 = *Strongly Agree*) to statements such as "This country will flourish if young people stop experimenting with drugs, alcohol, and sex, and pay more attention to family values."

Procedure

After providing informed consent, participants were presented with the following instructions:

> We are interested in examining what types of things people share over social media. Sometimes people share information because they think it is true and want others to know it. Sometimes people share information even if they think it is false because they would like to warn other people to not believe it if they hear it from somewhere else. Sometimes people share information that they are not sure about as a way to see what their friends and family think. And sometimes people share information for other reasons entirely. In this task, you will be presented with a series of claims regarding the current COVID-19 (aka SARS-CoV-2) pandemic that have been made and shared over both traditional media outlets, such as TV news programs or newspapers, and over social media outlets, such as Facebook or Twitter. You may have even encountered some of these already.
> For each claim, use the slider bar provided to rate how likely you think you would be to share this over your own social media accounts.

After reading the instructions, participants completed the task. The 18 claims we used as stimuli were presented in a randomized order. Participants were informed that these were real claims that have been made on both traditional news media outlets and on social media platforms. Following this task, participants filled out the individual difference measures in randomized order. Finally, participants filled out a demographics form. Participants were debriefed as to the nature of the study and informed that the claims they read regarding COVID-19 were not true. In the debriefing, we provided links to fact-checking and health agency websites for participants, to help provide participants with resources to keep up to date with COVID-19 information and misinformation.

RESULTS

Table 2 presents the descriptive statistics for scores on the individual difference measures and for mean participant ratings of their likelihood to share the examined types of COVID-19 misinformation. On average, our sample was not inclined toward liberalism or conservatism, as measured by the modified Political Issues Index. Our sample was mildly inclined toward conspiracy ideation. Additionally, the sample was mildly above the midpoint for the CoSS, indicating a slight inclination toward rejecting science as credible. Our sample also averaged slightly below the midpoint on the SDO scale, while averaging around the midpoint on the Traditionalism scale. Regarding willingness to share COVID-19 misinformation claims over social media, our sample averaged below the midpoint, suggesting an overall low willingness to share the COVID-19 claims we tested. All measures correlated significantly with each other at the $p < 0.001$ level; **Table 3** shows the correlation matrix. Diagnostics for

TABLE 2 | Descriptive statistics.

	M	*SD*	Range	Skew	Kurtosis
Conspiracy Mentality Questionnaire	7.73	1.80	1–11	−0.91	−0.23
Credibility of Science Scale	4.25	1.70	1–7	−0.48	−0.94
Political Issues Index	−0.05	7.41	−20 – 20	−0.48	−0.23
Social Dominance Orientation	2.95	1.39	1–7	−0.08	−1.21
Traditionalism	3.86	1.39	1–7	−0.12	−0.27
COVID-19 claims total	41.67	27.31	1–100	0.19	−1.09
Severity/Spread	44.81	27.97	1–100	0.06	−1.08
Treatment/Prevention	38.48	31.53	1–100	0.24	−1.29
Conspiracies	40.39	28.47	1–100	0.17	−1.10
Miscellaneous	41.77	27.20	1–100	0.21	−0.93

N = 296.

the inferential analyses reported below revealed no outliers that exerted sufficient influence on the models to warrant removal and that all assumptions necessary for linear analysis were met.

We assessed the relationship between the individual difference measures and self-reported willingness to share different kinds of COVID-19 misinformation over social media using a canonical correlation analysis. A canonical correlation analysis allows analysis of the relationship between sets of predictor and outcome variables by creating synthetic variates representing linear combinations of the predictor variables and linear combinations of the outcome variables. For each synthetic variate, the strength of the contribution to the synthetic variate for each variable produces a function coefficient. Additionally, the analysis produces a bivariate correlation between each predictor and criterion variable and the respective synthetic variate, known as the structure coefficient. This analysis strategy is designed to generate the highest correlation between the two variable sets (Tabachnick and Fidell, 2007). In canonical correlation analysis, multiple orthogonal models are created, equal to the number of variables in the smaller set. The first model is created to maximally explain the variance between the two sets of predictors, and subsequent models are created to maximally explain the remaining variance not explained by prior models. Each model represents one unique linear combination of outcome variables regressed onto one unique linear combination of predictor variables. We chose this multivariate analysis strategy because of the exploratory nature of the research, as it is an approach that can reveal at once multiple potential ways in which sets of variables relate to each other, rather than running a series of univariate multiple regression analyses. Canonical analysis is useful for exploratory research where there are distinct sets of variables of interest, such as a set of potential independent variables and a set of potential dependent variables.

The full model across functions was significant, creating four functions with squared canonical correlations (canonical r^2) of 0.48 for the first function, 0.10 for the second function, 0.02 for the third function, and 0.01 for the fourth function. However, only the first function (Wilk's λ = 0.45, $F(20, 952.8) = 12.84$, $p < 0.001$) and the second function (Wilk's $\lambda = 0.88$, $F(12, 762.3) = 3.16$, $p < 0.001$) were significant, and combined explained 58% of the total variance. Sensitivity analysis conducted using G*Power (Faul et al., 2009) with power set to 0.90 and α set to 0.05 revealed our analysis was powered sufficiently to detect effect sizes as small as $f^2 = 0.056$, corresponding roughly to $r^2 = 0.053$.

For the first function (see **Table 4**), the synthetic predictor variate was primarily composed of participant scores on the Political Issues Index and the measure of SDO, possessing standardized function coefficients greater than |0.33|. The first synthetic criterion variable was primarily composed of participant's intention to spread conspiracy-related misinformation, with a standardized function coefficient of −1.02. Together, the first model reveals that participants who are primarily more liberal (in terms of the issues index) and less oriented toward social dominance were less inclined to share COVID-19 claims that were conspiratorial in nature (see **Figure 1**). Additionally, the standardized structure coefficients revealed that all individual differences significantly correlated with the synthetic predictor variate, and all misinformation categories significantly correlated with the synthetic criterion variate.

For the second function produced by the canonical analysis (see **Table 4**), the synthetic predictor was substantially composed of participant scores on the measure of SDO and the measure of Traditionalism, with standardized function coefficients of at least |0.55|. The second function's synthetic criterion variate was primarily composed of intention to spread misinformation regarding the severity and spread of COVID-19, COVID-19 conspiracies, and miscellaneous COVID-19 misinformation claims. Each criterion variable possessed standardized function coefficients of at least |0.34| for the second synthetic criterion variate. The second model produced by the canonical analysis revealed that individuals high in SDO and low in Traditionalism were less inclined to share misinformation claims regarding the severity and spread of COVID-19, but more inclined to share COVID-19 conspiracies and miscellaneous COVID-19 misinformation claims (see **Figure 1**). Additionally, the standardized structure coefficients revealed that participant scores on the Conspiracy Mentality Questionnaire and Traditionalism scale were significantly negatively correlated with

TABLE 3 | Pearson product moment correlations.

	1	2	3	4	5	6	7	8	9	10
1. CMQ		0.57	0.34	0.27	0.33	0.47	0.45	0.43	0.49	0.40
2. CoSS			0.58	0.54	0.59	0.62	0.57	0.58	0.65	0.54
3. PII				0.32	0.77	0.28	0.28	0.28	0.30	0.17
4. SDO					0.20	0.44	0.35	0.43	0.48	0.43
5. Traditionalism						0.35	0.36	0.35	0.34	0.21
6. COVID claims							0.96	0.96	0.96	0.89
7. Severity/Spread								0.89	0.88	0.81
8. Treatment/Prevention									0.90	0.81
9. Conspiracies										0.84
10. Miscellaneous										

N = 296. All correlations significant at the p < 0.001 level. CMQ, Conspiracy Mentality Questionnaire; CoSS, Credibility of Science Scale (higher scores indicating greater skepticism of science); PII, Political Issues Index (higher scores indicating greater conservatism); SDO, Social Dominance Orientation short form.

TABLE 4 | Standardized function and structure coefficients for the first and second canonical variates.

Predictors	Function		Structure	
	CV1	CV2	CV1	CV2
Individual differences				
Conspiracy mentality	0.29	–0.18	**–0.40**	**–0.58**
Credibility of science	–0.27	–0.23	**–0.70**	–0.27
Political issues index	**–0.69**	0.25	**–0.93**	–0.18
SDO	**–0.33**	**0.55**	**–0.71**	**0.40**
Traditionalism	–0.13	**–0.83**	**–0.46**	**–0.79**
Kinds of misinformation				
Severity/Spread	0.18	**–1.70**	**–0.85**	**–0.37**
Treatment/Prevention	–0.02	–0.21	**–0.89**	–0.20
Conspiracies	**–1.02**	**0.34**	**–1.00**	–0.09
Misc.	–0.13	**1.50**	**–0.87**	0.24

N = 296. SDO, social dominance orientation. Bolded function items are substantial contributors to the synthetic variate. Bolded structure items are significantly correlated with the synthetic variate.

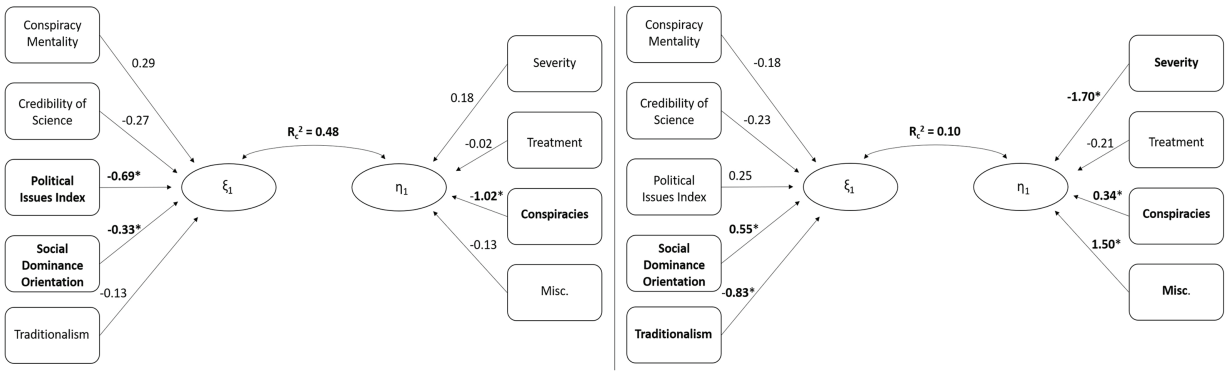

FIGURE 1 | Diagram of the two significant canonical models. Substantial contributors to the synthetic predictor variate (ξ) and criterion variate (η) are bolded and noted with *. The squared canonical correlations (R^2_c) are significant at the $p < 0.001$ level. **Left panel**: More alignment with liberal policy positions and a low social dominance orientation (SDO) predict a low willingness to share conspiracy theories about COVID-19 on social media. **Right panel**: A high SDO and a low endorsement of traditionalism predict a low willingness to share misinformation on social media related to the severity and spread of COVID-19, but a high willingness to share conspiracies about COVID-19 and miscellaneous cultural misinformation about COVID-19.

the synthetic predictor variate and scores on SDO measure significantly positively correlated with the synthetic variate, whereas inclination to share misinformation pertaining to COVID-19 severity and spread correlated negatively with the synthetic criterion variate.

DISCUSSION

The global COVID-19 pandemic has contributed to an environment allowing for the opportunistic study of the diffusion of misinformation over social media. We report on a preregistered exploratory study investigating theoretically relevant individual differences and willingness to spread different kinds of misinformation on a salient scientific topic, COVID-19. Overall, our canonical model revealed two distinct profiles predicting two patterns of willingness to share misinformation.

The first profile showed that individuals who are both more aligned with liberal policy positions and less oriented toward social dominance were substantially less willing to spread conspiracy-themed misinformation on social media. Whereas prior research has found that conservatism is positively related to spreading political misinformation on social media (Guess et al., 2019), our results suggest that liberals with a low disposition toward social dominance are less willing specifically to share conspiratorial misinformation than are conservatives with a high disposition toward social dominance, at least regarding a culturally salient scientific topic. This finding fits with recent research exploring the relationship between political ideologies, conspiracist ideation, and negative-biased credulity. Generally, the more conservative an individual is the more likely they are to endorse conspiracy theories and to hold a stronger general conspiracist worldview than for individuals who are more liberal, at least for political conservatism as practiced in the United States (van der Linden et al., 2020). Additionally, research by Samore et al. (2018) has found that even when political power dynamics favor conservatives, there exists a positive association between

conservatism and conspiracist ideation. The results of our canonical analysis add to the growing body of literature that suggests that political conservatism, at least within the United States, may be partially defined by a conspiracist mindset.

The second profile showed that individuals who are both high in SDO and low in traditionalism are less willing to spread misinformation about the severity and spread of COVID-19, but more willing to spread conspiracy-themed misinformation, as well as miscellaneous culturally salient misinformation claims. This result is particularly interesting in light of prior research indicating that traditionalism, more so than covarying social dominance inclinations, drives pathogen sensitivity (Tybur et al., 2016). Here, we found that individuals high in traditionalism and low in social dominance were more willing to share misinformation about the severity and spread of the COVID-19 pathogen, consistent with the hypothesis that traditionalism functionally relates to pathogen-sensitivity. Equally suggestively, a reverse pattern was obtained with regard to SDO and propensities to spread misinformation, such that individuals who favored social dominance but not traditionalism were less inclined to spread claims about the severity of illness, instead showing a willingness to spread conspiratorial claims, a thematically consistent association insofar as conspiracies inherently entail certain groups vying for advantage over others.

The significant structure coefficients for both profiles hint that the relationships between the selected individual difference variables and the subtypes of COVID-19 misinformation studied here are more complicated than could be revealed by the use of a general linear model approach. However, it is important to note that because of the nature of canonical analysis, the resulting models were algorithmically determined to explain the largest amount of variance, irrespective of the variates' theoretical context. Although every individual difference selected for inclusion in the present study was motivated by relevant prior literature, follow-up research is needed to validate the patterns of individual differences and misinformation-sharing inclinations reported here. In addition, many other variables likely relevant to a person's willingness to act as a vector for misinformation spread on social media were not included in the present study, such as degree of media literacy (Guess et al., 2019) or cognitive sophistication (Pennycook and Rand, 2020). Future research should expand the scope of individual differences examined. Further, we investigated only self-reported willingness to share, and did not collect any data related to actual sharing behaviors. Although prior research has found a moderate positive correlation between self-reported willingness to share information and actual rates at which that information is shared online (Mosleh et al., 2020), collecting behavioral data on who actually does share what kinds of specific misinformation is needed.

Another potential limitation of this research concerns our categorization scheme for the claims we tested. Our approach to categorizing coronavirus claims was qualitative and largely influenced by a categorization scheme created for the general public to navigate a fact-checking website. Although the scheme we used produced subscales with acceptable reliability coefficients, resulting in orthogonal models from the canonical analysis, other categorization schemes also warrant future investigation. For example, Pennycook et al. (2020) categorized 21 coronavirus misperceptions using the categories "Optimistic," "Pessimistic," "Magical," and "Conspiratorial" for their investigation about motivated reasoning and political polarization regarding coronavirus claims. Future research might examine additional categorization schemes.

CONCLUSION

The present study was exploratory by design. Accordingly, these results should be interpreted with caution, but may inform more sophisticated research and modeling into misinformation diffusion about a scientific topic. Despite the limitations of the present research, we find that factors primarily related to individuals' political beliefs, and in particular tendencies toward social dominance, are important for understanding how misinformation concerning COVID-19 diffuses online.

DATA AVAILABILITY STATEMENT

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found in the article/supplementary material.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by University of California, Merced's Office of Research and Economic Development. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

EL and MP designed the study and created the stimuli. EL carried out statistical analysis. EL and CH contributed to interpreting the findings. EL drafted the manuscript. LP and CH contributed to the final version of the manuscript, providing critical feedback. LP supervised the project. All authors contributed to the article and approved the submitted version.

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Using Social Media to Communicate Sustainable Preventive Measures and Curtail Misinformation

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Effective crisis and risk communication strategies are crucial to promote preventive measures, particularly during times of emergency such as the global SARS-CoV-2 (COVID-19) pandemic. With its global reach, social media is a key source of news and information about COVID-19. However, the abundance of misinformation about personal protective measures that people post on social media, makes it imperative to develop a deeper understanding of effective messaging strategies. Improving the quality of information and strategy with which it is disseminated through social media is crucial to minimizing anxiety, panic and improving the adoption of sustainable preventive measures in addition to curtailing misinformation. Understanding the components of effective health communication strategies allows us to glean common methods to address misinformation which in turn lead to people adopting the appropriate preventive measures. The purpose of this article is to understand how effective social media communication strategies can be crafted to promote sustainable preventive measures and curtail wide-spread misinformation. Health organizations as well as communications organizations have made available information for effective social media messaging and more importantly serve as a gateway to other resources. We review their recommendations to identify common social media communication elements on the adoption of sustainable preventive measures and effective strategies for curtailing misinformation. We further review social media messaging during the Ebola and Zika outbreaks to evaluate the success of social media strategies and draw from lessons learned. We then create a set of best practices for developing and disseminating social media messaging regarding COVID-19.

Keywords: social media, health communication, misinformation, COVID-19, preventive measures

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INTRODUCTION

In less than 6 months SARS-CoV-2 (COVID-19) has grown from a localized outbreak in Wuhan, China to a global pandemic (Johns Hopkins University and Medicine, 2020). The exponential spread has left countries and health officials scrambling to contain the virus and protect their citizens. Currently there is no vaccine for COVID-19 and with an incubation period of up to 14 days, the virus has proven extremely difficult to contain (Lauer et al., 2020). The rapid rate at which the scientific community is learning about COVID-19 and personal protective measures have created a need for regular, easily accessible, up-to-date, and accurate information. The dramatic

changes in our daily lives have had an enormous impact on our behaviors including where we turn for news. As the scientific community learns more, there is a dire need to be able to disseminate information immediately; social media provides a platform that can facilitate this.

On March 27th, António Guterres, the Secretary General of the World Health Organization, posted on Twitter, "Our common enemy is #COVID-19, but our enemy is also an 'infodemic' of misinformation. To overcome the #coronavirus, we need to urgently promote facts and science" (United Nations, 2020). Developing effective social media strategies that provide accurate information about COVID-19 preventive measures is of the utmost importance.

In 2018, Guardian columnist Natalie Nougayrède said "The use of [misinformation] is ancient, but never before has there been the technology to so effectively disseminate it" (Nougayrede, 2018). Curtailing misinformation and developing effective social media messaging that increase the adoption of preventive measures is of the utmost importance. In the face of a pandemic, developing effective risk and emergency social media strategies is also crucial to counteract misinformation. By providing up to date and accurate information, promoting preventative messages, bringing together communities of individuals and experts along with celebrities' role modeling healthy behaviors, social media has the potential to be a powerful tool that could increase the adoption of sustainable preventive measures. This article outlines seven best practices for developing social media messaging about COVID-19.

MISINFORMATION AND INFORMATION PROCESSING

How people process information is rooted in the work of Baruch Spinoza and René Descartes. Descartes argued that people typically screen out and process misinformation shortly after being exposed to it. Spinoza countered Descartes' by espousing that people accept all information they are exposed to as truth and verify it or reject it in a subsequent process (University of Pennsylvania Annenberg School of Communication, 2017). While much of the work on information processing is attributable to Spinoza and Descartes, it has continued to be a focus of research psychologists. Events such as 9/11, elections, Ebola, Zika, and most recently COVID-19 has led to several studies that explore why people accept or reject misinformation or conspiracy theories. Particular emphasis has been placed on whether people are predisposed to reject official accounts of major issues (conspiracy ideation) or whether they have specific beliefs about specific theories (conspiracy beliefs) (Klofstad et al., 2019). Several studies have found that conspiracy ideation is a better predictor of whether or not a person will accept or reject misinformation (Klofstad et al., 2019; Business of Apps, 2020; Uscinski et al., 2020).

Lantian et al. (2017) identified several characteristics of a person that is likely to believe in conspiracy theories including an openness to experience, low agreeability, distrust, and Machiavellianism (Grohol, 2018). A study by Uscinski et al. (2020) that focused specifically on conspiracy theories and misinformation regarding COVID-19 supported the findings of Lantian et al. (2017) and also mentioned ideological motives and the politicization of major events such as COVID-19 as potential reasons for why a person might believe a conspiracy theory (Ireton and Posetti, 2018; Grohol, 2018). One finding of the study was that 29% of respondents agreed that the severity of COVID-19 had been exaggerated to damage the reputation of President Trump. Understanding the underlying tendencies and reasons that lead a person to accept or reject misinformation is crucial to understand when developing effective, accurate, and expedient social media strategies during the COVID-19 pandemic.

SOCIAL MEDIA DURING COVID-19

Social media use as a source of information and entertainment has grown exponentially over the last decade. The top five platforms are Facebook with 2.26 billion users, YouTube with 1.9 billion, WeChat with approximately 1 billion, Instagram with 1 billion users (Ortiz-Ospina, 2019), and TikTok with 500 million users (Carey et al., 2020; Statista, 2020). Users are often active on multiple platforms, so it is difficult to provide an estimate on exposure to specific information. The rapid global spread of COVID-19 has altered where people turn for news and updates about the virus. A recent report that analyzed media behaviors during the pandemic reported that 40% of people visit social media more for news than they did before COVID-19 (Havas Media Group, 2020). Despite consuming more news on social media, a recent survey by Axios-Harris reported that out of 13 sources of news that were identified, respondents answered that they trusted news or information posted on social media the least (Harris Insights and Analytics, 2020).

While misinformation is widespread on social media, it is important to note the positive role that social media can play if used to disseminate clear and accurate information about COVID-19. Dr. Jemilah Mahmood, Undersecretary General for Partnerships at the International Federation of Red Cross and Red Crescent Societies, said of social media during a crisis "by engaging with social media as standard practice in the aftermath of an emergency, we can understand what people are worried about; we can see news they are sharing; and we can respond decisively, accurately, and collaboratively" (International Federation of Red Cross and Red Crescent Societies, 2017; Posetti and Matthews, 2018). Social media gives health organizations the ability to disseminate information and update the public almost instantly. It also provides an opportunity for health organizations to gain a deeper understanding of misconceptions about COVID-19 and information that the public wants. Understanding how to craft and frame effective social media messaging in an engaging and approachable way is necessary to capture the attention of the public and curtail misinformation.

METHODS

We conducted five reviews to identify a set of best practices for effective social media messaging to promote sustainable

protective measures and curtail misinformation. Successful and unsuccessful strategies were identified to help inform the best practices detailed in the "Discussion" section.

First, we reviewed documents from the four health organizations in **Figure 1** that contained recommendations for effective social media messaging. These health organizations were selected for review because of their large social media following and the integral role they have played in disseminating accurate and up-to-date information about COVID-19 preventive measures. Second, we reviewed suggestions for effective social media messaging made by the four communications organizations in **Figure 1**. These communications organizations were selected because they served a dual purpose by providing specific recommendations and providing resources for our third review while many other communications organizations only provided recommendations or shared resources. In our third review we reviewed information about effective social media messaging from the additional resources that were provided by the communications organizations. These communications organizations provided links to articles with sets of recommendations, or specific examples of social media messages from the New York Times, Office of Disease Prevention and Health Promotion, PolitiFact's, and Vox and other news outlets and government agencies that were not part of the first two reviews and may not have been identified otherwise. These websites were explored in depth until we reached a saturation point where we believed all of the information regarding COVID-19 social messaging had been identified. Fourth, we examined social media use during the Ebola and Zika outbreaks by referencing several peer-reviewed articles to understand how social media messages were crafted during the Zika and Ebola outbreaks. Fifth, we reviewed social media strategies from countries such as Vietnam that are considered success stories in controlling COVID-19.

We defined a best practice as a recommendation made by multiple health and/or communications organizations or a strategy that was used in countries that have low transmission rates and deaths. A suggestion that is made for crafting social media messaging by one organization is not sufficient regardless of the organization's prestige. Most organizations have their own terminology so it is critical to understand synergies, contradictions, and contextual factors that may affect the development of their social media guidelines or practices in their respective recommendations. These best practices can also build upon successful strategies utilized during the Ebola and Zika outbreaks.

Health Organizations	Communications Organizations
The World Health Organization	Society for Health Communication
The Centers for Disease Control and Prevention	The Communications Network
Médecins Sans Frontières (Doctors without Borders)	Communication for Development Network
Johns Hopkins Medicine (Coronavirus Resource Center)	COVID-19 Resource Center (The Lancet)

FIGURE 1 | Health and communications organizations.

DISCUSSION

From these five reviews, seven best practices were identified to inform effective social media messaging to curtail misinformation and promote sustainable preventive measures during COVID-19.

Framing Risk to Promote Preventive Measures and Reduce Panic

Social media messages that effectively frame risk have the potential to reduce panic and increase adoption of preventive measures by conveying what behaviors and decisions put a person at increased risk of developing COVID-19. Vox posted an infographic on social media that broke risk of developing COVID-19 down into four categories, lowest risk (home alone or with housemates), moderate risk (outdoor activities), higher risk (outdoor gatherings), and highest risk (indoor gatherings). The infographic includes recommendations about preventive measures that are specific to each category. The infographic clearly conveys how to minimize risk of developing COVID-19 while conveying what preventive measures should be taken regardless of what risk category a person finds themselves in Resnick (2020). Social media messages need to be framed in a way that create an understanding of what activities and behaviors increase risk while promoting what preventive measures are necessary for personal protection based on category of risk.

Engage Online Influencers and Amplify the Voices of Experts

Espousing opinions and filling social media with uninformed opinions is not productive during an outbreak such as COVID-19. What is needed during outbreaks are facts from trusted organizations such as the World Health Organization, Centers for Disease Control, National Institute of Health or other organizations. Sharing verified facts about COVID-19 reduces fear, anxiety, and increases the adoption of proper protective measures while sharing opinions instills fear and panic. Amplifying the voices of experts increases the number of people that receive accurate and up to date information about COVID-19.

One way to do this is to engage online influencers or celebrities with large social media followings. The World Health Organization has 751,000 followers on Instagram while the Centers for Disease Control has 852,000. In comparison, several celebrities have hundreds of millions of followers. Celebrities can amplify the voices of experts by using their platforms to share messages crafted by experts and health organizations. The "pass

mic" imitative began on May 21st, 2020 and allows a celebrity to hand over their Instagram account to medical experts or frontline workers. On May 21st Julia Roberts, who has 8.8 million followers on Instagram, handed her account over to Dr. Anthony Fauci, a leading member of the White House Coronavirus task force. Roberts briefly interviewed Dr. Fauci on YouTube in addition to posting six COVID-19 related posts crafted by Dr. Fauci. Several other celebrities have committed to doing the same (Paisley, 2020). In Vietnam singer Khac Hun partnered with Vietnam's National Institute to write and promote a song called "ghen co vy" (coronavirus in Vietnamese) to promote hand washing (BBC News, 2020a). The song was turned into a TikTok video choreographed by dancer Quang Dang and has reached millions of users. The video even gained attention and has been promoted by UNICEF (UN News, 2020).

Craft Messages for Lay Audiences

Often during outbreaks such as COVID-19, those in charge of relaying information to the public use confusing scientific terms or jargon. Organizations such as the World Health Organization (World Health Organization, 2020a), the Centers for Disease Control (Centers for Disease Control and Prevention, 2019), and the American Psychological Association (Lu, 2015) recommend crafting simple and clear messaging. During times of stress and panic it can be difficult for people to process information the way they normally do. Confusing or text heavy social media posts can easily overwhelm people and have an adverse psychological impact. Developing social media messages that are short and to the point increases the chances that people will retain the message. Visuals and infographics can be particularly useful tools for social media (Centers for Disease Control and Prevention, 2019; World Health Organization, 2020a). Several organizations utilize infographics to promote protective measures such as hand washing, social distancing, cleaning and disinfecting objects and surfaces on a regular basis in addition to others. The World Health Organization released a set of infographics, one of which is "COVID-19 – Know the Facts." The infographic is separated into three sections, one that highlights that COVID-19 is primarily transmitted from person to person, another that outlines other modes of transmission (elevator buttons, doorknobs, pens, etc.), and finally details six ways to reduce the risk of developing COVID-19. In a straightforward and engaging way, this infographic outlines the primary way COVID-19 is spread, other ways it can be transmitted that people are less conscious of, and ways to reduce risk (World Health Organization, 2020a).

Create Interactive Forums Where the Public Can Access Up-to-Date Information

While crafting accurate and effective social media messages is crucial, messages often contain only information on one aspect of COVID-19. Messages that contain too much text or too much information can become overwhelming (Social Science in Humanitarian Action Platform, 2020). During uncertain and unprecedented times such as COVID-19, people have lots of questions and often few reliable forums in which to ask them. Interactive social media forums that the public can engage with and navigate to find answers to their questions about COVID-19 increases the amount of reliable information that they consume. Interactive platforms also offer a more tailored experience that allows the user to dictate what information they access. Facebook, in collaboration with the World Health Organization, developed an interactive health alert service through Facebook Messenger where users can type in their own question or choose from a dashboard of topics. These dashboard topics include latest numbers, personal protection, a myth of fact quiz, frequently asked questions, travel advice, news and press, and a share option. In a little more than a month, the World Health Organization's Health Alert System has already reached over 12 million people (Posetti and Matthews, 2018; World Health Organization, 2020b). Interactive platforms such as the Health Alert System offer an opportunity to widen the reach of accurate and up-to-date health information to millions of people worldwide.

Be Honest About What Is Known and Unknown

Information cannot be withheld from the public out of fear about how they will respond. Trust with the public is built over time, and consistent messages that acknowledge what is known and what is unknown not only helps builds trust it provides health organizations an opportunity to emphasize what preventive measures are known to work and should be adopted (BBC News, 2020b; Ethical Journalism Network, 2020; Social Science in Humanitarian Action Platform, 2020). The absence of communication from trusted sources about COVID-19 also creates an information vacuum that leads to speculation (Lu, 2015). Speculation leads to anxiety, panic, and forces people to formulate their own opinions about what is going on and how to protect themselves. Providing consistent updates about social media is an opportunity for trusted organizations to build trust with the public and release information about what is known and not known. In Vietnam, a country that has recorded zero deaths and under 500 cases of COVID-19 and shares a border with China, social media was used by the government and scientific journalists, to disseminate information about the "strange pneumonia" in China in the early days of the pandemic (Klofstad et al., 2019). La et al. (2020) note that raising awareness among the citizens of Vietnam created trust between the government, civil society, and private individuals and reduced panic about COVID-19 (Klofstad et al., 2019).

The Centers for Disease Control developed a set of 16 sets of social media platform specific (Twitter, Facebook, Instagram) infographics that are meant to inform the public about several different issues surrounding COVID-19 (Centers for Disease Control and Prevention, 2020). The first infographic in the "stop the spread" set begins with "much is unknown about how the virus that causes COVID-19 spread" and goes on to promote preventive measures such as hand washing, disinfecting objects and surfaces in addition to others. These infographics acknowledge that there is risk but highlight that there are known ways preventive measures that will reduce the risk of developing COVID-19.

Media and Information Literacy

Being responsible consumers of information on social media is important under any circumstances but is even more important during times of crises. The concept of media and information literacy is grounded in the idea that we need to critically assess information that we encounter (BBC News, 2020a). Questioning whether or not a source is credible, cross-checking facts with trusted sources of information about COVID-19, and not falling prey to headlines that are meant to elicit an emotional response are all important (Social Science in Humanitarian Action Platform, 2020). During the COVID-19 pandemic, fake accounts have been created that claim to be academic institutions that are typically reliable sources of information. Recently, an account claiming to be a researcher at Stanford University Hospital posted false claims such as "taking a few sips of water every 15 min" can prevent COVID-19 (Ziv and Wineburg, 2020).

Understanding how to spot misinformation is important in order to curtail misinformation on social media. The "sanitize before you share" campaign created by the News Literacy Project lays out four steps to spot and stop the spread of misinformation on social media by enhancing social media user's ability to detect it. Before a person shares a post on social media they should pause and not share the post because of their emotional response to it. Next, look through the comments to see if someone has posted a response with a fact check. If there are no fact check responses, do a quick google search to see if the information in the post is supported by trusted health organizations. Finally, if there is no evidence that supports the post, ask for the user's source. Comments asking for the source show up in the comments section of the post and can also alert other users to the fact that the information in the post is questionable and should be treated with skepticism (News Literacy Project, 2020).

Use Recommended Hashtags in Posts

Hashtags are used in social media before a relevant keyword or phrase and creates a hyperlink making information about that topic easier to find and engage with. The Centers for Disease Control recommends using #COVID19 whenever posting something COVID-19 related. Hashtags provide a space where people can have open communication about COVID-19 and disseminate information. Other hashtags such as #CoronaVirusFacts are used by trusted organizations or experts to debunk myths about COVID-19. #KnowCOVID is another hashtag that is used that provides people with links to trusted sources of information and shares posts from reliable sources with updates about COVID-19. Others such as #StayHomeStaySafe and #StayHome are used to promote preventive measures. Hashtags have been used in a number of different ways in the pandemic and can be a useful tool for fighting misinformation and promoting preventive measures.

LIMITATIONS

Despite drawing on recommendations and strengths of social media strategies and campaigns from trusted organizations and lessons learned from past epidemics, this article has several limitations. Because of the number of trusted health and communications organizations that have disseminated information about COVID-19 on social media, we were unable to review many recommendations that could inform effective social media campaigns. However, because the best practices we set forth were based on recommendations that were found across organizations and drew upon lessons learned during past epidemics, we are confident that these best practices will improve the quality of social media messaging during COVID-19. Additionally, social media platforms are constantly evolving, and platforms such as TikTok were not popular or were only available in a few countries. While TikTok videos and other campaigns on other social media platforms reach millions of users, whether they increase preventive measures and/or curtail misinformation has not been evaluated. Despite the limitations of this study, we believe our recommendations can serve as a foundation for additional research into increasing the adoption of preventive measures and slowing the spread of misinformation about COVID-19 on social media.

CONCLUSION

Developing a set of best practices for crafting social media messages during COVID-19 and expanding their reach has the potential to improve the quality of information on social media. Information about personal protective measures must come from trusted health organizations or experts that have the most up to date information. Misinformation and mixed messages force people to develop their own opinion about the most effective personal protective measures. Misinformation also creates uncertainty about the nature of COVID-19 which leads to increased fear, anxiety, and panic that can be reduced by receiving consistent, straight forward updates and messages from trusted health professionals. Social media is currently riddled with misinformation about COVID-19. While we cannot do anything to eliminate misinformation on social media, these best practices can serve as a foundation for developing effective social media messages, widen the reach of posts by health organizations, and enhance social media user's ability to detect and share misinformation. Preventive measures are not only important to adopt to protect individuals, but failure to adopt proper preventive measures decreases our ability to control COVID-19.

AUTHOR CONTRIBUTIONS

MH wrote the manuscript. SS provided feedback. Both authors contributed to the article and approved the submitted version.

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BRIEF RESEARCH REPORT
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Together Apart: The Mitigating Role of Digital Communication Technologies on Negative Affect During the COVID-19 Outbreak in Italy

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The ongoing pandemic of COVID-19 has forced governments to impose a lockdown, and many people have suddenly found themselves having to reduce their social relations drastically. Given the exceptional nature of similar situations, only a few studies have investigated the negative psychological effects of forced social isolation and how they can be mitigated in a real context. In the present study, we investigated whether the amount of digital communication technology use for virtual meetings (i.e., voice and video calls, online board games and multiplayer video games, or watching movies in party mode) during the lockdown promoted the perception of social support, which in itself mitigated the psychological effects of the lockdown in Italy. Data were collected in March 2020 (N = 465), during the lockdown imposed to reduce the COVID-19 spread. The results indicated that the amount of digital technology use reduced feelings of loneliness, anger/irritability, and boredom and increased belongingness *via* the perception of social support. The present study supported the positive role of digital technologies in maintaining meaningful social relationships even during an extreme situation such as a lockdown. Implications such as the need to reduce the digital divide and possible consequences of the ongoing pandemic are discussed.

Keywords: COVID-19, social isolation, social support, digital technology, negative affect

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INTRODUCTION

A worldwide outbreak of severe acute respiratory syndrome (SARS)-CoV-2 (COVID-19) begun in December 2019. At the beginning of April 2020, it caused more than 138,000 deaths and had infected 2 million individuals worldwide (World Health Organization, 2020a). With more than 40,000 recorded infections, Italy was considered the second epicenter of the pandemic (Horowitz et al., 2020). As the number of infected people continued to rise, the Italian government enacted a decree on March 8, 2020 (OJ-N.59 of 8-3-2020), imposing a lockdown to the whole country, aimed at preventing the spread of the virus. The term *lockdown* refers to stringent containment measures, such as quarantine and social distancing, in order to slow down the spread of COVID-19. At the beginning of April 2020, 165,000 Italians had been infected, and among these, 62,000 were in Lombardy (Opendata, 2020), one of the regions most affected by the infection.

Potential negative feelings that people can experience in the current emergency period, such as anxiety, loneliness, boredom, anger, and irritability, have been recently listed by both the WHO and the APA (American Psychological Association, 2020; World Health Organization, 2020b).

Because of the restrictions imposed during the ongoing pandemic, populations have been asked to reduce social relations. Therefore, in the present study, we wanted to investigate the role of modern digital communication technologies in facilitating the maintenance of meaningful social relationships and promoting the perception of social support. We also examined whether the perception of social support due to the use of technologies for virtual meetings mitigated some of the possible negative psychological states during the pandemic.

THE ROLE OF PERCEIVED SOCIAL SUPPORT DURING A LOCKDOWN

Despite the need to reduce the contagion, social isolation can have several psychological consequences, leading to post-traumatic stress symptoms (Brooks et al., 2020). Among the stressors, there are infection fears, frustration, boredom, inadequate supplies and information, financial loss, stigma, and longer isolation duration (Brooks et al., 2020). Social isolation also collides with the fundamental needs of belongingness, the human emotional need to give and receive attention from others (Baumeister and Leary, 1995; Fiske, 2018). Indeed, the depth of connection people have with significant others is one of the constituents of psychological well-being (Ryff, 2014), by promoting a greater sense of self-worth and belongingness (Oh et al., 2014). On the contrary, the perception of lacking social support is strictly associated with loneliness (Lin et al., 2020), irritability and anger (e.g., Arslan, 2009), boredom and depression (Gariepy et al., 2016), and anxiety (e.g., Wang et al., 2018). In this regard, research consistently demonstrates that the perceived availability of social support, intended as a real or perceived experience that one is cared for and part of a mutually supportive social network (Taylor, 2011), reduces psychological distress, providing resources that can weaken the negative consequences of acute stressors (Cohen and McKay, 1984; Cohen and Wills, 1985; Lakey and Cohen, 2000). Therefore, social support could represent a relevant protective factor for mitigating the overall negative psychological consequences, supporting psychological well-being during a lockdown.

DURING A LOCKDOWN, EVERYONE WANTS TO BE—VIRTUALLY—CONNECTED

One substantial difference between the current COVID-19 pandemic and previous epidemics is the amount of tech tools that we can use today compared to the past. The technology available nowadays allows people to stay in contact with others in innovative ways, from virtual happy hours with friends to religious services. The worldwide increased use of online tools during the coronavirus lockdown has been registered by all the main digital platforms and social media (Perez, 2020). A recent review of studies (Waytz and Gray, 2018) suggests that online technology for communication may function both as a social connector and a separator. On the one hand, online communication reduces the social cues typical of face-to-face interactions, encouraging more impersonal interactions (White and Dorman, 2001) and making exchanging support more difficult (Lewandowski et al., 2011). Online communications have also been found to be associated with decreased empathy (Konrath et al., 2011) and increased individualism (Wellman et al., 2003). On the other hand, technology helps in maintaining social connections *via* digital communication platforms (Genoe et al., 2018), providing support for people for whom face-to-face social interactions are difficult to obtain (e.g., Fogel et al., 2002; Barak and Sadovsky, 2008; Delello and McWhorter, 2015). Waytz and Gray (2018) suggest that, depending on different factors such as age, generation, and developmental differences in technology use, online communication can improve social relationships when people use it to strengthen existing relationships with off-line friends and family, especially when in-person social interactions are impeded by external factors, such as a lockdown.

Indeed, the exceptionality of the restrictions imposed by the COVID-19 pandemic represented a unique situation for testing on the field the functioning of digital technologies for communication and virtual meetings as a substitute for meaningful face-to-face relationships. Indeed, the adoption of communication technologies during a lockdown could play a key role in favoring the perception of social support, which in turn could function as a buffer against the negative impact of social restrictions.

THE STUDY

The main aim of the present study was to verify whether online tech tools for communication and virtual meetings could reduce the negative psychological consequences of a lockdown. To do so, we tested the hypothesis that the amount of online communication usage (i.e., video calls, online board games, and streaming movie in party mode) during the lockdown that occurred in Italy would be positively associated with the perception of social support. In this case, the latter would be negatively related to loneliness, irritability, boredom, anger, and anxiety and positively associated with belongingness.

METHOD

Participants

For the sake of reliability, we intended to collect data on a large scale (i.e., $N > 250$). This guarantees high power for small and medium correlations (power = 0.95) and stability of correlations (Schönbrodt and Perugini, 2013).

In total, 899 participants accessed the online survey: 106 participants did not consent to participate in the study, 39 did not give the final consent for the data processing, eight did not

indicate whether they are of legal age, 20 declared that they were not of legal age, and 80 participants did not fill in any data and were considered as dropouts. In order to monitor the level of participants' attention, we included two "catch-trials" in our survey (i.e., "Please answer 2 to this item" and "Please answer 6 to this item"; see Oppenheimer et al., 2009; Leys et al., 2018): 180 respondents failed one or both items. Finally, one participant presented missing data.

All these participants were excluded from the final sample, which therefore consisted of 465 respondents (completion rate, 51.7%; 348 females, 116 males, one preferring not to answer, min age = 18 years, max age = 73 years, mean age = 31.29 years, SD = 13.19). Based on a Monte Carlo power analysis for mediation model, ran with 20.000 Monte Carlo Draws with 1,000 replications and a 95% confidence level, a sample of 465 participants guarantees a power of 0.98 for small indirect effects (IE = 0.20) and of 0.99 for medium effects (IE = 0.50; see also Perugini et al., 2018).

Overall, 72.5% of the participants in the final sample reside in Lombardy—the Italian region most affected by the virus—and the remaining 27.5% in the rest of Italy.

Procedures

Data were collected through a questionnaire using Qualtrics web system between March 20 and April 2, 2020. The data collection started about 2 weeks from the beginning of the lockdown that the Italian Government adopted for the urgent containment and management of the COVID-19 epidemiological emergency. By adopting a snowball sampling technique, the participants were recruited through social media and instant messaging systems, by sending a link to the web survey, and by asking to forward the link to their contacts.

Measures

Amount of Technology Use

We asked the participants to report how many times they had used different tools to stay connected during the lockdown prior to the data collection. Using six items, the participants were asked to report how many times they: (1) made or received a video call for a virtual dinner or lunch with their friends, partner, and/or family; (2) made or received a video call for a leisure meeting with their friends, their partner, and/or family; (3) made or received a voice call with their friends, partner, and/or family; (4) watched a movie in party mode; (5) played online board games with their friends, partner, and/or family; and (6) played multiplayer online video games. All frequency items were measured on the following scale: 1 = never, 2 = about once a week, 3 = from one to three times a week, 4 = from four to six times a week, 5 = once a day, and 6 = several times a day. The scores reported were then averaged to obtain an overall index of technology usage during the lockdown.

Since the same technologies could also be used for work (e.g., virtual meeting) and school (e.g., online streaming lectures), we asked the participants to report the frequency with which they (1) made or received a video call for work/school and (2) made or received a voice call for work/school. Both items were measured on the same response scale illustrated above. The scores were then averaged as an overall index of technology use for work/school activities.

The following measures were then used to assess participants' emotional state during the lockdown. Scales were presented in a random order to prevent response bias and were introduced with the following instruction: "Please, respond to the following statements thinking about how you felt during the last weeks of lockdown."

Perceived Social Support

We adapted the Multidimensional Scale of Perceived Social Support (Zimet et al., 1988), composed of 12 items identifying different sources of social support. Sample items are "I get the emotional help and support I need from my family" and "My friends really try to help me" (1 = strongly disagree to 7 = strongly agree).

Loneliness

We used the UCLA Loneliness Scale-Revised (Russell et al., 1980), a 20-item scale designed to measure subjective feelings of loneliness and social isolation. Sample items are "I have nobody to talk to" and "I feel left out" (1 = I never feel this way to 7 = I always feel this way).

State Irritability

We used the Brief Irritability Test (Holtzman et al., 2015), composed of five items in which the participants are asked to indicate how frequently they identify with each statement. Sample items are "I have been feeling irritable" and "Things have been bothering me more than they normally do" (1 = never to 7 = always).

State Boredom

We adopted the Italian version of the Multidimensional State Boredom Scale (MSBS; Fahlman et al., 2011; Craparo et al., 2017). The scale consists of 29 items assessing an individual's experience of state boredom. Sample items are "I feel bored" and "Time is passing by slower than usual" (1 = completely disagree to 7 = completely agree).

State Anger

The State-Trait Anger Expression Inventory (Forgays et al., 1997), composed of 10 items, was employed to assess participants' intensity of anger as an emotional state. Sample items are "I feel angry" and "I feel like swearing" (1 = completely disagree to 7 = completely agree).

State Anxiety

We used the short-form of the State-Trait Anxiety Inventory (Spielberger et al., 1983; Marteau and Bekker, 1992), composed of six items (e.g., "I feel nervous" and "I feel worried"; 1 = completely disagree to 7 = completely agree).

Belongingness

We used two five-part items adapted from McFarland et al. (2012), asking how close and how often participants use the word "we" to refer to several groups (e.g., family/friends/people in their community/Italians/people all over the world; 1 = never, 7 = very often).

Demographics and Control Measures

Previous literature suggested that negative affective states could vary as a function of time (Rubins, 1964). Since social distancing measures had been amended several times by the Italian government, after providing demographic data, the participants were asked to report the actual number of days they had already spent in isolation. Besides, the regulations provided some exceptions, such as going to work (only for specific categories of workers) and shopping for essential goods (e.g., food and pharmaceuticals). Therefore, we asked the participants to report the number of house exits that were made during the lockdown period (1 = never, 2 = about once a week, 3 = from one to three times a week, 4 = from four to six times a week, 5 = once a day, 6 = several times a day).

The forced isolation imposed by the lockdown could be harsher for people living alone or sharing confined spaces. The related literature suggests that several situational factors can be related to negative affect (Zysberg, 2015), such as the number of people living with (Savikko et al., 2005), living arrangements, and housing type (Krause-Parello and Gulick, 2013). Therefore, we asked the participants to report how many people they lived with during the lockdown and report their home/apartment size.

Finally, as control variables, we asked the participants to estimate their frequency of social technology usage to maintain social relationships and work/school motives before the lockdown period. To do so, the items created for assessing the overall amount of technology use during the lockdown were adapted by asking the participants to report the frequency of technology usage for social connections and business/school purposes by referring to their everyday life before the lockdown. The obtained scores were then averaged to create two separate indexes for the amount of technology use for maintaining social relationships and work/school motives before the lockdown.

RESULTS

Preliminary Analyses

Before conducting the analyses, data were inspected for normality and outliers. Separate multiple and simple regression models were tested considering the amount of technology use during the lockdown and social support as the predicting variables, whereas loneliness, boredom, anxiety, anger, irritability, and belongingness were entered as outcomes. Standardized residuals, skewness, and kurtosis values were all < 1.0, indicating a normal distribution of the residuals (Bulmer, 1979). Outliers were inspected by plotting Cook's distances by centered leverage values of the residuals for each regression model (Cook, 1977). Two influential data points emerged as common outliers in most of the tested models. Therefore, they were excluded from all the subsequent analyses and all the analyses performed on a sample of $N = 463$ (see also **Supplementary Material**).

At the time of the data collection, the participants reported having already spent about 14 days in isolation; 44 participants reported having left home for work reasons and 323 having left home for buying food. These two indicators were summed as an overall index of exits made during the lockdown period. On average, participants left home between one and three times a week.

Regarding the housing situation, 41 individuals stated that they were living alone and 422 with their family, flat mates, or their partner. On average, a family unit is composed of three people, and the average size of the houses/apartments was around 123 m^2.

To verify whether participants reported different levels of use of technologies for maintaining their social relationships during the lockdown compared to the past, a series of *t*-tests were performed. The results (see **Table 1**) highlighted a significant increase in the use of all technologies, except for voice calls for work/school.

Participants reported increased use of digital communication technologies during the lockdown compared to the past. They watched more streaming movies in party mode and played more online board games with their friends and multiplayer online video games compared to the period before the lockdown. The use of voice calls also increased, with participants reporting to have made or received more voice and video calls from their friends, partner, and/or family, but less voice calls for business/school motives than the pre-lockdown period.

Cronbach's alphas were ≥ 0.80 for all scales (see **Table 2**). Given the adequate internal consistency, we calculated composite scores for each scale, and correlational analysis was performed on all our variables. **Table 2** summarizes these results.

TABLE 1 | Mean comparisons for the frequency of technology use before and during the lockdown.

Use of technologies	Mean pre-lockdown (SD)	Mean during lockdown (SD)	Cohen's *d*	*t* Test
Video calls for virtual dinner/lunch	1.15 (0.57)	1.67 (1.08)	0.45	$t(462) = 9.77$, $p < 0.001$
Video calls for leisure meeting	1.46 (0.98)	3.05 (1.58)	0.93	$t(462) = 19.93$, $p < 0.001$
Streaming movies in party mode	1.57 (1.13)	1.88 (1.56)	0.27	$t(462) = 6.07$, $p < 0.001$
Online board games	1.46 (1.15)	2.07 (1.65)	0.52	$t(462) = 11.22$, $p < 0.001$
Multiplayer online video games	1.33 (0.97)	1.57 (1.32)	0.27	$t(462) = 5.87$, $p < 0.001$
Making or receiving voice calls from friends, partner, and family	3.56 (1.68)	4.28 (1.53)	0.48	$t(462) = 10.44$, $p < 0.001$
Making or receiving voice calls for work/school	2.56 (1.92)	2.37 (1.80)	0.13	$t(462) = -2.73$, $p = 0.007$
Making or receiving video calls for work/school	1.30 (0.91)	2.43 (1.62)	0.69	$t(462) = 14.77$, $p < 0.001$

N = 463.

TABLE 2 | Descriptive statistics and correlations among variables.

		α	*M*	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Age	–	31.26	13.19																
2	Gender	–	–	–	−0.163**															
3	Days of isolation	–	14.15	7.18	−0.206**	0.075														
4	Number of exits	–	2.36	1.63	0.358**	−0.089	−0.550**													
5	Number of persons living with	–	2.96	1.30	−0.283**	0.027	0.075	−0.118*												
6	House sqm	–	123.09	77.09	−0.106*	0.002	0.085	−0.055	0.357**											
7	Past technology use	–	1.75	0.55	0.168**	−0.149**	−0.013	0.012	−0.074	−0.030										
8	Amount of technology use	–	2.42	0.70	−0.196**	−0.021	0.037	−0.147**	−0.075	0.002	0.474**									
9	Past tech use for business/school	–	1.92	1.18	0.353**	−0.165**	−0.194**	0.233**	−0.158**	−0.113*	0.183**	0.056								
10	Frequency tech use for business/school	–	2.40	1.35	0.181**	−0.100*	−0.027	0.096*	−0.049	−0.002	0.116*	0.099*	0.562**							
11	Social support	0.89	5.53	0.96	0.115*	0.077	−0.039	−0.003	0.013	0.022	0.177**	0.162**	0.038	−0.014						
12	Loneliness	0.93	2.80	1.08	−0.249**	0.052	0.025	−0.085	0.034	0.006	−0.164**	−0.003	−0.078	−0.022	−0.507**					
13	State boredom	0.95	3.79	1.16	−0.367**	0.198**	0.114*	−0.145**	0.037	−0.011	−0.136**	0.078	−0.145**	−0.110*	−0.245**	0.617**				
14	State irritability	0.90	3.50	1.31	−0.399**	0.242**	0.117*	−0.140**	0.164**	0.030	−0.129**	0.089	−0.168**	−0.059	−0.250**	0.503**	0.685**			
15	State anger	0.90	2.65	1.23	−0.330**	0.196**	0.094*	−0.078	0.074	0.030	−0.072	0.091*	−0.102*	−0.059	−0.248**	0.502**	0.657**	0.733**		
16	State anxiety	0.84	4.48	1.23	−0.195**	0.301**	−0.024	−0.032	0.075	−0.023	−0.114*	0.041	−0.090	−0.063	−0.080	0.349**	0.571**	0.567**	0.565**	
17	Belongingness	0.80	4.53	1.01	0.187**	0.128**	−0.003	0.004	0.019	0.015	0.091	0.125**	0.056	0.029	0.428**	−0.311**	−0.230**	−0.223**	−0.213**	−0.039

*Gender was coded 1 = males and 2 = females. N = 463; *p < 0.05; **p < 0.01.*

As expected, the frequency of technology use during the lockdown was positively associated with perceived social support. The latter was negatively associated with feelings of loneliness, boredom, anger, and irritability, whereas it was positively associated with perceived belongingness.

A strong correlation (r = 0.73) between anger and irritability emerged. In this regard, Vidal-Ribas et al. (2016) stated that "irritability is a mood, and anger is its defining emotion" (p. 557), suggesting that these are different constructs that nevertheless often overlap. In light of the large correlation between the two measures, a composite index for anger/irritability was computed to be used in the following analyses.

Correlational analysis also yielded significant associations between participants' age and the outcome variables. All these variables, except loneliness, also emerged as significantly associated with participants' gender. Therefore, multiple regression analyses were conducted for exploring the effects of individual differences and situational variables on feelings of loneliness, irritability, boredom, anger/irritability, anxiety, belongingness, and perceived social support during the lockdown. Overall, significant effects of age and gender consistently emerged in most of the considered variables (see **Table 3** for significant results). Hence, they were treated as covariates in all the analyses reported below.

Direct and Indirect Effects

To further explore the associations between the constructs, indirect effects were evaluated considering the joint significance of the components (Yzerbyt et al., 2018) and the bootstrap confidence intervals computed using the PROCESS macro for SPSS (version 3.4, model 4, 5,000 iterations) (Hayes, 2017). Because of the multiple testing, we corrected the alpha level of the component tests with a Bonferroni correction and adjusted the confidence intervals accordingly (Dunn, 1961). Given that we tested five indirect effects, which required six components, we set the alpha level for the component tests at 0.008 and computed the 99% confidence intervals.

Each model considered the frequency of technology use as the focal predictor and perceived social support as the mediator. Loneliness, anger/irritability, boredom, anxiety, and belongingness were separately entered as outcome variables, whereas age and gender were included as covariates.

Table 4 reports the results for the tested models. Supporting our hypothesis, the amount of technology use was a significant predictor of perceived social support.

Moreover, perceived social support was negatively associated with loneliness, boredom, and anger/irritability. As expected, it was positively associated with belongingness. Crucially, the proposed theoretical model was sustained by the significance of the indirect effect of technology use *via* social support on these variables (no significant direct effects emerged). Contrary to our hypotheses, no significant effects were found for anxiety (see **Figure 1**).

DISCUSSION

The data collected during the lockdown in Italy showed the role of digital technology for maintaining social relations in attenuating the negative consequences of the social distancing imposed to reduce the spread of COVID-19. Specifically, digital technologies for communication and virtual meetings can promote a higher perception of social support, which in turn is associated with lower feelings of loneliness, boredom, and anger/irritability and a greater sense of belonging.

Anxiety was the only variable not affected by the use of digital technologies *via* social support. In this regard, we speculate that the uncertainty generated by a new and unpredictable situation, such as the current pandemic, might have fostered

TABLE 3 | Significant results of simple and multiple linear regressions.

Predictor	Dependent variable	Model statistics	*B*	*SE B*	β	95%CI		*p*
						LL	*UL*	
Age	Social support	$R^2 = 0.062$, $F_{(9, 453)} = 3.31$, $p < 0.001$	0.010	0.004	0.135	0.002	0.017	=0.011
Gender			0.267	0.103	0.121	0.064	0.469	=0.010
Past technology use			0.310	0.082	0.179	0.150	0.471	<0.001
Age	Loneliness	$R^2 = 0.081$, $F_{(9, 453)} = 4.44$, $p < 0.001$	−0.020	0.004	−0.246	−0.029	−0.012	<0.001
Past technology use			−0.257	0.091	−0.131	−0.437	−0.078	=0.005
Age	Boredom	$R^2 = 0.166$, $F_{(9, 453)} = 10.04$, $p < 0.001$	−0.031	0.004	−0.352	−0.040	−0.022	<0.001
Gender			0.349	0.118	0.131	0.108	0.581	=0.003
Age	Anger/irritability	$R^2 = 0.179$, $F_{(9,453)} = 10.99$, $p < 0.001$	−0.033	0.004	−0.365	−0.041	−0.024	<0.001
Gender			0.470	0.118	0.174	0.238	0.702	<0.001
Age	Anxiety	$R^2 = 0.124$, $F_{(9, 453)} = 7.11$, $p < 0.001$	−0.014	0.005	−0.155	−0.024	−0.005	=0.003
Gender			0.777	0.128	0.275	0.525	1.028	<0.001
Age	Belongingness	$R^2 = 0.077$, $F_{(9, 453)} = 4.203$, $p < 0.001$	0.019	0.004	0.243	0.011	0.027	<0.001
Gender			0.406	0.108	0.174	0.193	0.619	<0.001

N = 463; Predictors: (Constant), Age, Gender, Days of isolation, Number of exits, Number of persons living with, House sqm, Past technology use, Past tech use for business/school, Frequency tech use for business/school. LL, lower limit; UL, upper limit.

TABLE 4 | Significant components and direct and indirect effects.

Predictors	Outcome	Components and direct effects	Indirect effect (completely standardized indirect effect)	R^2	Total effect	R^2
Amount of technology use	Social support	b = 0.27, SE = 0.06, β = 0.20, t(459) = 4.27, $p < 0.001$, 99% CI [0.11, 0.43]	–	–	–	0.06
Social support	Loneliness	b = -0.56, SE = 0.04, β = -0.50, t(458) = −12.37, $p < 0.001$, 99%CI [−0.68, −0.45]	IE = −0.15, 99% CI [−0.25, −0.06] (IE = -0.10, 99% CI [−0.16, −0.04])	0.30	b = −0.08, SE = 0.07, β = −0.05, t(459) = −1.15, p = 0.25, 99% CI [−0.27, 0.10]	0.06
Amount of technology use		b = 0.07, SE = 0.06, β = 0.04, t(458) = 1.12, p = 0.26, 99% CI [−0.09, 0.23]				
Social support	Boredom	b = −0.28, SE = 0.05, β = −0.23, t(458) = −5.43, $p < 0.001$, 99%CI [−0.42, −0.15]	IE = -0.08, 99% CI [−0.14, −0.02] (IE = −0.05, 99% CI [−0.08, −0.01])	0.20	b = 0.02, SE = 0.07, β = 0.01, t(459) = 0.31, p = 0.75, 99% CI [−0.16, 0.21]	0.15
Amount of technology use		b = 0.10, SE = 0.07, β = 0.06, t(458) = 1.38, p = 0.17, 99% CI [−0.09, 0.28]				
Social support	Anger/irritability	b = −0.32, SE = 0.05, β = −0.26, t(458) = −6.16, $p < 0.001$, 99%CI [−0.45, −0.18]	IE = −0.09, 99% CI [−0.16, −0.03] (IE = −0.05, 99% CI [−0.09, −0.02])	0.24	b = 0.05, SE = 0.07, β = 0.03, t(459) = 0.70, p = 0.48, 99% CI [−0.14, 0.24]	0.17
Amount of technology use		b = 0.14, SE = 0.07, β = 0.08, t(458) = 1.92, p = 0.055, 99% CI [−0.05, 0.32]				
Social support	Anxiety	b = −0.12, SE = 0.06, β = −0.09, t(458) = −2.07, p = 0.04, 99%CI [−0.27, 0.03]	IE = −0.03, 99% CI [−0.09, 0.006] (IE = −0.02, 99% CI [−0.05, 0.004])	0.12	b = 0.03, SE = 0.08, β = 0.02, t(459) = 0.40, p = 0.69, 99% CI [−0.17, 0.24]	0.11
Amount of technology use		b = 0.06, SE = 0.08, β = 0.04, t(458) = 0.80, p = 0.42, 99% CI [−0.14, 0.27]				
Social support	Belongingness	b = 0.40, SE = 0.04, β = 0.38, t(458) = 8.98, $p < 0.001$, 99% CI [0.29, 0.52]	IE = 0.11, 99% CI [0.04, 0.20] (IE = 0.07, 99% CI [0.03, 0.13])	0.23	b = 0.26, SE = 0.07, β = 0.18, t(459) = 3.91, $p < 0.0001$, 99% CI [0.09, 0.43]	0.09
Amount of technology use		b = 0.15, SE = 0.06, β = 0.10, t(458) = 2.40, $p < 0.02$, 99% CI [−0.01, 0.31]				

N = 463. Statistical analyses were carried out considering gender and age as covariates. See ***Supplementary Material*** *for the complete results. IE, indirect effect.*

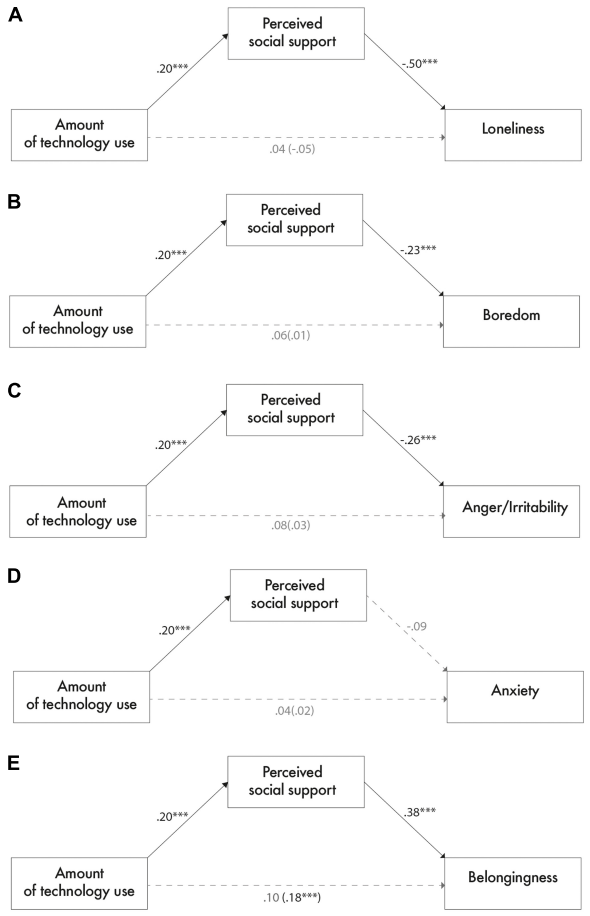

FIGURE 1 | Standardized regression coefficients for the indirect effects of technology usage during the lockdown on loneliness **(A)**, boredom **(B)**, anger and irritability **(C)**, anxiety **(D)**, and belongingness **(E)** through perceived social support. The total effect is in parentheses. ***$p < 0.001$.

high anxiety levels in people. In effect, worries about health and safety, uncertainty about the future, and no clear perspective about the end of lockdown may have contributed to the maintenance of generalized anxiety among individuals. The social support deriving from the use of technology likely was not sufficient to reduce such high anxiety. Alternatively, sharing fears, predictions, and information about the pandemic could have increased both the perception of social support and anxiety. These influences could have zeroed each other out, resulting in no effect.

Our data also showed that both age and gender were directly associated with the considered constructs (see **Supplementary Material**). With regard to age, the older the participants were, the less they felt lonely, angry/irritable, bored, and anxious during lockdown. This is not surprising since previous evidence suggested that adolescence is the peak age for experiencing loneliness (see Yang and Victor, 2011 for a review), while other studies showed that older individuals are usually less prone to experience boredom (Vodanovich and Kass, 1990), report more inner control of anger (Phillips et al., 2006), and are generally more capable of adaptive emotion regulation strategies (Orgeta, 2009; Zimmermann and Iwanski, 2014).

Regarding gender, women reported higher levels of psychological distress (i.e., greater feelings of anger/irritability, boredom, and anxiety). This could be due to the fact that, during the pandemic, women had to fulfill more roles compared to men (e.g., caregivers, professional, teacher, and mother), being a group more vulnerable and more at risk in this situation of psychological overload (see also González-Sanguino et al., 2020). Worth mentioning, however, is that our sample was unbalanced (75.1% females).

It is worth mentioning that the association of the amount of technology usage with the perception of social support is small in size ($R^2 = 0.06$), and the mitigating effects on the considered affective states could be explained mainly by the role of social support. In this regard, technologies are only one resource people can use to experience social support during a lockdown. Some studies show that social support can come from various sources, including religion and community ties (Taylor, 2011). Thus, the use of technology may explain only a reduced part of the variance in social support perception. Additionally, we did not investigate all the possible technologies that people used during the lockdown. Future studies should focus more on the specificity of certain technologies in promoting the perception of social support, such as modern social media, live streaming rooms, and collaborative webinars. It would also be interesting to test whether different technologies can favor different types of social support (informational, instrumental, and emotional support; see Taylor, 2011). In regard with this matter, we speculate that the use of communication technologies may have fostered informational support and mutual help to understand better all the information given during lockdown and locating what resources and coping strategies were needed. Replacing face-to-face relationships with virtual interactions may also have fostered greater emotional support, reassuring people about the uncertainty caused by the ongoing pandemic (see Taylor, 2011).

There are some limitations. First, our data were collected at the beginning of the pandemic and mainly in an area severely affected by the spread of the virus (i.e., Lombardy, Italy). It is possible that in areas less affected or with fewer restrictions, the use of digital technologies to compensate for the lack of social relationships may be weaker. Besides, our results rely on a single correlational study, preventing from drawing any conclusions on the causality between the considered constructs. Thus, future studies should consider a longitudinal or experimental design to test further whether the effects of social isolation can be mitigated by adopting digital technologies, even for longer periods. Second, the measure concerning the amount of digital communication relied on self-report data. Even if recent works suggested that the estimated time spent using a technology (e.g., smartphone) may be an adequate measure of the frequency of use when small resolution of data is required (Andrews et al., 2015), other studies reported that, usually, people underestimate technology usage time by 40% (Lee et al., 2017). Third, we have considered only some of the possible psychological consequences of a lockdown. Indeed, both the World Health Organization (2020b) and American Psychological Association (2020) reported

further outcomes, such as depression and posttraumatic stress disorder. Thus, to get a complete picture, future studies should consider a wider number of negative consequences. Moreover, among the possible positive affective states, only belongingness was considered. Future studies should focus more on other possible positive outcomes of using technologies when dealing with social distancing situations. Finally, the present results could have been influenced by the participants' self-selection. Those who responded to the questionnaire did so starting from a digital link, and therefore, our participants could be already used to communicate adopting digital tools.

CONCLUSION

Although the measure of lockdown is proving effective in containing the virus, Brooks et al. (2020) highlighted that the reduction of face-to-face interactions, the loss of freedom, and uncertainty lead to dramatic psychological effects.

In the present study, we showed that using digital technologies for communications and virtual meetings could represent a supportive tool to manage the negative consequences of the social distancing imposed during the COVID-19 outbreak in Italy by assisting social support. As suggested by Waytz and Gray (2018), online communications can improve social relationships, especially when close off-line relationships are not available, such as during an ongoing lockdown. The authors claimed that digital communications can have positive effects, allowing people to empathize with socially distant individuals, fostering emotional and informational support (Taylor, 2011). Nevertheless, all this requires people to be online and connected to technology. These technological solutions are less available to those already at a higher risk of infection, such as the elderly, ill people, and those living in poverty. The lack of reliable access to online services may, therefore, represent an additional burden for those with less access to material and social resources to buffer the negative effects of the coronavirus lockdown. Thus, policymakers should consider implementing strategies to reduce the digital divide in the near future, offering affordable access to communication technologies.

A continued pattern of social distancing, beyond the containment strategy to reduce the spread of the virus, could have broader societal effects, particularly for the most vulnerable (Leigh-Hunt et al., 2017). During the ongoing pandemic, instead of being what the sociologist Sherry Turkle has termed "alone together," we have access to digital tools that previous generations could not have imagined, and we can now invent new and socially meaningful ways of being together apart.

DATA AVAILABILITY STATEMENT

The dataset for this study is available through the Open Science Framework (https://osf.io/6g89a/?view_only=1a19465ac45f4256956010271cd18523). The design and analysis plans were not preregistered.

ETHICS STATEMENT

The study was conducted after receiving the ethical approval from the local Commission of the Department of Psychology for minimal risk study. All procedures performed in the study were in accordance with the APA ethical guidelines, the ethical principle of the Helsinki Declaration, and the Oviedo Convention on men's rights and biomedicine. Full informed consent was obtained before participants started the studies. At the beginning of the survey, the participants were informed about how the data were collected, processed, and stored. They were informed that the estimated duration of the questionnaire was about 15 min. No financial or material incentives were offered to the participants, who took part in the study on a voluntary basis.

AUTHOR CONTRIBUTIONS

AG, CB, RV, MD, and FD contributed to the conception and the design of the work. AG was responsible for the data collection and wrote the manuscript with valuable inputs from the remaining authors. AG and MG were responsible for the analysis. All the authors contributed to the interpretation of data and agreed for all aspects of the work and approved the version to be published.

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SUPPLEMENTARY MATERIAL

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The Role of News Consumption and Trust in Public Health Leadership in Shaping COVID-19 Knowledge and Prejudice

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The novelty of COVID-19 has created unique challenges to successful public health efforts because it has required the public to quickly learn and formulate knowledge and attitudes about the virus as information becomes available. The need to stay apprised of new information has also created a critical role for mass media and public institutions in shaping the public's knowledge of, attitudes about, and responses to the unfolding pandemic. In this study, we examine how media consumption and reliance on specific institutions for information shapes three critical outcomes associated with public health epidemics: the accumulation of knowledge and the endorsement of misinformation about COVID-19, and prejudicial responses to the virus. We surveyed 1,141 adults residing across the United States in March 2020. Using multivariate regression and *t*-tests, we found that participants had greater knowledge, were less likely to endorse misinformation, and reported less bias toward Asian Americans when they had higher trust in the CDC and lower trust in President Trump. Reliance on certain news formats and sources was also associated with knowledge, misinformation, and prejudice. Our findings suggest that trust and news consumption can pose critical barriers to health literacy and foster negative prejudicial responses that further undermine public health efforts surrounding the COVID-19 pandemic.

Keywords: COVID-19, trust, media, news, health promotion

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INTRODUCTION

SARS-CoV-2 and the corresponding disease in humans, COVID-19, were first identified in the late months of 2019. As the virus has spread and deaths have accumulated, countries across the globe have responded with substantial public health campaigns to contain the growing pandemic. The novelty of the virus, however, has posed numerous and continued challenges to successfully responding to the unfolding pandemic. In addition to requiring the scientific community to rapidly generate insight into the characteristics of the virus, how it spreads, and how to best prevent and treat it, it also required the dissemination of that knowledge to the public who were quickly formulating new attitudes and beliefs about the virus. Indeed, the public's knowledge of and response to COVID-19 is arguably the most important component of a successful public health campaign because it is only through widespread adherence to evidence-based practices that we

can meaningfully reduce the spread of the virus and its widespread public health, economic, and social consequences.

Over the course of the last few months, different media sources and institutions have taken varied approaches in the ways they have framed messages about COVID-19 to the public. While some media sources have focused on transmitting evidence-based information about COVID-19, others have used tactics such as downplaying the seriousness of the virus, perpetuating conspiracy theories and other misinformation, and scapegoating by placing the blame for the continued outbreak on China (e.g., Chiu, 2020). These differing messages have not only created deep fissures among the public, but have also resulted in harmful behaviors such as refusing to comply with recommended practices to stem transmission (Mervosh et al., 2020), violence toward those who try to enforce such practices (MacFarquhar, 2020), and even rising prejudice toward people of East Asian descent who have become blamed for COVID-19 (Ruiz et al., 2020).

Given the polarization that has emerged regarding COVID-19 and its impact on the public's response to the unfolding pandemic, we believe it is important to better understand the role of mass media in shaping the public's knowledge and attitudes related to COVID-19. More specifically, we examine how patterns of media consumption, and trust in key institutions that are issuing guidance to the public, affect the degree to which people hold accurate information about COVID-19, endorse common misinformation about COVID-19, and express stigma toward Asian Americans. The current study focuses on these specific outcomes due to their centrality to public health amid the COVID-19 outbreak. That is, knowledge, misinformation, and prejudice are key determinants of the degree of harm COVID-19 can inflict on physical and social well-being. In the following sections, we first describe the important role mass media and other informational sources can play in shaping attitudes and perceptions of social life. We then explicate how mass media consumption and trust in institutions central to public health can influence knowledge, misinformation, and prejudice in response to COVID-19.

The Role of Mass Media in Shaping Knowledge and Beliefs

Generally, the media messages the public are exposed to can be pivotal in shaping their perceptions and responses to health crises and other social issues (Randolph and Viswanath, 2004; Anderson, 2009; Sugimoto et al., 2013; Schmidt et al., 2018). The effects of media can be understood from the perspective of social cognition, which broadly refers to the ways people gain, process, store, and apply social information (Fiske and Taylor, 1991). Theoretical models of social cognition vary in their tenets but share the common prediction that such processes often involve attending to and relying on limited and sometimes biased information (Wyer and Radvansky, 1999). Media is one social agent that can produce such biases in social information through communicating and drawing attention to specific knowledge, ideas, values, norms, and behaviors (Shrum, 2002), perhaps at the exclusion of others.

One specific way in which media coverage has the ability to significantly shape public opinion is through framing an issue or topic to suggest what aspects of the issue are most salient (Nelson et al., 1997). Indeed, research on social cognition has found that people do not review all relevant evidence when formulating judgements (Fiske and Taylor, 1991) and media framing can influence what subset of information is determined to be most relevant or sufficient to draw a conclusion (Shrum, 2002). Media also plays a central role in informing the public's decisions through influencing the accessibility of information available when formulating judgments (Wyer and Radvansky, 1999). That is, people tend to rely on the information they are most readily able to recall, and the media can influence accessibility through repeated messaging that reinforces chosen aspects of a topic (Happer and Philo, 2013). Finally, media can also create sociocultural pressure to conform with the values, norms, or behaviors transmitted by the media content (Barlett et al., 2008; Grabe et al., 2008).

In support of the influential role of mass media, media has been linked to a number of social attitudes, behaviors, and health-related beliefs. As some examples, media consumption has been connected to body image concerns and body satisfaction (Barlett et al., 2008; Grabe et al., 2008), beliefs about climate change (Anderson, 2009), attitudes toward vaccinations (Schmidt et al., 2018), and health literacy (Hayes et al., 2007). There is also early evidence that media may be influencing knowledge and beliefs about COVID-19, which we turn to in the next section.

Media, Institutions, and Covid-19 Knowledge and Misinformation

The role of mass media in constructing social realities is of particular importance for COVID-19 because, as described above, the novelty of the virus has required the public to formulate new ideas and attitudes about the virus, which have taken shape in the context of the media messages one has been exposed to. Correspondingly, the varied approaches to disseminating information about COVID-19 to the public, coupled with the deep divides in the sources the public relies on for information, have the potential to influence how knowledge and attitudes about the virus have developed. First, media sources and institutions have differed considerably in their chosen framing of the virus which impacts what information will become disseminated to viewers. Framing techniques have included emphasizing the pandemic's threat to public health, focusing on discussions of civil liberties (Ingraham, 2020), or stressing the economic toll of the virus (Hilton, 2020). If a media outlet chooses to emphasize civil liberties, for example, they may present viewers with information about rights, personal freedom, and how uncomfortable it is to wear a mask at the exclusion of information about the benefits of masks, thus influencing how informed viewers are about this critical health-protective behavior.

Further, people have developed strong preferences for certain media formats and sources in the United States (Mitchell and

Oliphant, 2020; Zitner and Chinni, 2020). These preferences are formed by the tendency for people to seek out (Rodriguez et al., 2017) and more favorably evaluate (a process referred to as "motivated skepticism") (Ditto and Lopez, 1992) information that supports their personal and political motives. Importantly, these divisions are not limited to traditional sources of media but have also extended to U.S. institutions which have, at times, been in disagreement about key information related to the spread, severity, duration, and prevention of COVID-19. In particular, messaging from the President and White House staff has often been at odds with messaging from public health organizations, such as the Centers for Disease Control (CDC), and the degree to which each of these institutions is trusted and relied upon may change the information one is exposed to.

This has further been compounded by the notable absence of the CDC, the nation's health protection agency, at national press briefings. This organization has historically played a central role in providing important health information to the public, especially during epidemics (Greenfield-Boyce, 2020; Sun, 2020). Their absence may contribute to the existence of echo chambers wherein Americans are exposed to information that is consistent with their political views, even though some of that information may lack an evidence base. Together, this creates a significant barrier to cultivating an informed public because people are then only exposed to the information their trusted sources choose to distribute or emphasize.

Outside of raising concerns about the extent to which the public is exposed to relevant knowledge about COVID-19, there have also been particular fears about the spread of misinformation, or incorrect knowledge, related to COVID-19. Examples of misinformation related to COVID-19 have ranged from inaccurate information about the origin of the virus (e.g., that it was intentionally created and released) to incorrect beliefs about the severity or mortality of the virus. It also appears that this misinformation has reached a large audience, with three out of 10 Americans believing COVID-19 was created in a lab and a majority of Americans agreeing that news coverage is exaggerating risks related to the virus (Mitchell and Oliphant, 2020). This misinformation also carries important consequences, such as when sources downplay the risk of the virus, leading the public to underestimate the harm or the need to take precautions.

We posit media consumption is also likely connected to exposure to and endorsement of misinformation about COVID-19. Previous research on other critical lapses in public trust related to infectious disease, such as with vaccine hesitancy, has examined how and why misinformation persists despite the availability of evidence downplaying inaccurate claims (Lewandowsky et al., 2012). Researchers have argued that the repetition of false claims can make it more difficult to refute this information as can evidence that threatens one's worldview (Lewandowsky et al., 2012). This again underscores the importance of the media messaging one consumes which can present and continually reinforce false claims. In particular, the growth of the internet and social media have the potential to amplify the dissemination of misinformation by facilitating the easy and rapid release of non-credible information.

Media, Institutions, and COVID-Prejudice

One final potential outcome of polarized media use observed amid the COVID-19 pandemic is the rising prejudice and discrimination targeting people of east Asian descent (Ruiz et al., 2020). We argue the growing negative sentiments toward Asians must be considered in our evaluations of the effectiveness of the public health response to COVID-19 because experiences of discrimination can doubly disadvantage Asian Americans such that they must contend with the threat of the virus while also enduring racial backlash which can further erode their health and wellbeing (Gee et al., 2007). Additionally, increased prejudice has also generally increased social tensions that impede unified responses to combating the virus.

Though there are enduring tendencies to associate threats for disease with outgroup members (e.g., Faulkner et al., 2004; Navarrete and Fessler, 2006), messaging from the media and key U.S. institutions can also contribute to the observed increases in prejudice toward people of Asian descent in response to COVID-19. Notable examples include President Trump, White House officials, and popular media outlets referring to the virus as the "Chinese virus," the "Wuhan virus," or other names that link the virus to China and, by extension, people from that region (Rogers et al., 2020). Similarly, some news sources and officials have devoted considerable time to criticizing Chinese cultural practices or otherwise blaming China for the outbreak (Chiu, 2020). Numerous criticisms have been raised regarding this type of framing because of its potential to fuel prejudice and encourage discriminatory behaviors (Hoppe, 2018). The social cognition perspective summarized above aligns with these criticisms, underscoring how framing and repeated messaging that stigmatizes China can inform attitudes and social judgments. Therefore, we propose that news consumption and trust in institutions will also be related to expressions of COVID-19-specific prejudice toward Asians.

The Current Study

Trying to combat a global pandemic against the backdrop of inconsistent messaging about the spread, treatment, and symptoms of infectious diseases increases public health risks (Dhillon and Daniel Kelly, 2015). This is because perhaps one of the best remedies for slowing or mitigating the spread of the virus is a well-informed public who trust public health organizations and are willing to implement evidence-based precautions. Without this, people may not be equipped to make informed decisions to protect themselves and others, thus undermining efforts to slow the spread of infection. In addition, individuals may be at further harm if they not only lack the information necessary to engage in health protective behaviors, but endorse misinformation or engage in discriminatory behavior that threatens the well-being of social groups associated with an infectious disease. The aim of this study, accordingly, is to better understand how media consumption and trust in government and public health leadership relates to different facets of knowledge related to COVID-19, including the endorsement of misinformation, and the expression of prejudice toward Asian Americans among individuals living in the United States. More

specifically, we examine the news formats and sources people use, and trust in President Trump and the CDC, as predictors of knowledge and attitudes related to COVID-19.

This study makes a novel contribution by applying psychological theories to explain how information and misinformation are transmitted, and prejudice strengthened, through media use during the COVID-19 epidemic. This is critical to understand because exposure to media may affect the accumulation of different forms of knowledge, the ability to identify and ignore misinformation, and decisions to stigmatize outgroups, all of which are central to public health campaigns. In other words, understanding how informational sources vary in their support of health literacy and stigma reduction is critical to an effective public health response to this unfolding pandemic and can inform future public health efforts by directing them toward the media formats and sources they most need to target in campaigns to improve knowledge and attitudes. This study further illuminates the social processes that shape prejudicial reactions to public health crises by identifying how existing preferences for information consumption can give rise to stigmatized perceptions of minority groups.

MATERIALS AND METHODS

Participants

Data were collected from a national sample of 1,141 adults residing in the United States. Participants were recruited to complete a survey on their knowledge and attitudes about the coronavirus outbreak using Qualtrics panels, which is a third-party online participant recruitment service. Qualtrics Panels recruits participants from a pool of potential respondents who have agreed to participate in online market research. This approach to data collection was advantageous for this study because it allowed us to recruit a diverse set of geographically dispersed participants. There were a total of 1,346 participants who were recruited from Qualtrics Panels and entered the survey. Of these participants, 1,141 met our inclusion criteria, passed our quality control checks, and provided complete data, representing a completion rate of 84.8%. Data collection took place between March 13th and March 18th, 2020, during which time the United States was beginning to implement social distancing practices and many large institutions were beginning to close or modify their practices. The study was approved by the institutional review board at [name redacted] and informed consent was obtained from all participants before survey completion.

Our sample was demographically and regionally diverse. Roughly half of our sample identified as male (52.1%), 46.9% identified as female, and 0.8% identified as third gender or non-binary. Examining racial and ethnic identities, 74.7% of the sample identified as White, 13.3% as Black or African American, 7.5% as Hispanic or Latinx, 5.6% as Asian, 2.9% as American Indian or Alaskan Native, 0.6% as Native Hawaiian or Pacific Islander, and 0.5% as Middle Eastern. The average age of our participants was 44.66 (SD = 16.96) and ages ranged from 18 to 99 years old.

The majority of our sample identified as heterosexual (87.4%) and 12.6% identified as gay, lesbian, bisexual, or another sexual identity. The sample also varied on political affiliation, with 43.5% identifying as democrats, 28.9% identifying as independents, and 27.6% identifying as republicans. The most common level of education reported was a Bachelor's degree (23.7%), followed closely by some college but no degree (23.5%) and a high school diploma or equivalent (22.3%). Another 13.3% held an Associate's degree, 13.6% held a Master's, and 3.7% held either a doctoral or professional degree. Finally, our sample included participants from all 50 states and the representation for each state ranged from 0.2% (Wyoming) to 16.4% (California).

Measures

To test our hypotheses, participants were asked to report their level of trust in governmental and health leadership, the news sources they most relied on for information, their knowledge about various facets of COVID-19, and their attitudes about Asian Americans.

Institutional Trust

Trust was measured by asking participants to rate their level of trust, ranging from 0 (*no trust*) to 10 (*complete trust*), in the CDC and President Trump. We chose to focus on these two sources because: (1) the CDC is the leading health organization in the U.S. and a key source for evidence-based information about the pandemic, and (2) President Trump has issued frequent statements about the virus, sometimes in conflict with the CDC and other public health leaders, and thus may have a large influence on the public's knowledge and attitudes.

News Consumption

We next assessed the various news sources participants relied on for information in two ways. First, and following the distinctions used by Pew Research Center (Shearer, 2018), participants were asked how frequently they relied on television, news websites, radio, social media, and print newspapers and response options ranged from 1 (*never*) to 5 (*always*). This approach was taken because these various news formats have differing standards and requirements related to the credibility of the information they distribute. Next, to increase the specificity of our assessment of news consumption, we asked participants to indicate whether or not they frequently use the following news sources: CNN, Fox News, Facebook, National Public Radio (NPR), the New York Times, and Twitter. This allowed us to better document specific sources that may contribute to knowledge and prejudice related to COVID-19.

COVID-19 Knowledge

Knowledge was assessed using a multifaceted knowledge questionnaire developed for the current study. Items were created by integrating surveys on prior infectious disease outbreaks such as the H1N1 outbreak in 2009 (Di Giuseppe et al., 2008) with websites created by health organizations to inform the public and dispel misinformation about COVID-19 (Maragakis, 2020; World Health Organization, 2020). Further, the measure was constructed to measure four facets of knowledge that are critical

to public health responses to COVID-19: knowledge of the spread of the virus (6 items), knowledge of the common symptoms of the virus (8 items), information about treatments for the virus (4 items), and an endorsement of misinformation that was circulating at the time of the survey (3 items). Knowledge on the spread of COVID-19 asked participants to identify the methods that can effectively help prevent spreading the virus, including using hand sanitizer, washing hands with soap and water, using saline rinses, wearing facemasks, using hand dryers, and disinfecting surfaces. The measure of virus symptomology asked participants to identify the symptoms of COVID-19 from a checklist of symptoms that included runny nose, sore throat, body aches, cough, fever, nausea or vomiting, shortness of breath, and fatigue.

The third facet assessed knowledge of the treatments for COVID-19 through items asking whether COVID-19 can be prevented by the pneumonia vaccine, whether a current treatment or vaccine exists, if warmer weather will cure the virus, and when a vaccine is expected to be developed. Finally, misinformation was measured by asking participants to indicate their agreement with false statements that were commonly discussed at the time of the survey (i.e., COVID-19 has a similar mortality rate as the flu; COVID-19 is a manmade virus; and it is dangerous to receive a package from China).

Prejudice Toward Asians

We developed a 4-item measure to assess prejudice toward people of Asian descent that has arisen because of COVID-19. On a scale ranging from 1 (*extremely unlikely*) to 5 (*extremely likely*), participants were asked to report their likelihood of interacting with people of Asian descent in a variety of contexts. Specifically, participants were asked if they would order food from a restaurant with primarily Asian employees, sit next to an Asian person on a bus or other public transportation, attempt to limit interactions with Asian customers or coworkers, or intentionally move farther away from an Asian individual while in a public place. These behaviors were the focus of our measure because they align with reports of Asian Americans' experiences in response to COVID-19. The scale demonstrated adequate reliability ($\alpha = 0.78$) and results from a one-factor confirmatory factor analysis demonstrated good fit [$\chi^2(2) = 21.38$, $p < 0.001$, CFI = 0.99, TLI = 0.98, SRMR = 0.02].

Control Variables

Our analyses also included a number of control variables. First, we controlled for level of education because it is correlated with health literacy (Van Der Heide et al., 2013) and may also be related to general knowledge of viruses. We further controlled for political affiliation, age, gender, and race given the early evidence that COVID-19 beliefs, knowledge, and responses have been stratified by these demographic variables (Alsan et al., 2020; Jurkowitz and Mitchell, 2020; Tyson, 2020).

Analyses

Analyses were conducted by testing multivariate regression models that predicted each of the four facets of COVID-19 knowledge and bias toward Asians. For each model, we first regressed knowledge scores onto the control variables (i.e., gender, age, race, education, sexual orientation, and political affiliation). Step 2 then added the independent variables (i.e., trust in the CDC, trust in President Trump, and news consumption) to assess their relationship with different forms of knowledge and bias toward Asians. We finally conducted independent samples *t*-tests to assess the effects of using specific news sources on COVID-19 knowledge and bias toward Asians. These analyses compare mean scores on each of the outcome measures for participants who did and did not use each of the six specific news sources described previously. Analyses were conducted using IBM SPSS (Version 26.0).

RESULTS

Descriptive Statistics

Prior to testing our hypotheses, we examined the descriptive statistics and distribution of each of our independent variables (see **Supplementary Materials**). Rated on a scale of 0 to 10, the average trust rating for the CDC was 7.66 ($SD = 2.36$) and the average trust rating for President Trump was 4.17 ($SD = 3.69$). Examining the news sources respondents relied on, participants reported using television news sources most frequently ($M = 3.77$, $SD = 1.26$), followed by news websites ($M = 3.38$, $SD = 1.24$), social media ($M = 3.18$, $SD = 1.41$), radio ($M = 2.86$, $SD = 1.26$), and print newspapers ($M = 2.51$, $SD = 1.36$). These findings are similar to other reports of the most relied upon news sources (Shearer, 2018).

We next calculated the descriptive statistics for the four measures of COVID-19 knowledge. Participants scored an average of 4.79 ($SD = 0.94$) on the items assessing the transmission of the virus (out of a total possible score of 8) and an average of 5.45 ($SD = 1.28$) on the 8 items assessing knowledge of the symptoms of the virus. Further, the average score for the 4 items assessing treatment knowledge was 3.16 ($SD = 0.92$) and the average score for the three misinformation items was 1.22 ($SD = 0.87$). Overall, the descriptive statistics for the knowledge measures suggest participants held moderately accurate knowledge of COVID-19 but also tended to endorse at least some misinformation. Finally, participants scored an average of 2.45 ($SD = 1.04$) on our measure of prejudice toward people of Asian descent. Further, 475 (41.6%) of our participants endorsed that they were somewhat or extremely likely to engage in at least one of the behaviors included in the measure.

Predicting Knowledge of COVID-19

We calculated the intercorrelations for all study variables to present the bivariate relationships between the control variables, independent variables, and measures of COVID-19 knowledge (displayed in **Table 1**). We then examined the relationships between media, trust in institutions, and COVID-19 knowledge by conducting four regression models in which each facet of COVID-19 knowledge was predicted by the control variables in Step 1 and the independent variables in Step 2. Results from these models are shown in **Table 2**.

TABLE 1 | Intercorrelations among study variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Race																		
2. Female	0.014																	
3. Non-binary	0.025	−0.09*																
4. Republican	−0.21*	−0.06	−0.04															
5. Independent	−0.05	0.00	0.04	−0.39*														
6. Age	−0.26*	−0.05	−0.09*	0.13*	−0.02													
7. Education	−0.01	−0.06*	−0.03	0.06*	−0.12*	0.04												
8. Trust in CDC	−0.05	0.03	0.00	0.00	−0.08*	0.12*	0.05											
9. Trust in Trump	−0.19*	−0.13*	−0.05	0.55*	−0.06*	0.10*	0.04	0.01										
10. News: TV	−0.02	−0.07*	−0.08*	0.03	−0.12*	0.23*	0.07*	0.20*	0.07*									
11. News: Websites	0.01	−0.01	−0.07*	−0.02	−0.11*	−0.09*	0.24*	0.18*	0.03	0.28*								
12. News: Radio	0.06*	−0.12*	−0.03	0.06*	−0.11*	0.00	0.24*	0.06*	0.21*	0.29*	0.36*							
13. News: Social media	0.11*	0.05	0.02	−0.06	−0.11*	−0.37*	0.09*	0.06*	0.03	0.09*	0.36*	0.23*						
14. News: Print	0.03	−0.17*	−0.04	0.05	−0.14*	0.08*	0.23*	0.05	0.13*	0.30*	0.28*	0.45*	0.15*					
15. Misinformation	0.05	−0.02	−0.07*	0.08*	0.02	−0.06	−0.14*	−0.16*	0.13*	0.01	−0.10*	0.01	0.11*	0.01				
16. Treatment knowledge	−0.10*	0.14*	0.01	−0.10*	0.03	0.17*	−0.05	0.15*	−0.25*	0.01	−0.03	−0.18*	−0.16*	−0.16*	−0.23*			
17. Symptoms knowledge	−0.11*	0.18*	−0.03	0.00	0.01	0.11*	−0.08*	0.13*	−0.13*	0.03	−0.01	−0.15*	−0.07*	0.21*	−0.13*	0.29*		
18. Spread knowledge	0.02	0.10*	−0.05	−0.04	0.03	0.05	−0.12*	0.07*	−0.17*	−0.02	−0.09*	−0.22*	−0.07*	−0.26*	−0.03	0.23*	0.31*	
19. Anti-Asian attitudes	0.07*	−0.08*	−0.04	0.09*	−0.07*	−0.06*	0.03	−0.11*	0.20*	0.08*	0.02	0.18*	0.12*	0.19*	0.22*	−0.20*	−0.22*	−0.13*

*N = 1,141; race is coded 1 for White/Caucasian and 2 for racial minorities. *p < 0.05.*

TABLE 2 | Regression analyses predicting knowledge about COVID-19.

	Misinformation			Treatments			Symptoms			Spread		
Variable	**β**	**SE**	**95% CI**	**β**	**SE**	**95% CI**	**β**	**SE**	**95% CI**	**β**	**SE**	**95% CI**
Step 1												
Race	0.127*	0.062	0.006, 0.249	−0.197**	0.064	−0.323, −0.071	−0.280**	0.090	−0.457, −0.104	0.053	0.067	−0.078, 0.185
Female	−0.064	0.051	−0.165, 0.036	0.262***	0.053	0.157, 0.366	0.459***	0.074	0.313, 0.605	0.180**	0.055	0.072, 0.289
Non-binary	−0.693**	0.262	−1.207, −0.179	0.361	0.272	−0.172, 0.894	−0.031	0.380	−0.777, 0.715	−0.343	0.283	−0.899, 0.212
Republican	0.241***	0.064	0.115, 0.367	−0.296***	0.066	−0.426, −0.166	−0.070	0.093	−0.252, 0.113	−0.043	0.069	−0.179, 0.092
Independent	0.117	0.062	−0.004, 0.239	−0.076	0.064	−0.202, 0.050	−0.028	0.090	−0.204, 0.148	0.034	0.067	−0.097, 0.165
Age	−0.003	0.002	−0.006, 0.000	0.010***	0.002	0.007, 0.013	0.007**	0.002	0.003, 0.012	0.003*	0.002	0.000, 0.007
Education	−0.079***	0.017	−0.111, −0.046	−0.026	0.017	−0.060, 0.008	−0.061*	0.024	−0.108, −0.014	−0.068***	0.018	−0.103, −0.032
R^2 (ΔR^2)			0.206***			0.275***			0.243***			0.171***
Step 2												
Race	0.115	0.061	−0.004, 0.234	−0.196**	0.062	−0.317, −0.075	−0.261**	0.088	−0.433, −0.089	0.066	0.065	−0.060, 0.193
Female	−0.038	0.051	−0.138, 0.062	0.175**	0.052	0.073, 0.276	0.341***	0.074	0.197, 0.486	0.071	0.054	−0.035, 0.178
Non-binary	−0.683**	0.256	−1.185, −0.181	0.236	0.260	−0.273, 0.746	−0.141	0.370	−0.868, 0.586	−0.500	0.272	−10.034, 0.034
Republican	0.112	0.076	−0.036, 0.260	0.028	0.077	−0.122, 0.179	0.205	0.109	−0.009, 0.420	0.182*	0.080	0.024, 0.339
Independent	0.090	0.063	−0.033, 0.213	−0.004	0.064	−0.128, 0.121	0.036	0.091	−0.142, 0.214	0.064	0.067	−0.067, 0.195
Age	0.000	0.002	−0.004, 0.003	0.007***	0.002	0.004, 0.011	0.006*	0.002	0.001, 0.011	0.003	0.002	−0.001, 0.006
Education	−0.072***	0.017	−0.105, −0.039	−0.009	0.017	−0.042, 0.025	−0.036	0.025	−0.084, 0.013	−0.031	0.018	−0.066, 0.005
Trust in CDC	−0.054***	0.011	−0.075, −0.033	0.049***	0.011	0.027, 0.070	0.057***	0.016	0.026, 0.088	0.029*	0.012	0.006, 0.052
Trust in Trump	0.024**	0.009	0.008, 0.041	−0.063***	0.009	−0.080, −0.046	−0.050***	0.012	−0.074, −0.026	−0.043***	0.009	−0.061, −0.025
News: TV	0.036	0.022	−0.008, 0.080	0.015	0.023	−0.029, 0.060	0.056	0.032	−0.007, 0.120	0.043	0.024	−0.003, 0.090
News: Websites	−0.095***	0.024	−0.141, −0.049	0.045	0.024	−0.002, 0.092	0.057	0.034	−0.010, 0.125	−0.007	0.025	−0.057, 0.042
News: Radio	0.005	0.024	−0.041, 0.052	−0.056*	0.024	−0.104, −0.009	−0.046	0.034	−.113, 0.022	−0.075**	0.025	−0.124, −0.025
News: Social media	0.104***	0.021	0.064, 0.145	−0.063**	0.021	−0.104, −0.022	−0.016	0.030	−0.075, 0.042	0.005	0.022	−0.038, 0.049
News: Print	0.012	0.021	−0.030, 0.054	−0.066**	0.022	−0.109, −0.024	−0.167***	0.031	−0.228, −0.106	−0.136***	0.023	−0.181, −0.092
R^2 (ΔR^2)			0.318(0.059)***			0.414(0.095)***			0.351(0.064)***			0.344(0.089)***

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

The first model, which predicted knowledge of transmission, indicated that knowledge was higher among women ($b = 0.180$, $p < 0.01$), older adults ($b = 0.003$, $p < 0.05$), and less educated participants ($b = -0.068$, $p < 0.001$). Further, an examination of the news and trust variables entered in Step 2 showed that, after controlling for race, gender, political affiliation, age, and education, knowledge scores were higher among people with greater trust in the CDC ($b = 0.029$, $p < 0.05$) and lower trust in President Trump ($b = -0.043$, $p < 0.001$). Further, a greater reliance on radio news sources was associated with less accurate knowledge about COVID-19 transmission ($b = -0.075$, $p < 0.01$), as was a greater reliance on print newspapers ($b = -0.136$, $p < 0.001$).

The next model predicted knowledge of the symptoms of COVID-19. Results for the demographic variables showed significant relationships between knowledge and race ($b = -0.280$, $p < 0.01$), being female ($b = 0.459$, $p < 0.001$), age ($b = 0.007$, $p < 0.01$), and education ($b = -0.061$, $p < 0.05$). Results from Step 2 demonstrate that knowledge of COVID-19 symptoms was higher among participants with a greater trust in the CDC ($b = 0.057$, $p < 0.001$) and lower trust in President Trump ($b = -0.050$, $p < 0.001$). The only news format related to knowledge of symptoms was print media, and greater reliance on print news was associated with less symptom-related knowledge ($b = -0.167$, $p < 0.001$).

Results from the third model, which predicted knowledge of COVID-19 treatments, indicated that treatment knowledge was significantly higher among White participants ($b = -0.197$, $p < 0.01$), women ($b = 0.262$, $p < 0.001$), and older participants ($b = 0.010$, $p < 0.001$). Knowledge of treatment was also significantly lower among republicans ($b = -0.296$, $p < 0.001$). Further, trust in the CDC was significantly positively related ($b = 0.049$, $p < 0.001$), and trust in President Trump was significantly negatively related ($b = -0.063$, $p < 0.001$), to knowledge of COVID-19 treatments. Of the news variables, reliance on radio sources ($b = -0.056$, $p < 0.05$), social media ($b = -0.063$, $p < 0.01$), and print sources ($b = -0.066$, $p < 0.01$) were associated with less accurate knowledge of treatments.

The final knowledge model assessed endorsement of misinformation. An examination of the demographic variables showed that misinformation was significantly higher among racial minority participants ($b = 0.127$, $p < 0.05$) and republicans ($b = 0.241$, $p < 0.001$), and significantly lower among non-binary participants ($b = -0.693$, $p < 0.01$) and more educated participants ($b = -0.079$, $p < 0.001$). Participants with more trust in the CDC endorsed significantly less misinformation ($b = -0.054$, $p < 0.001$) whereas participants with more trust in President Trump endorsed greater misinformation ($b = 0.024$, $p < 0.01$). Finally, reliance on news websites was significantly negatively associated with misinformation ($b = -0.095$, $p < 0.001$) and reliance on social media was associated with increased misinformation ($b = 0.104$, $p < 0.001$).

Predicting Prejudice Toward Asians

Results for the regression model predicting prejudice toward people of Asian descent is shown in **Table 3**. Of the demographic variables entered in Step 1, significant relationships were found for race ($b = 0.186$, $p < 0.05$), being female ($b = -0.173$, $p < 0.01$), identifying as republican ($b = 0.232$, $p < 0.01$), and age ($b = -0.004$, $p < 0.05$). These findings suggest prejudice was higher for racial/ethnic minorities and republicans and significantly lower for women and younger adults. In Step 2, prejudice was significantly lower among participants with a greater trust in the CDC ($b = -0.049$, $p < 0.001$) and significantly higher among participants with greater trust in President Trump ($b = 0.052$, $p < 0.001$). Prejudice was also significantly lower among participants who relied on news websites ($b = -0.067$, $p < 0.05$) and higher among participants who relied on radio ($b = 0.066$, $p < 0.05$), social media ($b = 0.057$, $p < 0.05$), and print news sources ($b = 0.100$, $p < 0.001$).

TABLE 3 | Regression analyses predicting negative attitudes toward Asian Americans in response to COVID-19.

Variable	β	SE	95% CI
Step 1			
Race	0.186*	0.074	0.040, 0.331
Female	−0.173**	0.061	−0.293, −0.053
Non-binary	−0.537	0.313	−1.151, 0.077
Republican	0.232**	0.077	0.082, 0.383
Independent	−0.049	0.074	−0.194, 0.096
Age	−0.004*	0.002	−0.008, 0.000
Education	0.011	0.020	−0.028, 0.050
R^2 (ΔR^2)			0.172***
Step 2			
Female	0.167*	0.072	0.027, 0.308
Non-binary	−0.067	0.060	−0.185, 0.051
Race	−0.389	0.302	−0.981, 0.203
Age	−0.037	0.089	−0.212, 0.138
Education	−0.083	0.074	−0.228, 0.062
Republican	−0.003	0.002	−0.007, 0.001
Independent	−0.012	0.020	−0.051, 0.027
Trust in CDC	−0.049***	0.013	−0.074, −0.024
Trust in Trump	0.052***	0.010	0.033, 0.072
News: TV	0.038	0.026	−0.014, 0.089
News: Websites	−0.067*	0.028	−0.122, −0.013
News: Radio	0.066*	0.028	0.011, 0.121
News: Social media	0.057*	0.024	0.009, 0.105
News: Print	0.100***	0.025	0.050, 0.149
R^2 (ΔR^2)			0.337 (0.084)***

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

The Effects of Specific News Sources

As described in the "Materials and Methods" section, participants were also asked follow up questions about the specific news sources they frequently use and we examined whether the use of these specific sources is related to COVID-19 knowledge and prejudice. To do so, we calculated *t*-tests to compare people who frequently used each of the sources (i.e., CNN, Fox News, Facebook, Twitter, National Public Radio [NPR], and the New York Times) to people who did not use these sources to determine if consuming each source of media impacted knowledge and prejudice related to COVID-19.

Results, shown in **Tables 4**, **5**, indicate that people who used Fox News scored significantly higher on misinformation ($t = -4.117$, $p < 0.001$) and prejudice ($t = -2.392$, $p < 0.05$), and significantly lower on treatment knowledge ($t = 2.766$, $p < 0.01$) than people who did not use Fox News. Participants who frequently used Facebook similarly scored significantly higher on misinformation ($t = -3.360$, $p = 0.001$) and prejudice ($t = -3.574$, $p < 0.001$), and significantly lower on knowledge of COVID-19 treatment ($t = 3.900$, $p < 0.001$) and symptoms ($t = 2.387$, $p < 0.05$). Participants who frequently used Twitter scored significantly lower on knowledge of treatment ($t = 2.621$, $p < 0.01$) and knowledge of symptoms ($t = 2.538$, $p < 0.05$).

Further, misinformation scores were significantly lower among participants who frequently use CNN ($t = 2.054$, $p < 0.05$) compared to those who do not as well as among participants who frequently use the New York Times ($t = 4.397$, $p < 0.001$) as compared to those who do not. Prejudice was similarly lower among participants who frequently used the New York

TABLE 4 | *T*-tests comparing knowledge scores for people who use and do not use specific news sources.

	Treatment				Symptoms		
News source	***N***	***M***	***SD***	***T***	***M***	***SD***	***T***
CNN							
Use	462	3.17	0.96	−0.382	5.45	1.31	−0.080
Don't use	679	3.15	0.89		5.45	1.26	
Facebook							
Use	409	30.01	0.98	3.900***	5.33	1.40	2.387*
Don't use	732	3.24	0.88		5.52	1.97	
Fox News							
Use	398	30.06	0.88	2.766**	5.45	1.22	0.029
Don't use	743	3.21	0.94		5.45	1.31	
NPR							
Use	137	3.32	0.86	−2.242*	5.53	1.24	−0.822
Don't use	1,004	3.13	0.93		5.44	1.28	
New York Times							
Use	215	3.25	0.90	−1.684	5.46	1.38	−0.090
Don't use	926	3.13	0.92		5.45	1.25	
Twitter							
Use	215	30.00	10.02	2.621**	5.23	1.46	2.822*
Don't use	926	3.19	0.89		5.50	1.23	
	Spread				**Misinformation**		
News source	***N***	***M***	***SD***	***T***	***M***	***SD***	***T***
CNN							
Use	462	4.81	0.95	−0.422	1.16	0.86	20.054*
Don't use	679	4.78	0.93		1.27	0.88	
Facebook							
Use	409	4.77	0.98	0.737	1.34	0.85	−3.360**
Don't use	732	4.81	0.91		1.16	0.88	
Fox News							
Use	398	4.75	0.92	1.240	1.37	0.88	−4.117***
Don't use	743	4.82	0.94		1.15	0.86	
NPR							
Use	137	4.79	0.90	0.065	0.86	0.88	5.256***
Don't use	1,004	4.79	0.94		1.27	0.86	
New York Times							
Use	215	4.79	0.94	0.124	0.99	0.90	4.397***
Don't use	926	4.79	0.94		1.28	0.86	
Twitter							
Use	215	4.72	10.04	1.230	1.26	0.91	−0.674
Don't use	926	4.81	0.91		1.22	0.86	

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

TABLE 5 | *T*-tests comparing prejudice scores for people who use and do not use specific news sources.

	Prejudice			
News Source	***N***	***M***	***SD***	***T***
CNN				
Use	462	2.42	10.09	0.729
Don't use	679	2.46	0.99	
Facebook				
Use	409	2.59	10.08	−3.574***
Don't use	732	2.36	10.00	
Fox News				
Use	398	2.55	10.03	−2.392*
Don't use	743	2.39	10.04	
NPR				
Use	137	2.26	1.11	20.082*
Don't use	1,004	2.47	10.02	
New York Times				
Use	215	2.25	10.06	30.070**
Don't use	926	2.49	10.02	
Twitter				
Use	215	2.50	1.19	−0.732
Don't use	926	2.43	10.02	

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

Times ($t = 3.070$, $p < 0.01$) as compared to those who did not. Finally, participants who frequently used NPR scored significantly lower on misinformation ($t = 5.256$, $p < 0.001$) and prejudice ($t = 2.082$, $p < 0.05$), and significantly higher on treatment knowledge ($t = -2.242$, $p < 0.05$). Results from our *t*-tests demonstrate the importance of the specific news sources one relies on in determining not only knowledge but also prejudice connected to COVID-19.

DISCUSSION

In this study, we assessed whether the types and sources of media people consume, and institutions in which people place their trust, are associated with three negative public health consequences: lack of disease-specific knowledge; the endorsement of misinformation related to COVID-19; and prejudice toward Asian Americans in response to COVID-19. Our results provide support for the role of media and institutional trust in determining all three of these important outcomes and provide evidence that media framing shapes the knowledge people accumulate, their ability to identify misinformation, and attitudes related to COVID-19. This findings help identify specific barriers that may prevent more effective and positive public health responses in the United States. In the sections below, we elaborate on each of these findings and their implications.

Trust in Institutions

The current study demonstrates the importance of the public's trust in public health and governmental institutions. More specifically, our results suggest that greater trust in the CDC was associated with increased knowledge, less acceptance of misinformation, and lower prejudice toward Asian Americans. This supports the positive role of trust in health organizations, demonstrating that individuals are more likely to hold critical public health information and resist scapegoating if they believe that the leading public health agency is trustworthy. By contrast, greater trust in the President Trump was associated with decreased knowledge and greater endorsement of misinformation. Individuals trusting information from President Trump, who has continued to link the origin of the outbreak to China, also report greater prejudice toward Asian Americans. This suggests that the presence of informational sources that associate infectious diseases with specific racial/ethnic groups may have significant public health impacts beyond the development of health literacy and contributes to the continued debate about the use of China-centric language and naming to describe COVID-19 (Rogers et al., 2020).

These findings challenge and extend previous findings on the role of trust in determining health attitudes and behaviors. Namely, extant research examining trust has identified *mistrust* in government as a critical barrier to positive health attitudes and behaviors (Jamison et al., 2019; Larson et al., 2018; Whetten et al., 2006). In contrast, our findings suggest that trust in governmental leadership can be a hindrance to health literacy when the messages issued by governmental leaders are at odds with those from public health organizations and emerging evidence-based practices. Practically, this finding also highlights that messaging from governmental leaders in the United States may be impeding effective public health responses to COVID-19.

Media Consumption

In terms of media consumption, we find effects of the news mediums people consume on both knowledge and attitudes related to COVID-19. First, we find that social media use is associated with several negative consequences, including the endorsement of misinformation related to COVID-19, lower knowledge about how the disease is treated, and greater prejudice toward Asian Americans. This may be because social media allows for the easy and widespread distribution of information while also having minimal standards to assess the credibility of such information. This explanation comports with the recent finding that Americans who rely most on social media reported seeing more misinformation about the pandemic than those who rely on other sources (Jurkowitz and Mitchell, 2020).

In addition, there is increasing evidence that information provided on some social media platforms, such as Facebook, is curated by both users and platform algorithms, according to political affiliation and other characteristics (Bakshy et al., 2015). This increases the chances that individuals may consume information that confirms existing views rather than contributes to the accumulation of evidence-based public health information. Reinforcing this even further, social media users may only follow and friend others who share similar ideologies and post similar content which can create a false consensus wherein users may believe that most people share their COVID-19 knowledge, beliefs, and attitudes, thus making

their knowledge and beliefs seem more credible. Given the growing reliance on social media as a news source (Shearer, 2018), public health agencies may benefit from targeting information and bias-reduction campaigns at those who rely on forms of social media such as Facebook for information.

Further, individuals using print and radio sources were less common in our study, but these sources were also associated with lower knowledge of COVID-19 and greater stigmatization of Asian Americans. Because these sources are more often utilized by Americans over 65, these platforms may emphasize political perspectives that are more common among this cohort and which systematically downplay COVID-19 risks or emphasize the relationship of the virus to China. Finally, and in support that some media formats can have positive influences during public health crises, individuals using web news sources were less likely to endorse misinformation. These findings overlap with recent Pew Research Center findings that individuals utilizing national news on news websites are likely to closely follow COVID-19 updates which could help account for why the endorsement of misinformation was lower (Jurkowitz and Mitchell, 2020).

Finally, comparisons of people who use specific news sources, such as Fox News, Twitter, and Facebook, showed that this type of news consumption may bolster prejudice and impair knowledge about COVID-19. Use of NPR, by contrast, was associated with more positive knowledge development and lower prejudice. Given the stark divide in media preferences along partisan lines (Mitchell and Oliphant, 2020), it seems that different media sources influence knowledge and attitudes, likely through the way COVID-19 is framed. For example, downplaying the virus or comparing it to the flu, criticizing public health recommendations such as social distancing, or promoting misinformation are some ways that news outlets may play an outsized role in influencing knowledge and attitudes related to COVID-19. Our findings highlight that partisan divides in news consumption materially impact the accumulation of public health knowledge, the ability to identify and discount misinformation, and attitudes toward minority racial/ethnic groups. Public health officials should consider the political divide in media consumption a critical barrier to overcome in the promotion of health literacy related to COVID-19.

Practical Implications

A successful public health response to any infectious disease epidemic relies on adequate knowledge of the disease itself and a willingness to make personal sacrifices to reduce transmission. The proliferation of new information related to COVID-19, much of which has not been scientifically validated, has created what the World Health Organization calls an "infodemic" (The Lancet Infectious Diseases Editorial Board, 2020). There is an essential need, therefore, to communicate evidence-based information, but public health leaders are facing critical barriers, especially the deep divides both in the messages different news sources and institutions have emphasized amid the pandemic and in the sources the public trusts and relies on for information. The polarization of media usage and trust in both President Trump and the Centers for Disease Control in the United States appears to shape different types of knowledge of the virus and the endorsement of misinformation. Importantly, the public health impact of diverse messaging extends beyond the development of health literacy and is materially affecting the health of Asian Americans who are stigmatized for their association with the virus' origin in China.

As such, public health should focus specifically on countering misinformation and addressing the different messages that Americans are receiving from various information sources. In addition, public health messages should be framed in a way that is politically neutral as political affiliation seems to shape responsiveness to public health leadership in the United States. In doing so, public health leaders stand to enhance trust in and the widespread dissemination of evidence-based public health recommendations. Public health organizations and officials can also use the findings from this study to direct their public health campaigns to reach people who are most in need. While it may not be possible for such organizations to control and prevent the spread of inaccurate or harmful information via media outlets, they can target the sources of media most detrimental for health literacy (e.g., social media) to provide consumers with accurate information that may help to counteract more negative messaging.

Limitations and Future Research

Our study has several limitations which are important to note. First, we conducted this study in March of 2020 as the COVID-19 epidemic was still growing in the United States. Because we measured knowledge and beliefs early on in the epidemic, it is possible that our results could change as information becomes more publicly available and as more scientific studies are published. The amount and types of misinformation that have circulated have also grown since the time of our survey and additional work is needed to assess the more complex conspiracy theories and false beliefs the public may now endorse. However, despite these drawbacks, we believe gathering information at the onset of the spread of COVID-19 in the U.S. is informative as behaviors and attitudes in the early weeks will be formative in determining the virus's severity.

Second, there are also limitations with our methodology that impact the conclusions we can draw from our data, including the reliance on a cross-sectional survey design which does not allow us to determine causality as well as the quantitative nature of our measures. Given the growing complexity of knowledge and attitudes related to COVID-19, future qualitative studies are warranted to explore how media shapes trust in different information sources and different facets of knowledge related to COVID-19. Finally, the amount of variance explained in our models suggests there are also other variables outside of those explored in the current study that may affect the degree to which the public holds accurate knowledge, endorses misinformation, and expresses prejudice toward people of Asian descent. For example, having a personal connection to someone who has gotten COVID-19 may influence

knowledge through directly exposing individuals to COVID-19 information and/or motivating these individuals to become more informed to support their friends or family through their illness. Additionally, individual differences such as personality variables and competing belief systems have been connected to beliefs in conspiracy theories (Swami et al., 2010; Newheiser et al., 2011) and may also be related to COVID-19 knowledge and misinformation.

CONCLUSION

To summarize, our findings suggest that various news formats and informational sources shape how much individuals know about the virus and whether individuals hold stigma toward Asian Americans who have become associated with the virus. These findings are important because they identify the key role of mass media and public institutions in affecting the accumulation of knowledge necessary to keep the public safe in an infectious disease epidemic and with beliefs that threaten the health and wellbeing of a subsection of Americans. The polarized nature of American media consumption, in particular, creates an environment where individual beliefs are often reinforced rather than challenged. There is a profound need, accordingly, for public health leaders to construct effective messaging related to COVID-19 that is available to all Americans and is politically neutral, and to combat mistrust in key public health agencies tasked with providing critical public health information to the public.

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 Ohio University Institutional Review Board. Written informed consent was obtained from all participants and was received electronically.

AUTHOR CONTRIBUTIONS

LD and BF contributed to the conception and design of the study, oversaw data collection and wrote portions of the manuscript, and edited the manuscript. LD organized the data and performed the statistical analysis. Both authors read and approved the final manuscript.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.560828/full#supplementary-material

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Dealing With the COVID-19 Infodemic: Distress by Information, Information Avoidance, and Compliance With Preventive Measures

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In the ongoing coronavirus disease 2019 (COVID-19) pandemic, media reports have caused anxiety and distress in many. In some individuals, feeling distressed by information may lead to avoidance of information, which has been shown to undermine compliance with preventive health behaviors in many health domains (e.g., cancer screenings). We set out to examine whether feeling distressed by information predicts higher avoidance of information about COVID-19 (avoidance hypothesis), and whether this, in turn, predicts worse compliance with measures intended to prevent the spread of COVID-19 (compliance hypothesis). Thus, we conducted an online survey with a convenience sample (N = 1,059, 79.4% female) and assessed distress by information, information avoidance, and compliance with preventive measures. Furthermore, we inquired about participants' information seeking behavior and media usage, their trust in information sources, and level of eHealth literacy, as well as generalized anxiety. We conducted multiple linear regression analyses to predict distress by information, information avoidance, and compliance with preventive measures. Overall, distress by information was associated with better compliance. However, distress was also linked with an increased tendency to avoid information (avoidance hypothesis), and this reduced compliance with preventive measures (compliance hypothesis). Thus, distress may generally induce adaptive behavior in support of crisis management, unless individuals respond to it by avoiding information. These findings provide insights into the consequences of distress by information and avoidance of information during a global health crisis. These results underscore that avoiding information is a maladaptive response to distress by information, which may ultimately interfere with effective crisis management. Consequently, we emphasize the need to develop measures to counteract information avoidance.

Keywords: COVID-19, emotional distress, information avoidance, eHealth literacy, trust in media, compliance

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INTRODUCTION

In the coronavirus disease 2019 (COVID-19) pandemic, people have been exposed to an ongoing news cycle. This prompted the World Health Organization (WHO) to state that the healthcare system is not just fighting an epidemic, but also an infodemic. This refers to vast amounts of information that spread rapidly and can impede effective crisis management (Zarocostas, 2020).

Thus, information is a mixed blessing in the COVID-19 pandemic. On the one hand, effective communication of facts helps individuals develop adequate risk perceptions and make adaptive health decisions to protect themselves and their peers (Garfin et al., 2020). On the other hand, vast amounts of information may also impose additional strain on crisis management (Kim et al., 2019; Garfin et al., 2020), as they trigger unpleasant emotions that can have undesired consequences (Sweeny et al., 2010).

Information and media coverage on content that is perceived as threatening can elicit aversive emotions, such as distress (Rubin et al., 2009; Wheaton et al., 2012; Pfefferbaum et al., 2014; Klemm et al., 2016; Thompson et al., 2017). When information is contradictory or uncertain, distress and risk perceptions may be even more elevated (Taha et al., 2014; Fischhoff et al., 2018). Past research on natural or human-made disasters showed that consuming more media coverage is typically associated with increased incidences of post-traumatic stress disorder (PTSD), anxiety, and depression (Pfefferbaum et al., 2014). More specific examples for media consumption and distress during viral outbreaks include the 2014 incidences of Ebola in the United States and the swine flu pandemic. Although individual risk was comparably low in both crises, media exposure to the topic was associated with heightened distress and functional impairment (e.g., Rubin et al., 2010; Wheaton et al., 2012; Thompson et al., 2017). Taking the high individual risk of the COVID-19 pandemic into account, it is not surprising that anxiety and distress have been elevated in response to the crisis (see Wang et al., 2020).

Besides adverse consequences for mental health, heightened distress by information can have relevant consequences for an individual's behavior in the crisis (Jones and Salathe, 2009; Rubin et al., 2010; Bults et al., 2011). For example, during the swine flu pandemic, higher distress was associated with better compliance with preventive measures (Jones and Salathe, 2009; Rubin et al., 2009). Whereas this is clearly positive from a crisis management perspective, other consequences of distress may be undesirable. For instance, distress was also associated with increased utilization of healthcare services during past viral outbreaks, which put additional strain on already overburdened healthcare systems (McDonnell et al., 2012). Similarly, distress triggered panic purchases early in the COVID-19 pandemic. This led to global shortages of specific consumer goods and important medical equipment, such as hand sanitizer and face masks (Cheng et al., 2020; Garfin et al., 2020). Such behavioral consequences of distress may be most detrimental when they interfere with compliance with preventive measures. As it is not yet clear in what way distress influences compliance with preventive measures during the COVID-19 pandemic (Holmes et al., 2020), the examination of individuals' responses to distressing health information is pertinent. In particular, responses that reduce compliance need to be identified so that authorities can adequately address them.

Individuals respond to threatening health information either by surveilling it and taking appropriate measures or by avoiding threatening information (Sweeny et al., 2010; Howell and Shepperd, 2013a, 2016). We focus on information avoidance, as this is one reaction to distressing information that has often been overlooked in previous research on responses to viral outbreaks. Findings from other health domains show that a substantial proportion of the population opts to avoid anxiety-provoking information, such as HIV status, cancer risk, or a genetic disposition to diseases (Hightow et al., 2003; Orom and Shepperd, 2015; Taber et al., 2015). Generally, health information avoidance is an emotionally driven, maladaptive defensive response (Howell and Shepperd, 2013b; Sweeny et al., 2010). According to the information avoidance framework, individuals most commonly avoid information when learning the information is associated with aversive emotions (e.g., receiving a cancer diagnosis elicits fear) or requires individuals to take undesired actions (e.g., undergoing surgery; Ajekigbe, 1991; Sweeny et al., 2010). Both responses are highly relevant in the case of COVID-19, as the topic not only is threatening but also requires individuals to take undesired actions (e.g., social distancing).

Furthermore, information avoidance can result from overexposure to health topics that receive an abundance of attention in the media (Barbour et al., 2012). In a recent survey, two thirds of participants reported feeling the need to take breaks from the news on COVID-19 (Mitchell et al., 2020). While this may help individuals remain calm, it also implies that they can miss out on important novel information (e.g., additional preventive measures, rising incidences in their area of residence) or may even underestimate the severity of the situation, no longer being confronted with it. Thereby, avoiding information about COVID-19 could result in intentional or unintentional worse compliance with preventive measures, with severe consequences for crisis management. In line with this, information avoidance has been associated with lower compliance to preventive behaviors in other health domains (Emanuel et al., 2015). However, to our knowledge, information avoidance and its potential consequences have not yet been assessed in a global health crisis.

We set out to examine whether distress caused by information about COVID-19, avoidance of information, and compliance with preventive measures in the case of COVID-19 are interrelated. We expected that a higher level of distress by information is associated with more avoidance of information (avoidance hypothesis), and that more avoidance of information is associated with worse compliance with preventive measures (compliance hypothesis).

In addition, we inquired about participants' information seeking behavior, level of eHealth literacy, and trust in information sources. To date, individuals obtain news from a variety of sources, and some of these may be particularly at risk of spreading misinformation about COVID-19 (Depoux et al., 2020). Thus, individuals' ability to find information and critically evaluate the reliability of information (i.e., eHealth literacy) may be decisive for their emotional and behavioral responses to this crisis (Sentell and Vamos, 2020). Moreover, considering information provided by health authorities and the media as trustworthy enhanced compliance with preventive measures during the swine flu pandemic (Rubin et al., 2009). Thus, we assumed that outlining the role of these variables and their interaction with distress by information, information

avoidance, and compliance with preventive measures may aid the development of recommendations for action in the COVID-19 pandemic.

MATERIALS AND METHODS

Participants

Participants were recruited from the community and via the social media platforms. Ethical approval for the study was granted by the ethics committee of the University of Mannheim. Initially, 1,432 participants started the online study. However, 26.05% dropped out before completing all questions, which is comparable to dropout rates reported in other online studies (Galesic, 2006; Hengen and Alpers, 2019). The majority of dropouts occurred directly after accessing the survey. All incomplete datasets were excluded. This resulted in a final sample of N = 1,059 participants (age; M = 39.53, SD = 12.85, 79.4% female, 44.4% university degree) and included participants from all 16 German states. Furthermore, a substantial number of participants had a preexisting mental health condition (28.4%) or a physical health condition that put them at higher risk of a severe progression of COVID-19 (30.6%). Finally, 3.6% of our sample had been tested for COVID-19 and 1% tested positive.

Data Collection and Procedure

Data were collected from March 27 until April 29. Notably, in Germany, the strict regulations to slow down the spread of COVID-19 (i.e., contact restrictions) started on March 22 and were first relaxed on April 20. The study was presented in SoSci Survey and hosted on the university's secure server. The online link to the study was distributed on social media and advertised on the website of our university. Participants accessed the study by clicking on the link. Prior to participation, individuals received general information about the study topic and procedure and provided informed consent. Then, participants completed a questionnaire battery, taking approximately 20 min. To measure our main outcome variables, this battery included the distress by information subscale of the Cyberchondria Severity Scale—15 (CSS-15; Barke et al., 2016), one self-generated item on information overload, the adapted Information Avoidance Scale (Howell and Shepperd, 2016), and a self-generated scale to assess compliance with preventive measures during the crisis. Furthermore, the following measures were also assessed and considered as predictors in the regression analyses when they significantly correlated with the outcome: sociodemographic data, information seeking behavior and media usage, the eHealth Literacy Scale (eHEALS; Norman and Skinner, 2006), and the Generalized Anxiety Disorder—7 instrument (GAD-7; Spitzer et al., 2006). On all measures, participants were instructed to report on their emotions and behavior since the start of the COVID-19 pandemic. Participants received no compensation for participation.

Main Outcomes

Distress by Information

Distress by information about COVID-19 was assessed with the distress by information subscale of the CSS-15, which has previously been validated in a representative German sample (Barke et al., 2016). This subscale assesses heightened distress after obtaining health information on a 5-point Likert scale (1 = "never" to 5 = "always"). We asked participants to specifically refer to information about COVID-19 instead of health information in general. Furthermore, we added an item to capture the magnitude of information and distress ("the amount of information about COVID-19 is getting to be too much").

Information Avoidance

Avoidance of information was assessed using the adapted Information Avoidance Scale (Howell and Shepperd, 2016). This instrument has high internal consistency and convergent and discriminant validity and provides stable results across time and different sample populations. We again adapted this scale to measure avoidance of information about COVID-19. Participants responded to items on a 7-point Likert scale (1 = "strongly disagree" to 7 = "strongly agree"). Our German translation (translated and back-translated by two bilingual psychologists) can be obtained upon request.

Compliance With Preventive Measures

We assessed compliance with preventive measures during the crisis on 13 items, which we generated according to recommendations of the German Federal Centre for Health Education (BZgA, 2020). Assessed behaviors included (1) staying at home, (2) following recommended hygiene regulations (washing hands regularly, cough and sneeze etiquette), (3) keeping an appropriate distance to other people, (4) wearing a face mask, (5) having in-person social contact, (6) going to a park or playground, (7) going to the gym, (8) going to a party, (9) going to a restaurant, (10) taking a trip, (11) visiting family, (12) using public transportation, and (13) excessive purchases. Results from an exploratory factor analysis for this scale are reported in the **Supplementary Material**. Although internal consistency was weak, we kept all 13 items in our final index as all behaviors are highly relevant in the COVID-19 pandemic.

Although all assessments referred to the entire time of the ongoing pandemic, we reminded participants that this applied to their behavior as well. This was to clarify that we were also interested in compliance with these measures before they became mandatory. Participants responded to items by indicating whether they had shown "less," "no change," or "more" of each one of the relevant behaviors during the crisis. Similar to previous studies in the field (e.g., Jones and Salathe, 2009), we scored behavior in an index and allocated one point when participants reported having shown more of a preventive behavior (e.g., staying at home, following recommended hygiene regulations, wearing a face mask, keeping an appropriate distance to other people), or when participants reported having shown less of behavior that could spread the virus or burden the system (e.g., social contacts in person, taking a trip, visiting family, using public transport, excessive purchases, going to a park or playground, a gym, a party, or a restaurant). Consequently, higher scores on the index indicate better compliance with preventive measures.

Additional Variables of Interest

We also assessed information seeking behavior and media usage, eHealth literacy, and generalized anxiety to test their associations with distress by information, information avoidance, and compliance.

Information Seeking Behavior and Media Usage

We assessed information seeking behavior and media usage by asking participants if (and for how long) they followed the news on COVID-19, whether their media consumption had increased since the start of the crisis, and whether they searched online for COVID-19-related mental or physical health information (e.g., how to stay mentally healthy during quarantine). We presented participants with a list of information sources, including news channels' websites, internet search engines, social media (authorities' channels), social media (user-generated content), public TV, private TV, health authorities, friends and family, primary care physicians, and the newspaper. We asked participants to indicate which sources they had used to obtain information about COVID-19. Next, we asked participants to rate how trustworthy they considered all sources to be on a 5-point Likert scale (1 = "not trustworthy" to 5 = "trustworthy"). Thus, participants also rated the trustworthiness of the sources they did not use.

eHealth Literacy

We assessed eHealth literacy with the eHEALS (Norman and Skinner, 2006). The eHEALS is a widely used scale that captures an individual's perceived ability and comfort to access and apply online health information. We adapted all items to ask participants specifically about their eHealth literacy regarding COVID-19. Participants answered all items on a 5-point Likert scale (1 = "strongly disagree" to 5 = "strongly agree").

Anxiety

The level of anxiety experienced since the start of the crisis was assessed with the GAD-7 (Spitzer et al., 2006). This instrument asks participants to indicate how often they felt impaired by a series of symptoms on a scale from 1 to 4 (1 = "never" to 4 = "almost every day"). We selected this measure as it is widely used and its validity has been demonstrated with a large German sample (Löwe et al., 2008).

Statistical Analysis

Statistical analyses were run in IBM SPSS Statistics 27 (SPSS Inc., 2020) and PROCESS (Hayes, 2020). Prior to all analyses, assumptions (e.g., multicollinearity) were tested, and when violated, appropriate corrections were applied. Furthermore, we adjusted the significance levels according to Bonferroni–Holmes to correct for multiple tests.

Prior to hypothesis testing, we calculated descriptive data on information seeking behavior. Trust ratings of information sources were compared between participants who reported the use of a certain source and participants who did not use this source. Furthermore, we calculated the average trust rating of all information sources used by a participant and examined the role of this as a predictor in the subsequent analysis. This trust variable had four missing values, as four participants did not report to use any information source.

We linearly transformed sum scores of distress by information, information avoidance, eHealth literacy, generalized anxiety, and the average trust in information sources used to a range of 0–100 to enhance comparability. We log-transformed the compliance score as the data were not normally distributed (participants generally reported high compliance). Then, we calculated correlational analyses to examine if our main outcome variables (distress by information, information avoidance, and compliance) were significantly associated with one another. We also tested their association with other variables (e.g., sociodemographic data, generalized anxiety, date of data collection). We conducted group comparisons to see whether individuals with a mental or physical health condition or individuals who searched health information online differed in levels of distress, information avoidance, and compliance with preventive measures. Significant variables were included as predictors into subsequent regression analyses. The date of an individual's participation had no effect on any of the outcome variables, and hence time was not considered in the subsequent analyses.

We ran a stepwise linear regression to explore which variables predict distress by information. For hypothesis testing, we conducted two more regression analyses. These tested the predictive value of distress by information about information avoidance (avoidance hypothesis) and information avoidance on compliance with preventive measures (compliance hypothesis).

Finally, we further explored the interrelatedness of distress by information, information avoidance, and compliance with preventive measures in a mediation analysis (Model 4) using PROCESS (Hayes, 2020). Thus, we tested whether avoidance of information (M) mediates an effect of distress by information (X) on compliance with preventive measures (Y). We controlled for sociodemographic variables, anxiety, and eHealth literacy in this analysis. Furthermore, we report standardized effects and coefficients in the results of this analysis.

RESULTS

Descriptive Data on Information Seeking and Media Usage

Of our large and diverse sample, 67.1% indicated that they had been following the media coverage on the COVID-19 outbreak for more than 1 month, whereas 30.1% indicated following the news for less than 1 month, and 2.7% reported not following the news. Furthermore, 66% indicated that their media consumption in the COVID-19 outbreak was higher than their regular media consumption. Furthermore, 80.7% reported to have searched online for COVID-19-related physical health information, and 42.6% reported to have searched for COVID-19-related mental health information.

Participants used a variety of information sources (M = 4.5, SD = 1.75), most of which were media sources (M = 3.68, SD = 1.46). Group comparisons showed that information sources were rated as more trustworthy by the participants who used

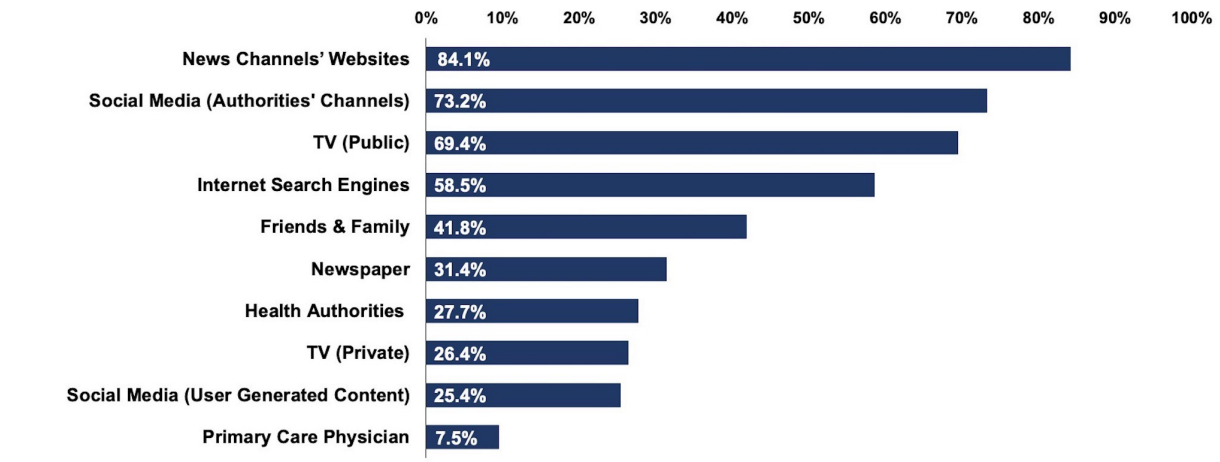

FIGURE 1 | Percentage of participants reporting to use each source to obtain information about COVID-19.

them than by the participants who did not use them, $ts \geq 2.82$, $ps \leq 0.004$, $ds \geq 0.20$. Exact statistical values are reported in the **Supplementary Material**. An overview of the information sources individuals used is provided in **Figure 1**.

Correlations Among Main Outcomes and Other Variables

To test whether our main outcome variables were interrelated and to explore which other variables were associated with them, we first conducted correlational analyses. These showed that distress by information was associated with higher information avoidance, $r = 0.269$, $p < 0.001$, and higher information avoidance was associated with lower compliance with preventive measures, $r = -0.146$, $p < 0.001$. Thus, the requirements for our planned analyses were met. Interestingly, distress by information was also associated with higher compliance, $r = 0.135$, $p < 0.001$. We followed up on this effect after hypotheses testing in the mediation analysis below. These and all other correlations are presented in **Table 1**.

Regression on Distress by Information

We included variables that were significantly correlated with distress as predictors into a stepwise regression analysis. Furthermore, group comparisons showed that individuals with a preexisting mental or physical health condition and individuals searching online for physical or mental health information reported higher levels of distress, $ts \geq 2.8$, $ps \leq 0.001$, $ds < 0.19$. Thus, these variables were dummy coded and also entered into the analysis as predictors. The final model explained 33.9% variance of distress by information, model fit: $F(6, 1{,}048) = 91.01$, $p < 0.001$. Furthermore, results showed that higher generalized anxiety, $\beta = 0.498$, $t(1{,}054) = 19.36$, $p < 0.001$, lower eHealth literacy, $\beta = -0.191$, $t(1{,}054) = -7.27$, $p < 0.001$, searching physical health information online, $\beta = 0.096$, $t(1{,}054) = 3.55$, $p < 0.001$, searching mental health information online, $\beta = 0.081$, $t(1{,}054) = 3.02$, $p = 0.003$, trust in information sources used, $\beta = 0.062$, $t(1{,}054) = 2.33$, $p = 0.020$, and consuming more news than before the crisis, $\beta = 0.056$, $t(1{,}054) = 2.18$, $p = 0.029$, had incremental predictive value.

Regression on Information Avoidance (Avoidance Hypothesis)

To test our avoidance hypothesis, we ran a regression on information avoidance with distress by information and other variables that correlated significantly with this outcome as predictors. Group comparisons showed no differences between participants with and without a preexisting physical health condition, $t(1{,}057) = 1.43$, $p = 0.154$, $d = 0.09$, but individuals with a preexisting mental health condition reported higher information avoidance than individuals without one, $t(1{,}057) = 2.57$, $p = 0.01$, $d = 0.18$. Thus, preexisting mental health condition was considered as a predictor in the analysis. Results supported our hypothesis, showing that higher distress by information was the most powerful predictor of higher information avoidance. The final model explained 18.3% of the variance, model fit: $F(5, 1{,}049) = 48.31$, $p < 0.001$, and other significant predictors of higher information avoidance included in the model were lower trust in information sources used, lower age, lower eHealth literacy, and lower generalized anxiety. Exact statistics are shown in **Table 2**.

Regression on Compliance With Preventive Measures (Compliance Hypothesis)

To test our compliance hypothesis, avoidance of information and other variables significantly correlated with the outcome were entered into a stepwise regression model. Group comparisons showed that participants with a preexisting physical health

TABLE 1 | Correlation analyses of distress by information, information avoidance, compliance with preventive measures, and other variables.

	Variables	*N*	(1)	(2)	(3)	(4)	(5)	(6)
(1)	Distress by information	1,059						
(2)	Information avoidance	1,059	0.269**					
(3)	Compliance	1,059	0.135**	−0.146**				
(4)	eHealth literacy	1,059	−0.190**	−0.224**	0.083*			
(5)	Anxiety	1,059	0.531**	0.085**	0.078*	−0.098**		
(6)	Trust	1,055	−0.019	−0.222**	0.117**	0.290**	−0.103**	
(7)	Age	1,059	−0.042	−0.163**	0.138**	−0.077*	−0.075*	−0.015

*$p < 0.05$, two-tailed. **$p < 0.01$, two-tailed. In the correlations of distress by information, information avoidance, and compliance, we controlled for sociodemographic variables (age, gender, education), anxiety, and eHealth literacy.*

TABLE 2 | Summary of the final regression model on information avoidance.

Step	Predictor	β	95% CI		*t*	*p*	R^2	Δ R^2
			LL	UL				
(1)	Distress by information	0.333	0.267	0.399	9.88	<0.001	0.088	
(2)	Trust	−0.195	−0.253	−0.138	−6.65	<0.001	0.134	0.046
(3)	Age	−0.171	−0.226	−0.116	−6.11	<0.001	0.157	0.023
(4)	eHealth literacy	−0.127	−0.186	−0.069	−4.26	<0.001	0.172	0.015
(5)	Anxiety	−0.132	−0.197	−0.067	−3.97	0.003	0.183	0.011

n = 1,055. CI, confidence interval; LL, lower limit; UL, upper limit.

condition and participants who previously searched for physical or mental health information online were more compliant, $ts \geq 2.99$, $ps \leq 0.003$, $ds \leq 0.19$. Thus, these variables were included as predictors. Group comparisons regarding a preexisting mental health condition were non-significant, $t(1,057) = 0.13$, $p = 0.896$, $d = 0.01$. The final model explained 13.9% variance, model fit: $F(8,1046) = 22.23$, $p < 0.001$). Results supported our hypothesis, showing that lower avoidance of information was a significant predictor for better compliance with preventive measures. Other significant predictors of better compliance were searching online for physical health information, watching more news than before the crisis, higher age, higher education, more distress by information, a preexisting physical health condition, and female gender. Exact statistics are shown in **Table 3**.

Mediation Analysis With Information Avoidance

Distress by information predicted better compliance with preventive measures and higher avoidance of information. Information avoidance, in turn, predicted worse compliance. Thus, we followed up on this in a mediation analysis (Model 4 in PROCESS; Hayes, 2020) to test whether information avoidance mediates an indirect negative effect of distress by information on compliance with preventive measures that runs counter to the overall positive effect. Results showed that the total effect of distress by information on compliance was positive, c path = 0.157, $p < 0.001$. This effect consisted of a direct positive effect of distress by information on compliance, c' path = 0.218, $p < 0.001$, and a small indirect negative effect on compliance, mediated by avoidance of information, a × b path = −0.062, 95% CI (−0.088, −0.039). The mediation model is shown in **Figure 2**.

DISCUSSION

The ongoing COVID-19 pandemic obviously has a major impact on our emotions and our behavior. This study provides insights into the consequences of distress people experience from information about COVID-19 and information avoidance during this global health crisis. Overall, distress by information predicted better compliance. However, this was clearly diminished when distress led to information avoidance (avoidance hypothesis), which lessened compliance (compliance hypothesis). Both findings expand upon the growing body of literature on distress during the COVID-19 outbreak (Bao et al., 2020; Qiu et al., 2020; Rajkumar, 2020; Torales et al., 2020), by specifying the consequences of distress by information on information avoidance and compliance. Furthermore, our results underscore the critical role of trust in information sources and eHealth literacy. Higher trust was associated with less information avoidance, and individuals with higher eHealth literacy reported less distress by information and less avoidance of information.

Overall, distress was associated with better compliance with preventive measures and may thereby ultimately benefit crisis management. Most likely, this is because emotional salience typically increases attention and motivation. This is in line with previous findings on crisis behavior, which indicate that more anxious or worried individuals may be more compliant with preventive measures (Jones and Salathe, 2009; Rubin et al., 2010). However, when individuals respond to distress by avoiding information on COVID-19, this desirable effect on compliance

TABLE 3 | Summary of the final regression model on compliance with preventive measures.

	Predictor	β	95% CI		*t*	*p*	R^2	Δ R^2
			LL	UL				
(1)	Searching health information online	0.139	0.079	0.198	4.59	<0.001	0.53	
(2)	News	0.133	0.075	0.192	4.45	<0.001	0.082	0.029
(3)	Age	0.094	0.035	0.152	3.23	<0.001	0.097	0.015
(4)	Education	0.124	0.067	0.181	4.29	<0.001	0.106	0.009
(5)	Distress by information	0.137	0.075	0.199	4.35	<0.001	0.115	0.009
(6)	Information avoidance	−0.142	−0.205	−0.080	−4.46	<0.001	0.130	0.015
(7)	Physical health condition	0.086	0.027	0.144	2.88	0.004	0.136	0.006
(8)	Gender	−0.060	−0.117	−0.002	−2.05	0.041	0.139	0.003

n = 1,055. CI, confidence interval; LL, lower limit; UL, upper limit.

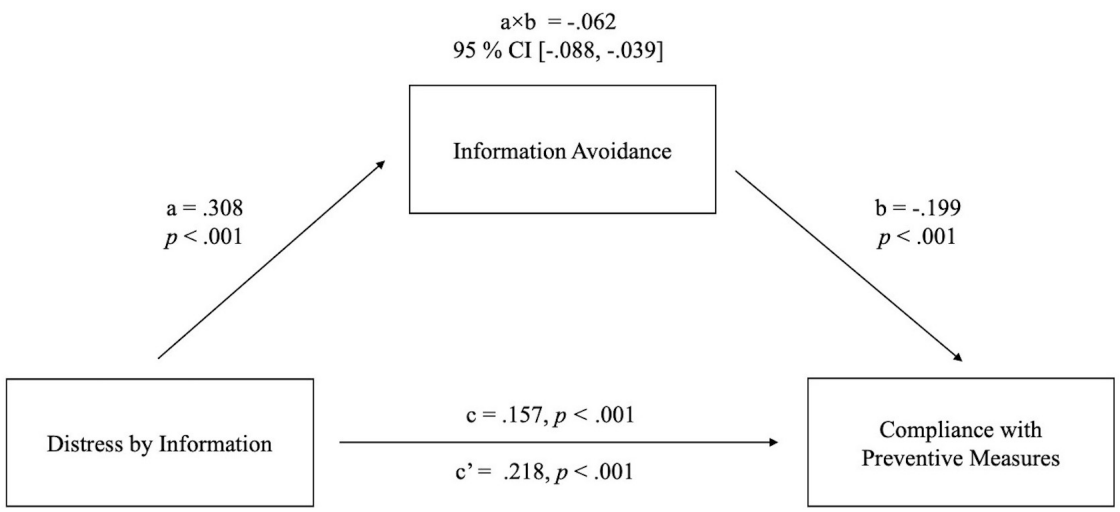

FIGURE 2 | Schematic representation of the mediation model calculated with 5,000 bootstrap samples using PROCESS software. The pathway from distress by information to information avoidance (a) and then to compliance with preventive measures (b) represents the indirect effect of distress by information on compliance with preventive measures, mediated by information avoidance (referred to as a × b path). The path from distress by information to compliance with preventive measures (c') shows the direct effect. The total effect of distress by information on compliance with preventive measures (c) is also shown on this path. Sociodemographic variables (age, gender, education), anxiety, and eHealth literacy were controlled for in this analysis.

is diminished. This corresponds with other findings showing that avoidance is a maladaptive strategy to reduce distress (Pittig et al., 2014). With respect to prevention, avoidance has been found to act as a barrier to preventive health behaviors (e.g., Cutler and Hodgson, 2003; Hightow et al., 2003; Howell and Shepperd, 2013a; Emanuel et al., 2015; Taber et al., 2015). Our findings highlight that information avoidance may be central to the negative consequences of information-related distress and may thereby interfere with crisis management.

Whether distress by information leads to avoidance is likely the consequence of personal coping style. Past research showed that individuals' responses to threatening health information critically depend on their tendency to monitor or blunt threatening information (Miller, 1987, 1995; Williams-Piehota et al., 2005). Whereas *monitors* cope with distress by surveilling threatening information and taking appropriate measures, *blunters* are more easily overwhelmed by threatening information and avoid it (Williams-Piehota et al., 2005). In line with this, information avoidance correlated negatively with monitoring and positively with blunting in a previous study (Howell and Shepperd, 2016). It is, thus, understandable that in our sample, behaviors that are typical for monitoring (e.g., watching more news than before the crisis, searching health information on the internet) were the best predictors for higher compliance with preventive measures. This may inspire future studies on behavior in the COVID-19 pandemic to address coping styles.

Besides avoiding negative emotions and fighting overexposure to a particular topic (Sweeny et al., 2010; Barbour et al., 2012), research has shown that information avoidance can result from the feeling that there is nothing one can do to prevent negative consequences (Miles et al., 2008; Taber et al., 2015). This may also be the case with COVID-19, as information regarding the effectiveness of preventive measures has been contradictory or changed over time (e.g., withdrawn Ibuprofen warnings; Sodhi and Etminan, 2020; Torjesen, 2020). Such contradictions may irritate individuals and encourage information avoidance.

Reducing avoidance of information may be particularly important in long-term crisis management. After an initial period of mandatory restrictions, regulations were relaxed in order to circumvent higher economic costs. At the same time, the goal was to prevent the uncontrolled spread of the virus with high casualties. Introducing preventive measures on a regional level appears to be a promising approach to contain the virus (Bittihn et al., 2020). This requires timely and tailored communication from governments as well as high information attainment from the public. Moreover, missing out on important novel information (e.g., rising COVID-19 incidences in one's area of residence) may have detrimental consequences.

Critically, the successful containment of the virus may be impeded if opinions shift and the public considers the restrictions and preventive measures to fight COVID-19 to be exaggerated. As major viral outbreaks often occur in waves, making it through the first wave without adverse consequences can provide individuals with a false sense of security (Khosravi, 2020). In line with this, levels of anxiety and acceptance of preventive measures declined after the contact restrictions were relaxed in Germany (Betsch et al., 2020a). Such changes in emotional salience may bias retrospective evaluation of the crisis, as individuals tend to rate events less aversive once the peak of anxiety has passed (Müller et al., 2019). In light of this, a continuous emphasis on the benefits of receiving information and the necessity of preventive behaviors is pivotal to crisis management (Betsch et al., 2020a).

From a clinical perspective, we are well aware that avoidance can be a rather stable behavioral pattern (Pittig et al., 2018) and rational approaches are sometimes not sufficient to alter such habitual behavior (Alpers, 2010; Helbig-Lang et al., 2014). However, past research suggests that contemplation is a promising technique to reduce information avoidance, and thereby, it may also foster better compliance with preventive measures. Contemplation refers to deliberately thinking about the consequences of obtaining information vs. not obtaining information. In general, this draws an individual's attention to the long-term benefits of receiving information and reduces avoidance of information (Howell and Shepperd, 2013b). This could be advocated in media campaigns that encourage individuals to stay informed, by outlining the benefits of receiving information and the perils of information avoidance. Similarly, calls to "stay at home" or "flatten the curve" were effectively communicated through the media early in the COVID-19 crisis. Furthermore, health messages distributed in the media should be tailored to individuals' information preferences and coping styles, as this increased preventive behaviors in other health domains (Williams-Piehota et al., 2005).

The media is an important tool to keep the public informed in times of crisis. This is corroborated by our findings, showing that the majority of people used a variety of information sources and consumed more news during the COVID-19 crisis than before the crisis. Interestingly, health authorities' social media channels were one of the most commonly used information sources. Thus, social media may be a particularly direct medium to effectively communicate information to the public (Lachlan et al., 2016). Moreover, our findings suggest that many individuals feel that they can discriminate between reliable and unreliable content within one kind of medium. For instance, a substantial percentage of participants obtained news from authorities' social media channels (73.2%), but a much smaller percentage of participants obtained information from user-generated content on social media (25.4%). Furthermore, participants rated the authorities' social media channels as more trustworthy than user-generated content. This implies that individuals critically evaluated the origin of the health information that they received, which we interpret in terms of adequate eHealth literacy.

Finally, our results underscore the critical role of trust in information sources and adequate eHealth literacy in crisis management. Both higher trust in information sources and higher eHealth literacy predicted less distress by information and less avoidance of information. These results are in line with past findings, which demonstrate that trust benefits crisis management (Rubin et al., 2009) and that more health literate individuals experience lower psychological distress when facing a disease (Lin et al., 2019) and report less avoidance of information (Strekalova, 2016). This emphasizes that low eHealth literacy may also be an indirect threat to global public health management in the COVID-19 crisis. However, authorities (e.g., Robert-Koch-Institute, WHO) are already addressing this in measures, such as making high-quality information about COVID-19 available in simple language. Expanding this to other high-quality media coverage may be one way to fight the implications of low eHealth literacy and information avoidance at the same time.

LIMITATIONS

Our findings need to be considered in light of several limitations. First, we conducted a cross-sectional survey that means that causal inferences are beyond the scope of our data. Consequently, the possible mechanisms of actions that we discuss need to be verified in future studies. Nevertheless, our results are an important first step and provide promising starting points for future research.

Second, our sample is not representative of the general population in Germany, as the data were collected online and the majority of the participants were female and highly educated. Obviously, this limits the generalizability of the findings. However, we expect that our findings regarding information avoidance and compliance may underestimate actual correlations in a representative sample. Because we distributed the link to the study in social media groups that shared information on COVID-19 (e.g., Facebook groups named "corona information" or "corona help"), our sample may have been particularly eager to seek information on COVID-19. Furthermore, both female gender and higher education predicted more compliance in our regression analyses. Consequently, this bias likely led to an underestimation of our effects. Future studies should aim for a more balanced sample and may employ different sampling methods.

Third, to our knowledge, there was no established scale to measure compliance during a pandemic at the time point

of data collection. Thus, we assessed compliance with a self-generated scale, which was not yet well-validated. This too may have resulted in underestimated effects. Moreover, we relied on self-report data, which generally need to be interpreted cautiously. However, the anonymous format of our survey may have minimized demand characteristics.

Finally, following the conventions by Cohen (1988), the effects we detected are small to moderate. In particular, the effects regarding compliance with preventive measures are small, and the regression model on compliance explained less variance than our other regression models. However, in part, this may be because we collected data in an early phase of the COVID-19 crisis. In this time, levels of distress and risk perception were most pronounced (Betsch et al., 2020c). In accordance, compliance may have been particularly high in our sample. However, as compliance decreased in subsequent stages of the crisis (Betsch et al., 2020b), the repercussions of information avoidance may now be even more pronounced.

CONCLUSION

In sum, the present findings show that experiencing distress by information about COVID-19 may influence compliance with preventive measures. While such distress may generally foster compliance, distress can also induce information avoidance, and this, in turn, lessens compliance with preventive measures. Thus, we consider information avoidance a maladaptive response to exacerbated distress. From a public health perspective, this may interfere with crisis management. As the adequate provision of information may be particularly important in sustained crisis management, measures to counteract information avoidance should be developed and implemented in a timely manner.

DATA AVAILABILITY STATEMENT

The data supporting the conclusions of this article have been deposited on MADATA (University of Mannheim) Research Data Repository (doi: 10.7801/345) and will be made available by the authors, without undue reservation, to any qualified researcher.

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of the ethics committee of the University of Mannheim. All participants received information about the study purpose and procedure and gave informed consent prior to participation. Participants who did not consent were not granted access to the online survey. As no personal data was collected, other than in the questionnaire, participants remained completely anonymous.

AUTHOR CONTRIBUTIONS

All authors contributed to research conceptualization and design. KUS and AKK implemented the questionnaire and analyzed the results. KUS drafted the manuscript and all authors contributed to reviewing and editing. GWA provided the resources.

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SUPPLEMENTARY MATERIAL

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frontiers in Psychology

BRIEF RESEARCH REPORT
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Risk Perception and Media in Shaping Protective Behaviors: Insights From the Early Phase of COVID-19 Italian Outbreak

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In the absence of target treatments or vaccination, the SARS-CoV-2 pandemic can be impeded by effectively implementing containment measures and behaviors. This relies on individuals' adoption of protective behaviors, their perceived risk, and the use and trust of information sources. During a health emergency, receiving timely and accurate information enables individuals to take appropriate actions to protect themselves, shaping their risk perception. Italy was the first western country plagued by COVID-19 and one of the most affected in the early phase. During this period, we surveyed 2,223 Italians before the national lockdown. A quarter of the sample perceived COVID-19 less threatening than flu and would not vaccinate, if a vaccine was available. Besides, most people perceived containment measures, based on social distancing or wearing masks, not useful. This perceived utility was related to COVID-19 threat perception and efficacy beliefs. All these measures were associated with the use of media and their truthfulness: participants declared to mainly use the Internet, while health organizations' websites were the most trusted. Although social networks were frequently used, they were rated lower for trustfulness. Our data differ from those obtained in other community samples, suggesting the relevance to explore changes across different countries and during the different phases of the pandemic. Understanding these phenomena, and how people access the media, may contribute to improve the efficacy of containment measures, tailoring specific policies and health communications.

Keywords: COVID-19, risk perception, media, social media, containment measures, protective behaviors, vaccine, efficacy

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INTRODUCTION

The spread of the SARS-CoV-2 pandemic may have catastrophic consequences in terms of people's well-being, welfare, and economic losses. In the absence of target medical treatments or vaccination, the pandemic can be impeded only by rapidly implementing protective behaviors (Betsch, 2020).

Many governments have activated unprecedented policies aimed at controlling the progress of the pandemic, while in a few countries, the implementation of these norms is still voluntary. In both cases, the effectiveness of containment measures depends on how the population perceives the risks associated with the contagion (Van Bavel et al., 2020).

In health psychology, the motivation to protect oneself from diseases is related to the perceived threat. As defined in the *protection motivation theory* (PMT), the perceived threat is derived from both how a person feels vulnerable to develop a certain condition and how severe it would be for him to be affected (Rogers, 1983; Floyd et al., 2000; Witte and Allen, 2000; Brug et al., 2009). Several studies confirmed significant, although small, relationships between the perceived vulnerability and severity with protective intentions and behaviors, including vaccinations (for a meta-analysis, see Brewer et al., 2007). Accordingly, the current COVID-19 risk perception may drive the adoption of protective behaviors. PMT also hypothesized that other relevant variables, such as efficacy beliefs, are key predictors of protective motivation (Rogers, 1983; Floyd et al., 2000; Witte and Allen, 2000). This dimension is usually defined as response efficacy (i.e., the perception of the effectiveness of the available protective actions in reducing the hazard) and self-efficacy (i.e., a person's confidence on his ability to engage in such protective actions). Furthermore, risk perception is associated with information needs (Neuwirth et al., 2000). During a health emergency, receiving timely and accurate information enables individuals to take appropriate actions to protect themselves, in line with health agencies' recommendations (World Health Organization, 2017). Health communications and interventions that increase risk appraisal and efficacy beliefs also lead to increase protective intentions and behaviors (Sheeran et al., 2014). Thus, to provide effective communication, understanding how a society uses and trusts different information sources (i.e., media) is of crucial relevance, considering their effect on perceived risk (Coleman, 1993; Reynolds and Seeger, 2005; Dudo et al., 2007; Lin and Lagoe, 2013; Kwok et al., 2020).

Assessing societal attitudes toward the current pandemic, in terms of people's perceived risk, their attitudes toward containment measures and vaccines, along with their media use and trust, may have a large impact on pandemic management.

Previous insights on the early phase of the outbreak came from the Hong Kong and Vietnam communities (Huynh, 2020a; Kwok et al., 2020), where data indicate high levels of COVID-19 risk perception and adhesion to self-protective measures, as well as associations between these domains and usage of media. However, as the authors suggested, the previous experience of citizens with other epidemics, such as SARS, might have contributed to define "a secondary immune response" in terms of psychological and behavioral responses (Kwok et al., 2020).

Italy was the first western country plagued by COVID-19, and one of the most affected in the early pandemic. The first transmission was registered on 18 February 2020; 1 month later, positive cases increased to ∼47,000, revealing an exponential growth: differently from Hong Kong and Vietnam, Italy, as other western countries, did not have a recent "pandemic heritage."

We analyzed risk perception, use and trust of media, and perceived utility of protective behaviors in 2,223 Italians recruited through an online survey in the first phase of outbreak, before the government legislated the lockdown in the whole country: 60% of our samples lived in Lombardia, the second Italian region for population density and the most affected one in that period.

METHODS

Participants Recruitment

The survey was administered online from 27 February to 8 March 2020. The administration period covered an important phase for the pandemic in Italy: the first secondary transmission was registered on 18 February 2020, the first local emergency responses and quarantine measures were defined on 21 February (engaging two provinces for a total of 53,785 inhabitants), which culminated in lockdown measures in all the country on 8 March 2020 (around 60 million people). A software package, specifically developed for scientific online survey, was used to design the questionnaire (SoSci Survey, 2015[1]).

The study was advertised on authors' contacts and their referrals and on different universities and city social groups through different social media (e.g., Facebook, Instagram, and WhatsApp). Participants were invited to complete the survey via a hyperlink and to disseminate the study, identifying a non-probability voluntary response sampling. Individuals who were aged 18 or above, understood Italian, and provided their informed consent may complete the survey. Participants were informed of the purpose of the study, and their participation was completely voluntary and anonymous. The study was approved by the local ethics committee (i.e., IRCCS San Raffaele Scientific Institute).

Participants Characteristics

Participants were asked about their demographics: gender, age, marital status, years of instruction, educational qualification, study area, employment status, socioeconomic status, as well as whether they had undergone a flu vaccine and would vaccinate for SARS-CoV-2. At the time the online survey was conducted, the infection rates were different across the country: we asked the participants to indicate the region of birth, the domicile, the type of city they lived in (i.e., number of inhabitants), whether and where they had traveled abroad in the past 6 months as well as in Italy in the last 2 weeks.

Risk Perception

Participants were required to report measures of risk perception for COVID-19 (De Zwart et al., 2009) and other five harmful conditions: flu, HIV, heart attack, car accident, and health consequences related to climate change. Following PMT, participants rated for each condition:

Severity ["How serious—on a scale from 1 to 10—would it be for you if you got (disease) in the next year?"];

[1]http://www.soscisurvey.de

Vulnerability ["How likely do you think it is that you will develop or contract a (disease) in the next year; very unlikely (1) to very likely (5)"];

For COVID-19 and flu, the following additional efficacy belief questions were included:

Response-efficacy ["To what extent do you think people can take effective actions to prevent getting COVID-19/flu in case of an outbreak"; not at all (1) to very much (4)];

Self-efficacy ["How confident are you that you can prevent getting COVID-19/flu in case of an outbreak"; not confident (1) to very confident (4)].

For each participant, administering order for harmful conditions was randomized. The perceived threat was defined as the product of severity and vulnerability (De Zwart et al., 2009). Assuming that risk perception could vary among participants according to different individual factors (e.g., age, health conditions, personal history of exposure to viral infections), in a similar way for COVID-19 and flu, we considered scores provided for flu as an intrasubject control condition: we thus defined the relative COVID-19 threat risk perception as the difference between COVID-19 and flu scores.

Preventive Measures

Participants were asked to rate how much a set of containment measures (i.e., washing hands, limiting social interactions, avoiding crowded places, staying home, and using masks) were useful in preventing the spread of the virus in everyday life [Strongly disagree (1) to Strongly Agree (5)].

Information and Media Exposure

Participants were asked to rate the usage of different sources of information [Never (1) to Always (5)], how much they trusted on the quality/veracity of the information provided on these sources [No trust (1) to total trust (5)], and how much media affected the usage of containment measures (i.e., social distancing, face masks, and washing hands) [Not at all (1) to Totally (5)].

Statistical Analyses

Frequency and proportion were tabulated. Associations between age, gender, years of education, and COVID-19 risk perception and efficacy belief measures were explored through ANOVA and Pearson correlations. Logistic regression was performed entering willingness to vaccinate for SARS-CoV-2 (Yes vs. No, coded 0 1), if a vaccine was available, as a dependent variable, while age, gender, educational level, relative COVID-19 threat perception, and efficacy beliefs as predictors. Association between willingness to vaccinate and relative COVID-19 threat perception (similar/lower than flu vs. higher than flu) was explored with Pearson's chi-squared test. Associations between continuous variables (i.e., age, years of education, perceived utility of containment, relative threat and efficacy beliefs for COVID-19, and use and trust on media) were assessed through Pearson correlations. One-way ANOVAs were performed exploring effects of willingness to vaccinate and relative COVID-19 threat (similar/lower than flu vs. higher than flu) on the perceived utility of containment, use, and trust on media, and *post hoc* pairwise comparisons for significant effects were Bonferroni corrected for multiple comparisons. Statistical significance was set at $p < 0.05$ in all the analyses, which were performed in STATA 14 (Stata Statistical Software: Release 14, College Station, TX, United States: StataCorp LP).

RESULTS

Demographics

A total of 6,376 clicked the survey hyperlink; 3,170 gave their consent to participate in the study and were aged 18 or above. Subjects who did not currently live in Italy or did not answer questions related to perceived utility of containment measures, risk perception for COVID-19, and willingness to vaccinate were removed case wise. The final sample included 2,223 participants. Most of the participants were female (30.4% male, 675 respondents), of young age (mean age 36.4, SD $\pm$ 13.3), well-educated (32.7% of respondents had a master's degree), workers (55.2%, 1,228 respondents had a full-time job) (**Supplementary Table 1**), lived in Lombardia (59.2%, 1,315) and in metropolis (32%, 711) (**Supplementary Table 2**). Our sample is younger, more educated, and with a higher representation of females than reference data for Italian population (**Supplementary Table 1**). Furthermore, most of the participants never got vaccinated for the flu (67.6%).

From the travel history of participants (**Supplementary Table 3**) emerged the majority (66.9%, 1,487) who did not travel abroad in the last 6 months; however, most of the participants had traveled around Italy for work and pleasure in the last 2 weeks (66.9%, 1,487).

Risk Perception Measures

Flu was rated as the least severe health condition, followed by COVID-19 (**Table 1**). On the contrary, flu was associated with the highest vulnerability, followed by consequences of climate change and, ranked third, COVID-19. Perceived threat was defined as the product of severity and vulnerability: flu had the lowest perceived threat compared to other conditions, COVID-19 was ranked third, after car accidents and climate change (**Figure 1**). For 46% of the participants, the probability of developing COVID-19 in the next year was perceived with a severity higher than 5 (subjects rated severity on a scale from 1 to 10), while only 19% for flu: ranking severity of COVID-19 higher than flu. However, 26% rated likely or very likely the probability to develop COVID-19 in the next year, against 41% for the flu (**Supplementary Table 4**). We also found that 24% of the sample perceived a higher threat related to flu than to COVID-19, while 13% considered them similar.

Females perceived COVID-19 threat higher than males ($F = 11.7$, $\eta^2 = 0.016$, $p < 0.001$); however, no effects were found considering relative threat perception (COVID-19 vs. flu), suggesting no different effects between COVID-19 and flu risk perception. No significant associations with years of education and age were detected.

In terms of efficacy beliefs (**Supplementary Table 5**), most of the participants, respectively, 57.4 and 62.6%, were confident that people (response-efficacy) and themselves (self-efficacy) were

TABLE 1 | Risk perception: mean and standard deviations.

Harmful condition	Perceived severity		Perceived vulnerability		Perceived threat	
	Mean	SD	Mean	SD	Mean	SD
COVID-19	5.36	2.47	2.95	0.98	2.70	0.87
Flu	3.50	2.14	3.28	1.15	2.25	0.87
Car accident	8.36	1.87	2.85	0.91	3.39	0.76
Climate change	7.62	2.29	3.08	1.19	3.36	1.04
Heart attack	8.75	1.97	1.74	0.85	2.66	0.75
HIV	8.89	1.99	1.33	0.65	2.36	0.61

Perceived severity is the answer to "How serious (scale from 1 to 10) would it be for you if you got (the disease) in the next year?" Perceived vulnerability is the answer to "How likely do you think it is that you will develop or contract a (disease) in the next year; very unlikely (1) to very likely (5)."

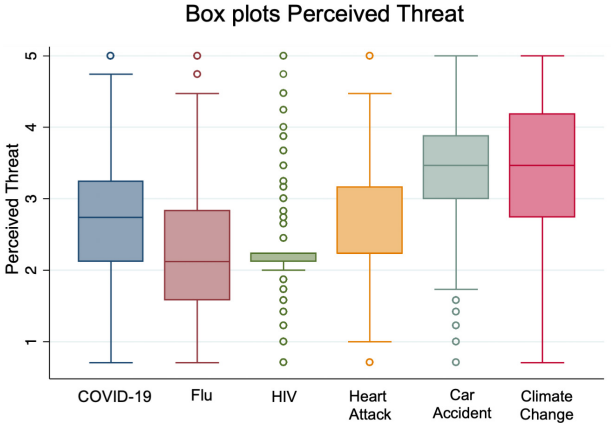

FIGURE 1 | Perceived threat for evaluated harmful conditions (box plots).

able to prevent COVID-19. However, an oppositive trend can be observed for flu: only 38% indicated that people can prevent the disease and 48.6% referring to themselves. By performing paired *t*-tests on efficacy measures, results showed that self-efficacy was higher than response efficacy for both COVID-19 ($t = 2.4$, $d = 0.05$, $p = 0.01$) and flu ($t = 8.9$, $d = 0.2$, $p < 0.001$), indicating that participants considered themselves as being more effective in diseases protection than other people. However, both efficacy beliefs for COVID-19 were higher than those reported for flu (response efficacy: $t = 19.2$, $d = 0.4$; $p < 0.001$; self-efficacy: $t = 13.3$, $d = 0.28$, $p < 0.001$). Females reported a higher level of self-efficacy ($F = 5.16$, $\eta^2 = 0.006$, $p = 0.001$), which was also positively associated to years of education ($r = 0.08$, $p = 0.003$). Both response- and self-efficacy were also directly related to age ($p < 0.001$, respectively, $r = 0.1$, $r = 0.07$).

Preventive Measures

Participants, 657 (29.5%), declared they would have not vaccinated for SARS-CoV-2, against 1,566 (70.4%) who would have vaccinated, if a vaccine had been available. Participants that perceived threat for COVID-19 as lower or similar than flu were more inclined to not vaccinate (Pearson $\chi^2 = 32.5$, $p < 0.001$) (**Figure 2A**).

The logistic regression showed significant predictors of the likelihood of vaccinating ($n = 2{,}105$; LR $\chi^2 = 66.9$; pseudo $R^2 = 0.02$; $p < 0.001$). Specifically, the intention to not vaccinate was predicted by (a) lower relative COVID-19 perceived threat ($b = -0.33$, Std. Err = 0.05, $Z = -5.96$, $p < 0.001$, OR = 0.71), (b) lower response-effective ($b = -0.2$, Std. Err = 0.07, $Z = -2.56$, $p = 0.011$, OR = 0.82), (c) lower educational level ($b = -0.11$, Std. Err = 0.04, $Z = -2.59$, $p = 0.009$, OR = 0.89), and (d) higher age ($b = 0.01$, Std. Err = 0.004, $Z = 3.39$, $p = 0.001$, OR = 1.01). Self-efficacy, gender, and annual income did not exert significant effects. Participants also rated how much a set of protective behaviors (i.e., washing hands, limiting social interactions, avoiding crowded places, staying home, and using face masks) was perceived useful in preventing virus diffusion. Most of the participants agreed (also strongly) on the utility of washing hands and avoiding crowded places as measures to limit the spread of the virus, respectively, 94 and 74% (**Figure 2B** and **Supplementary Table 6**). For other protective behaviors, such as limiting social interactions, staying home, and using masks, the perceived utility was reduced, respectively, 45, 15, and 15%.

Higher perceived utility of containment measures was associated with higher relative perceived threat for COVID-19 ($r = 0.2$, $p < 0.001$) (**Figure 2C**) and higher levels of self- ($r = 0.1$, $p < 0.001$) and response efficacy ($r = 0.13$, $p < 0.001$). Those who perceived threat for COVID-19 as lower or similar to flu gave a lower rating to the utility of containment measures ($\eta^2 = 0.027$; $p < 0.001$); this was confirmed for all the behaviors except for washing hands.

Information and Media Exposure

Of the participants, 60% declared that they often/always consulted health organization websites (e.g., World Health Organization, Italian Ministry of Health) to keep informed on the current situation (**Figure 3** and **Supplementary Table 7**). Websites in general and newspaper websites were also frequently consulted (∼51%), followed by TV news (45%). Only health organization websites were defined as trustable sources from most of the participants (86%). On the other hand, newspaper websites, TV news, and websites in general were rated trustful from, respectively, 27, 25, and 10% of the participants. Scientific TV programs were rated as good quality of information by 69%; however, they were frequently consulted only by 28%.

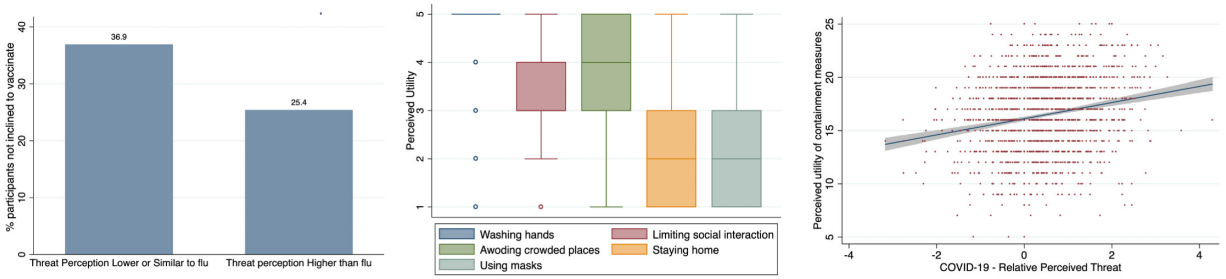

FIGURE 2 | COVID-19 perceived threat and attitude to vaccination and containment measures: **(A)** COVID-19 threat perception and vaccination. **(B)** Perceived utility of containment measures. **(C)** Perceived utility of containment measures and threat perception.

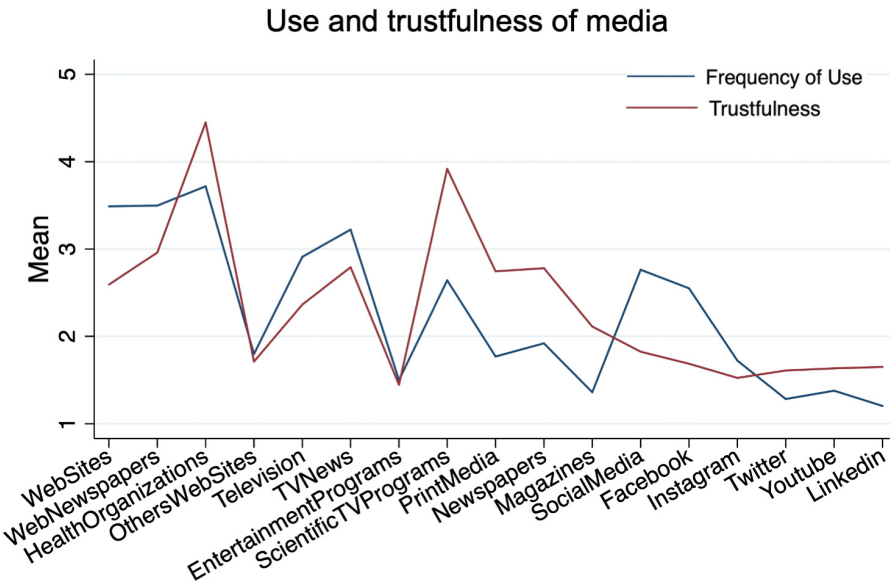

FIGURE 3 | Use and trustfulness of media to keep informed about COVID-19.

Printed media and printed newspapers were perceived as trusty media by ∼20% but, only ∼10% declared to often/always consented them. Social media were often/always consulted to keep informed by 30% of the participants; specifically, Facebook appeared the most used but less than 3% trusted information shared on them.

Higher use of media and higher rate of their trustfulness was related with a higher COVID-19 threat perception (use: $r = 0.09$, $p < 0.001$; trust: $r = 0.07$, $p = 0.002$), higher response-efficacy (use: $r = 0.12$, $p < 0.001$; trust: $r = 0.1$, $p < 0.001$) and self-efficacy (use: $r = 0.06$, $p = 0.01$; trust: $r = 0.06$, $p < 0.01$), and larger use of protective behaviors (use: $r = 0.17$, $p < 0.001$; trust: $r = 0.19$, $p < 0.001$). On the contrary, both those who were not inclined to vaccinate and who perceived threat for COVID-19 lower or similar to flu used less (attitude to vaccination: $F = 14.7$, $\eta^2 = 0.007$, $p < 0.001$; perceived threat: $F = 15.5$, $\eta^2 = 0.008$, $p < 0.001$) and trusted less media (attitude to vaccination: $F = 22.5$, $\eta^2 = 0.01$, $p < 0.001$; perceived threat: $F = 10.2$, $\eta^2 = 0.005$, $p = 0.001$). People who would have not vaccinated use less ($F = 26.4$, $\eta^2 = 0.01$, $p < 0.001$) and trust less ($F = 32$, $\eta^2 = 0.01$, $p < 0.001$) media, also institutional health originations' website, which were generally more used in younger ($r = -0.14$, $p < 0.001$) and higher educated people ($r = 0.08$, $p < 0.001$). Accordingly, participants of both these groups reported a lower influence of media on the adherence to containment measures (attitude to vaccination: $F = 89.3$, $\eta^2 = 0.04$, $p < 0.001$; perceived threat: $F = 24.6$; $\eta^2 = 0.01$, $p < 0.001$).

DISCUSSION

According to our results, collected during the Italian first phase of the outbreak, a quarter of the surveyed Italians perceived COVID-19 less threatening than flu, and if a vaccine was available, they would not vaccinate. Most people perceived containment measures, based on social distancing and on wearing masks, as not useful. Attitude to vaccination and utility of protective behaviors were related to COVID-19 threat perception and efficacy beliefs. All these measures were associated with the use of media and their perceived truthfulness.

In more detail, 46% of the participants perceived being affected by COVID-19 as severe, but only 26% rated it as likely. Risk perception in Italy was strikingly lower compared to data obtained in the early phases of pandemic in Vietnam and Hong Kong (Huynh, 2020b; Kwok et al., 2020): in the latter, the corresponding percentages for severity and vulnerability were 97 and 89%. Furthermore, 37% of the participants perceived COVID-19 as a threat less or similar to flu, highlighting threat underestimation during the first phase of the outbreak. Females perceived COVID-19 as more threatening than males do, in line with recent evidence obtained in 10 plagued countries across Europe, America, and Asia (Dryhurst et al., 2020), consistent with higher reported risk perception in women (Kim et al., 2018). However, in our study, no differences were detected when results are compared to flu, suggesting no specific effect of gender specifically on COVID-19.

In line with previous meta-analysis (Sheeran et al., 2014) and recent worldwide findings on COVID-19 (De Bruin and Bennett, 2020; Dryhurst et al., 2020), a lower perceived threat was also associated with a lower perceived utility of containment measures. In our sample, most of the participants agreed on the utility of washing hands and avoiding crowded places as measures adopted in order to limit the spread of the virus, but other protective behaviors, such as limiting social personal interactions, staying home, and using masks, were perceived useful only from, respectively, 45, 15, and 15% of the participants. This might have contributed to the spread of the virus (Walter et al., 2012), resulting in an exponentially increase in cases in Italy during this first pandemic phase. An indirect comparison with Hong Kong data (Kwok et al., 2020) suggests that our responders perceived protective measures, e.g., wearing masks or social distancing, remarkably less useful.

Such evidence confirmed that perceived threat is a potential key factor in affecting positive containment measures, especially for social distancing norms. Notably, recent findings, which confirmed a significant association between risk perception and different containment measures during the early phase of the pandemic in the United States (10–12 March 2020), showed an increase of this relationship and levels of perceived risk and protective behaviors in a later stage (13–31 March 2020). These results suggest that measures related to risk perception may rapidly change paralleling the different pandemic phases. Our data have been collected before the national lockdown as soon after the first registered contagion, providing a cross section of the first approach to the virus in a western country.

Perceived efficacy identifies another relevant predictor of protective motivation (Rogers, 1983; Floyd et al., 2000; Witte and Allen, 2000): in our sample, higher COVID-19 response- and self-efficacy were related to a higher perceived utility of containment measures, as found in recent data on worldwide pandemic (Dryhurst et al., 2020; Mækelæ et al., 2020). Interestingly, our participants significantly reported both higher response- and self-efficacy for COVID-19 compared to flu (small to medium effect sizes) and rated themselves more efficient in preventing the diseases (self-efficacy) compared to other people (response-efficacy) for both the viruses, although for SARS-CoV-2, we detected a trivial effect (d = 0.05). These results may indicate an "optimistic bias," i.e., the illusion of being less at risk than others from adverse events and illness, as previously found for COVID-19 (Dolinski et al., 2020) and in line with results detected in different countries comparing own to others' efficacy (Mækelæ et al., 2020). From an overall perspective, most of the participants (∼60%) were confident that both themselves and other people can take effective actions to prevent COVID-19 in case of an outbreak. However, as previously highlighted, most containment measures, such as limiting social interactions, staying home, and using masks, were mainly perceived not useful in preventing the spread of the virus. Despite perceived efficacy is relevant in order to promote protective behaviors, efficacy beliefs should be accompanied by adequate knowledge of the correct prophylactic measures. Otherwise, unrealistic efficacy beliefs may result in a possible misleading "illusion of control," i.e., tendency for people to overestimate their ability to control events (Langer, 1975), which may further expose people to increased risk of contagion. That is, contagions may increase exponentially, even if perceived efficacy is high, when risk perception and correct knowledge of prophylactic measures are low: in line with what we dramatically observed in Italy during this first period of pandemic. Combined with the "illusion of control," an optimistic bias in probability estimates and information processing could explain why people estimate a higher efficacy for the more severe, and never experienced, COVID-19 over the less severe, and commonly experienced, flu, as well as for themselves than for others.

Our results suggested another crucial relationship: higher use of media and a higher rate of their trustfulness associated with higher COVID-19 threat perception, response- and self-efficacy, and use of protective behaviors, in line with previous findings (Huynh, 2020a). This relationship highlighted the crucial effect that media may exert in shaping risk perception and usage on protective behaviors. To collect information on COVID-19, participants declared to mainly use web sites of public health organizations (e.g., World Health Organization, Italian Ministry of Health), which also obtained the highest rate in terms of trustfulness, differently from the Hong Kong community, where only 16% of the respondents found information from official websites reliable or very reliable (Kwok et al., 2020). In our sample, scientific television programs and newspapers (both printed and in web format) received good ratings in terms of trustfulness. However, they were not frequently consulted, except for websites. Overall, the Internet was confirmed as the most used source. Although social networks were also quite consulted, they received a lower rate in terms of information quality. These results outlined a profound change compared to previous decades, when the Internet was significantly less used than other media (Walter et al., 2012).

The adherence to protective behaviors as well as vaccinations is extremely important in preventing epidemics (World Health Organization, 2020). Interestingly, risk underestimation has been demonstrated to reduce adhesion to containment measures and be a barrier to vaccination (Walter et al., 2012). Studies conducted on 2009 A/H1B1 virus or "swine flu" showed that the success of public health programs was largely dependent

on individual risk perception: despite the vaccination was the most effective preventive intervention, only a low portion of the population got vaccinated (Renner and Reuter, 2012). Thus, to explore attitude to a SARS-CoV-2 vaccine may have a remarkable impact in tailoring the most effective health communication, preparing the population for its arrival. In our sample, around a third of our participants declared that they would not vaccinate for SARS-CoV-2, if a vaccine was available. This attitude was predicted by higher age, and lower relative COVID-19 perceived threat and response efficacy, in accordance with previous meta-analytic evidence for vaccinations (Brewer et al., 2007). These data suggested that specific health communication should be focused on vaccinations in the perspective of available vaccines for SARS-CoV-2 and that older people may particularly benefit from tailored media strategies, as defined as the at-risk population for COVID-19 disease. Notably, those who were not inclined to vaccinate used less media and judged the information less reliable, an effect detected also for institutional health originations' websites. This kind of media was less used in older and less educated people. This indicates that media, or new media, should be shaped and tailored in order to achieve this part of the population, increasing their trust.

Although the detected relationships between the use of media, risk perception, and adoption of protective behaviors are small, in line with meta-analytic evidence (Brewer et al., 2007; Sheeran et al., 2014), we nevertheless support the necessity to incentivize people to refer to public health organizations and scientific sources also through other sources, such as television or social media. Media and social media should increase the broadcast of educational messages focused on personal hygiene, seeking early medication care and self-isolation. These measures would help in effectively limit the pandemic. However, risk communication should also be aimed at increasing both risk perception and efficacy beliefs, as our results suggest. On the one hand, fear, possibly related to a high-risk perception, induces changes in behavior only when subjects feel able to deal with threat (i.e., efficacy); on the other hand, fear may lead to defensive reactions such avoidance or reactance (Witte and Allen, 2000). Meta-analytic evidence showed that induced increase in risk appraisal had a larger impact in changing intentions and behaviors when either response and self-efficacy are simultaneously enhanced (Sheeran et al., 2014). Moreover, health communications should target vulnerable populations increasing adherence to correct protective behaviors, with specific attention to vaccines for the next future. Notably, relevant dissimilarities in terms of use and trust media may arise in different cultures or countries, as it appeared by comparing our results to some eastern countries' data. Therefore, taking into account this variability may have a remarkable impact on defining the most effective health communication.

Our results confirmed previous insights concerning the role of risk perception and media in shaping protective behaviors. However, we have highlighted differences in the Italian population compared to other communities with a recent history of epidemics and a different trust and use of media during the early phase of a pandemic. We focused on a segment of the Italian population that lives in a geographical area with a high population density, deeply plagued by the virus, exactly during the beginning of the outbreak. Clearly, to explore how these findings change across different countries and during different phases of the pandemic may provide important insights on its management, together with its determinants and resulting behaviors. For example, previous studies highlighted that sociocultural variables, differently expressed in each country, can affect risk perception and the adoption of containment measure during COVID-19 pandemic (Dryhurst et al., 2020; Huynh, 2020c). Understanding these phenomena, and how people access to media, may contribute to improve the efficacy of containment measures, tailoring specific policies and health communications to target vulnerable populations and helping institutions worldwide. By highlighting the importance of media in influencing perceived threat and compliance to prophylactic measures, we implicitly suggest that public health policies should prompt the spread of sound scientific information though the Internet, as a foundation for a healthy world.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because of confidentiality and ethical restrictions. Requests to access the datasets should be directed to BV, vai.benedetta@hsr.it.

ETHICS STATEMENT

The study involving human participants was reviewed and approved by the local ethical committe at IRCCS San Raffaele Scientific Institute. The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

All authors contributed to the conception and design of the study, data collection, and manuscript revision, and read and approved the submitted version. BV and SC organized the database. BV performed the statistical analysis and wrote the first draft of the manuscript. CV, LP, and GS contributed by writing sections of the manuscript.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2020.563426/full#supplementary-material

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Novel Coronavirus (COVID-19) Pandemic: The Role of Printing Media in Asian Countries

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During all critical incidents, the media frame our understanding and create powerful forces at both individual and societal levels. The mental health of readers and viewers can also be affected by the media after tragic events. Potentially, the media have a proactive role in shaping the actions of the mass population and thereby influencing policy actions. The print media especially are considered a key avenue for taking information to the masses. However, in this information and communications technology (ICT) era, people are increasingly reluctant to carry hard-copy newspapers, instead preferring e-newspapers. At the present time, entire newspapers, and especially their opinion sections, are deluged by concerns about the novel coronavirus disease 2019 (COVID-19) pandemic. After China and Japan first encountered COVID-19, other Asian countries began their COVID-19 fight at different times between January and March 2020. All affected countries sought to manage the pandemic in their own way, following lessons learned from China and Japan. Every form of media in affected countries highlighted concerns by presenting news, perceptions, and opinions related to the pandemic. With opinion sections and editorials, the key sections of e-newspapers to reflect experts' perceptions and thoughts, this study aims to examine experts' views in the e-newspapers of five different countries in Asia, in relation to China and Japan. Considering the diversity of socioeconomic and geopolitical settings, five countries—South Korea, Singapore, Iran, India, and Bangladesh—are selected, each represented by one leading English-language e-newspaper. This study explores how experts' perceptions in the studied countries present different aspects of life. It also examines which e-newspaper emphasized which aspect of life and in which period of the outbreak. By intensive text mining in each selected e-newspaper, the study found that experts' opinions addressed diverse issues with regard to COVID-19. These issues are grouped under the following eight categories: health and drugs, preparedness and awareness, social welfare and humanity, the economy, governance and institutions, politics, the environment and wildlife, and innovation and technology. This pioneering study of five different e-newspapers in Asian countries from January to March 2020 presents a similar picture of experts' concerns and their roles in shaping responses to health crises; thus, it plays a role in contributing to policy actions.

Keywords: coronavirus, COVID-19, print media, editorial, opinion, Asia

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INTRODUCTION

Dudden and Marks (2020) asserted the following: "[p]reventing journalists from covering unpleasant information reassures a government that hates criticism, but leaves the public less secure." This presents clarification of the media's position during the novel coronavirus disease 2019 (COVID-19) pandemic. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) respiratory coronavirus was an earlier instance of coronavirus, with the latest coronavirus officially referred to as COVID-19. Studies have claimed that, during the last two decades, the mass media have become a vital part of social, political, economic, and environmental situations. Studies have also argued that the role of the mass media in any crisis or disaster cannot be denied, as the media facilitate access to information for government, policy makers, and citizens to assist with managing the situation (Ghassabi and Zare-Farashbandi, 2015). COVID-19 is a new type of virus, with the virus changing its form, structure, and characteristics through continuous mutation and rapidly spreading from person to person by close contact. A study conducted by Indian scientists among 3,636 patients across 55 countries indicated that, to date, COVID-19 has mutated at least 11 times (Biswas and Majumder, 2020). In this pandemic, people worldwide are relying more and more on credible news media (Straits Times, 2020a). People want reliable news about how their lives are changing during lockdown, about the millions of people who have lost their jobs, about the millions who have become infected, and about the hundreds of thousands who have died (Muno, 2020). A recent study by the University of Oxford polled people in Argentina, Germany, South Korea, Spain, the United Kingdom (UK), and the United States (US) and found that people gave the news media greater credibility than social media. The study also claimed that 60% of respondents stated that the news media helped them to understand the pandemic crisis, while 65% supported the view that the news media explained to them what to do in response to the pandemic (Nielsen et al., 2020).

Time magazine, a US weekly news publication published since 1923 and now a news website, is headquartered in the city of New York (Time Magazine, 2020). Its January 2020 issue recorded 41,000 English-language articles with the word "coronavirus," of which 19,000 used the word in the headline. On the other hand, Recode (a technology news website that has focused on business in Silicon Valley since 2014) (Recode, n.d.[1]) reported on March 17th, 2020, that around 1% of published articles on 3,000 high-traffic news sites were related to the coronavirus. Furthermore, news website visitors were found to be reading the news more due to COVID-19, with the total number of article views ∼30% higher in mid-March 2020 than in mid-March 2019 (Molla, 2020).

The Huanan Seafood Market in Wuhan, China, is considered to be the epicenter of the COVID-19 outbreak. The first news reports about the outbreak came from Wuhan Municipal Health Commission on December 31st, 2020 (Gralinski and Menachery, 2020). As a result of COVID-19's highly infectious nature, in January 2020, different parts of China and different countries in Asia gradually started to report their first cases of COVID-19. Among the many countries in Asia, Japan, Thailand, Vietnam, Singapore, South Korea, India, and the Islamic Republic of Iran (Iran) were on the initial list of countries reporting their first cases of the outbreak. Between January and April 2020, almost every country in the world was fighting against COVID-19. As of April 30th, 2020, more than 3,193,886 cases of COVID-19 have been reported in 225 countries and territories, resulting in 227,638 deaths. In addition, 972,719 people have recovered (Gisanddata, n.d.[2] At the time of writing this paper (April 2020), the US has the highest level of infection followed by Spain, Italy, Germany, and Britain (**Figure 1**).

In every region and country, from the identification of the first infected case to the gradual spread, the fatalities and the initiatives to fight COVID-19 are reported in different types of media. In every country, from reporting the first case, the government, institutions, and the media have shown their highest levels of concern in addressing the pandemic's different aspects. Chunara et al. (2012) argued that, during infectious disease outbreaks, in the initial weeks, it may not be possible to have adequate and appropriate data from health institutions and officials. This absence of institutional reports and data may hinder early epidemiological assessment (Chunara et al., 2012), with all sectors of a country and all strata of society relying on the media. The media frame our understanding and create powerful forces at both individual and societal levels during all critical incidents. The media can also negatively affect the mental health of readers and viewers after any tragic events (Hawdon et al., 2014). Thus, the media are said to have a proactive role in shaping actions of the mass populations and thereby influence policy actions. The print media are considered an especially crucial factor in taking information to the masses.

The COVID-19 pandemic has established its association with every aspect of life, ranging across health, society, the economy, politics, the environment, sports, recitation, arts and culture, the media, innovation, and technology. The pandemic has led to disruption, postponement, or cancelation of hundreds of important national and international religious, political, and cultural events, including the Tokyo Olympics (The New York Times, 2020). Widespread shortages of supplies have been exacerbated by panic buying (CNBC, 2020). Schools, colleges, and universities have closed either on a nationwide or local basis in 197 countries, affecting ∼91% of the world's student population (United Nations Educational, 2020). After the initial outbreak of COVID-19, conspiracy theories, misinformation, and disinformation emerged regarding the origin, scale, prevention, treatment, and other aspects of the disease (British Broadcasting Corporation, 2020). Misinformation and disinformation spread through social media (Kassam, 2020; McDonald, 2020) and text messages (The Financial Times, 2020), as well as the print and broadcast media

[1]Recode (n.d.). Available at: www.vox.com/recode.

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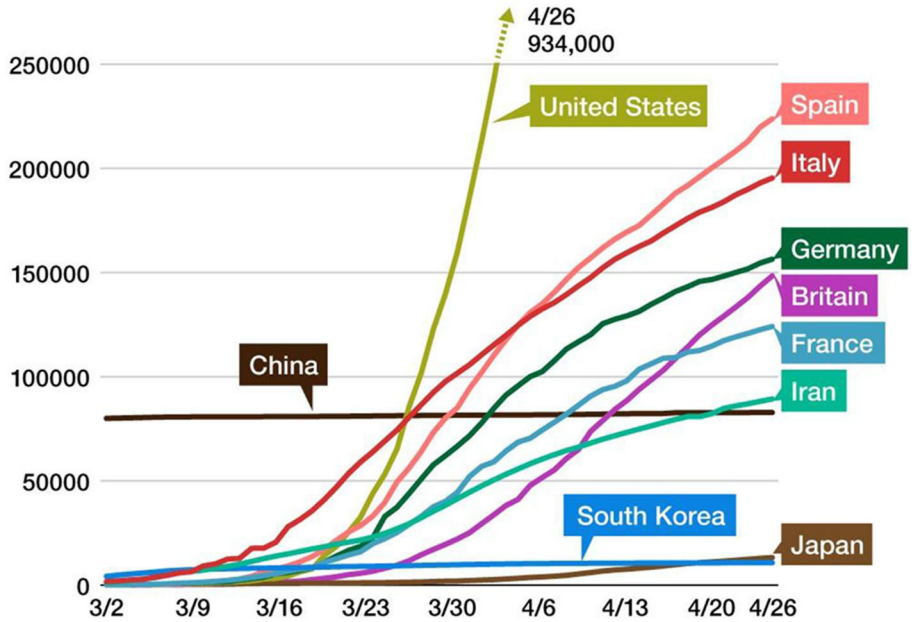

FIGURE 1 | Countries with the highest number of coronavirus disease 2019 (COVID-19) infections up to April 26th, 2020 (source: https://www.nippon.com/en/japan-data/h00673/).

of countries such as China, Iran, and Turkmenistan (Kassam, 2020; The Diplomat, 2020; The Jerusalem Post, 2020).

Following the experiences of China and Japan, other countries in Asia started their fights against the COVID-19 outbreak at different times from January to March 2020. All affected countries came forward to manage the pandemic their own way, following the lessons learned from China and Japan. Concerns in affected countries were highlighted by every form of media by presenting news, perceptions, and opinions related to the COVID-19 outbreak. However, in this world of the Internet and social media, different forms of media and approaches are continuing to be used to convey and spread the news. Nevertheless, reliability and trust are not always the same in all forms of media. Prior research has claimed that the print media are still the most reliable and valued source of information for the public, stating that the print media play a vital role in taking information to the masses and in continuing to shape public opinion in countries (Kuppuswamy, 2017). However, in this information and communications technology (ICT) era, people are reluctant to carry hard-copy newspapers, instead showing their preference for e-newspapers. Therefore, readers of online newspapers or e-newspapers, the digital version of print newspapers, are increasing in number (Hollander et al., 2011; Richardson and Stanyer, 2011). Almost all leading newspapers in different parts of the world have their corresponding e-newspapers. These online versions offer faster access and more updates compared with their print counterparts (Bokesoy, 2008). As online versions or e-newspapers have rapid access, they can spread and update the news about COVID-19 more quickly to large communities worldwide. Notably, the English-language versions of e-newspapers in affected countries continue to play a pivotal role in informing the world about the spread and infection of COVID-19, the preparedness and awareness situation, institutional efforts, and other critical issues.

From the literature review, it can be said that the media have a proactive role in shaping the mass population's actions, thereby influencing policy actions. The print media especially are considered a key factor in taking information to the masses. With the shortage of institutional reporting and COVID-19 results, all industries in a nation and all strata of society depend on the media. In the present study, newspapers, and especially their opinion sections, have been deluged with concerns about the COVID-19 pandemic. Expert opinions and editorials are the key sections of newspapers reflecting, as they do, experts' perceptions and thoughts. Therefore, this study aims to examine experts' views as expressed in the e-newspapers of five Asian countries from different regions, covering diverse socioeconomic and geopolitical settings, namely, South Korea, Singapore, Iran, India, and Bangladesh, with one leading English-language e-newspaper of each country selected. The study, as documented in this article, explores how experts' perceptions in the studied countries present different aspects of life. By intensive text mining in each selected e-newspaper, experts' opinions were found to address diverse issues regarding COVID-19. Different issues were grouped into the following eight categories: health and drugs, preparedness and awareness, social welfare and humanity, the economy, governance and institutions,

politics, the environment and wildlife, and innovation and technology. This pioneering study of five different e-newspapers in Asian countries from January to March 2020 presents a similar picture of experts' concerns and their roles in shaping responses to health crises; thus, it plays a role in contributing to policy actions.

ASIA'S CORONAVIRUS SITUATION: FOCUSING ON THE STUDIED ELECTRONIC NEWSPAPERS IN SELECTED COUNTRIES

The World Health Organization (2020a) declared the outbreak of a "Public Health Emergency of International Concern" on January 30th, 2020, and a "Pandemic" on March 11th, 2020. Using COVID-19 data compiled from the WHO's "Coronavirus disease (COVID-2019) situation reports" https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports, Wikipedia's heading "COVID-19 pandemic" https://en.wikipedia.org/wiki/COVID-19_pandemic, and Johns Hopkins University's "Coronavirus Resource Center" https://coronavirus.jhu.edu/map.html, this article presents the exact numbers of confirmed cases and recovered cases and the death toll in each selected country in this study. **Table 1** presents information on the date of the first confirmed case, the total number of confirmed cases, recovered cases, and deaths as well as the mode of transmission in the selected five Asian countries. **Table 2** presents the cumulative affected cases and deaths by months from January to March 2020 in the selected five Asian countries.

The first confirmed case of COVID-19 in South Korea was announced on January 20th, 2020. South Korea introduced one of the most extensive and best-organized epidemic control programs in the world. As a result of such programs, up to April 30th, 2020, the country had only 10,765 confirmed cases with 247 deaths. The first case of COVID-19 in Singapore was confirmed on January 23rd. Like South Korea, Singapore took strict measures to stop the spread of COVID-19; thus, up to April 30th, they had only 15,641 confirmed cases and 14 deaths. On the other hand, Bangladesh and India are developing countries with almost half the population living below the poverty line. The first case was reported on March 7th in Bangladesh and on January 30th in India. The two countries, up to April 30th, had 7,103 and 33,050 confirmed cases, respectively. Experts have criticized the low number of tests conducted in Bangladesh with its population of over 160 million. Newspaper reports and social media are continuing to report additional deaths of patients with COVID-19 symptoms.

Experts have suggested that the number of infections could be much higher as India's testing rates are among the lowest in the world, even though it is the world's second most populous country with 1.35 billion people. Furthermore, Iran reported its first confirmed cases of COVID-19 infections on February 19th, 2020. The number of confirmed cases is 93,657, up to April 30th, with 5,957 deaths. Owing to accusations directed at the government in Iran of cover-ups, censorship, and mismanagement, some external estimates of the number of COVID-19 deaths are much higher than those from government sources.

MATERIALS AND METHODS

As every part of the world, ∼213 countries and territories, and every aspect of life are now associated with the COVID-19 pandemic, all forms of media are highlighting the news, opinions, and concerns related to COVID-19. How different countries in Asia and their print media are shaping the concerns and worries related to the outbreak are explored by this study. The approach taken by this study in its selection of countries and e-newspapers and the issues that it has chosen to cover are presented in **Figure 2**.

Selection of Countries

As the scope of simultaneously focusing worldwide would be too broad, in this study, only five countries, namely, South Korea, Singapore, Bangladesh, India, and Iran, from four regions of Asia were selected. As many Asian countries were among the first to be affected by the COVID-19 outbreak, it was determined by the present study that Asian countries would be the central focus of the study. The COVID-19 pandemic began in Asia in Wuhan, China, and has spread widely throughout the continent. Among the earliest Asian countries to report COVID-19 cases after the outbreak in China were Japan, South Korea, Singapore, Taiwan, and Vietnam. Therefore, after China and Japan, South Korea and Singapore were the next two countries to receive greater attention from the media about the COVID-19 outbreak, its impact on society, health, and the economy; control measures; government initiatives; etc.

The coronavirus pandemic in South Korea, at one stage, appeared terribly out of control, with skyrocketing new cases and a large cluster of people experiencing illness, rendering the country the next most affected outside China. In South Korea, on February 18th, 2020, the pandemic unexpectedly spread. Over 2 weeks, the caseload rose by a factor of 180, with 909 daily cases on February 29th, 2020. However, the chaos soon dissipated. South Korea began reporting evidence of reduced numbers on March 6th, 2020, from more than 200 infected cases per day to $<$100 cases per day. In comparison to many other countries, South Korea has taken a stronger stance to control and minimize the risks of COVID-19. For example, in the US on January 20th, 2020—the same day that South Korea discovered its first outbreak—the overall incidence on March 31st, 2020, reached 163,000, with at least 2,860 deaths. Spain and Italy also failed to minimize the spread. These results have prompted the present study to select South Korea as one of the study settings and to evaluate the facts through online media analysis. Furthermore, South Korea has proven that COVID-19 can be contained in another way. Businesses have carried on as normal, and no town has been shut down. Life in South Korea is back to normal, with new cases declining.

According to the WHO, outside China, Singapore has the highest level of contact with Wuhan, with an estimated 3.4 million people traveling between Wuhan and Singapore annually.

TABLE 1 | Number of people affected by coronavirus disease 2019 (COVID-19) in selected five Asian countries (to April 30, 2020).

Country	Confirmed cases[a]	Recovered cases	Deaths	Transmission classification[b]	Date of first confirmed case
South Korea	10,765	9,059	247	Local transmission	20 January 2020
Singapore	15,641	1,188	14	Local transmission	23 January 2020
Bangladesh	7,103	150	163	Local transmission	07 March 2020
India	33,050	8,325	1,074	Local transmission	30 January 2020
Iran (Islamic Republic of)	93,657	73,791	5,957	Local transmission	19 February 2020
Total	160,216	92,513	7,455		
Global percentage	5.02	9.51	3.27		

World Health Organization (WHO), Wikipedia, and Johns Hopkins University.
[a]*Numbers include both domestic and repatriated cases.*
[b]*Local transmission indicates locations where the source of infection is within the reporting location.*

TABLE 2 | Compilation of data of the number of people affected by COVID-19 in selected Asian countries.

Country	Affected by month			Deaths by month		
	January	February	March	January	February	March
South Korea	11	3,150	9,887	–	17	165
Singapore	16	102	926	–	–	3
Bangladesh	–	–	51	–	–	5
India	1	3	1,397	–	–	35
Iran	–	593	44,606	–	43	2,898
Total	11,836	83,911	140,599	243	2,935	6,475

Compiled from the existing data sources of the WHO, Wikipedia, and Johns Hopkins University.

These travelers formed the greatest potential existential threat as a result of COVID-19 (World Health Organization, 2020b). However, despite this threat, it is interesting to note that the rate of the spread of coronavirus infection in Singapore has been one of the slowest worldwide (Kuguyo et al., 2020). Singapore, very early on, had its first case of COVID-19, a Chinese tourist who arrived on January 23rd, 2020, from Wuhan, thus placing the virus epicenter in total lockdown that same day to ensure safety. However, an alarming exponential rise occurred within 2 weeks of the first case among the migrant worker population of Singapore—the hundreds of thousands of men from developing countries working in manufacturing, shipping, and maintenance. Singapore is totally dependent on these workers to keep its economy functioning, and they carry out jobs in which social distancing is impossible. These workers are also required by law to live in dormitories (dorms)—private facilities that house up to 12 men per room, with shared bathroom facilities, cooking facilities, and social facilities. It seemed almost inevitable that these dorms would become clusters of infection, with this proving to be the case. One facility alone accounted for 15% of all national cases. Singapore used a robust legal framework and political strategy to control the pandemic in this island nation. Therefore, Singapore is a key state to study in order to understand the application of regulations to control the COVID-19 pandemic.

Bangladesh and India received attention from both print and social media as these two developing countries are the most populous countries in the world. Media reports on how the governments of these two countries were handling the COVID-19 situation proved to be popular, with readers and viewers keen to see how they were tackling the health, employment, and economic crises that have arisen during the pandemic. On the other hand, Iran is considered a unique country in Asia in terms of its geographical location, religion, economy, technology, and government, and facing as it does long-term sanctions from societies across the world. Therefore, considering these diverse geographical, social, cultural, economic, and political backgrounds, South Korea, Singapore, Bangladesh, India, and Iran were selected purposively for the present study. The present study reviews and reports the role of the print media in relation to COVID-19 in these five countries. Only expert opinions and columns under the "Opinion" sections of the top five circulated English-language newspapers from these five countries were selected for the study.

Selection of Newspapers

Taking into consideration newspapers' reputation, position, and daily print circulation, five English-language daily newspapers from the five selected countries were considered for this study. These comprised *The Korea Herald* (South Korea), *The Straits Times* (Singapore), *The Daily Star* (Bangladesh), *Hindustan Times* (India), and *Tehran Times* (Iran). All the newspapers had both print and online versions, with pages/accounts in different social media including Facebook, Twitter, YouTube, LinkedIn, and Instagram, as well as having apps in the Google Play Store

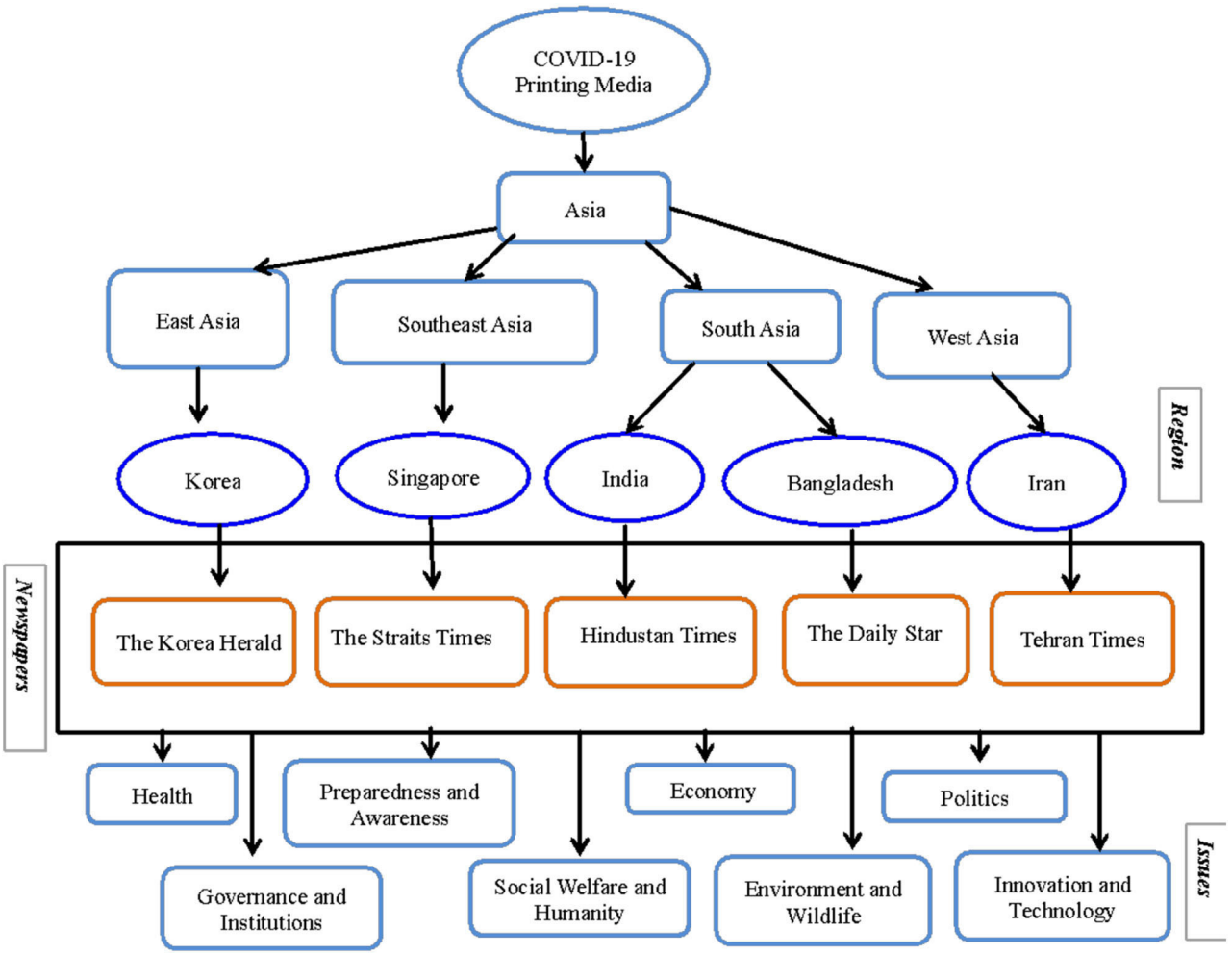

FIGURE 2 | Regions, newspapers, and issues addressed in this study.

and the App Store for Android and Apple mobile phone users, respectively (**Table 3**).

Text Mining From Opinion Sections

Instead of regular news items, the opinions of guest authors (experts and scholars) related to the recent outbreaks of COVID-19 in the selected five Asian countries were analyzed in this study. All the selected newspapers published opinions, thoughts, concerns, advice, and suggestions of experts and editors worldwide in their "Opinion" sections. These opinions were also expressed in the "Editorial" (statements made by the Editor on behalf of the newspaper itself), "Viewpoint," and "Opinion" in the selected newspapers. Considering these various sources, the Opinion section can be defined as an article, usually published in a newspaper or magazine, that mainly reflects the author's opinion about a subject or a recent issue without claiming objectivity. The opinion expressed is intended to supplement the news sections and to provide for the exchange of ideas. On the other hand, text mining (also referred to as "text data mining" or "text analytics") is the prime approach used in this research to gather critical concerns and focus on experts' perceptions and opinions as expressed in the text. The fundamental virtue of the text-mining approach is its timeliness; information from online text sources can be easily collected and promptly available for various uses (Pyo and Kim, 2019).

Primary Issues Used in Text Mining

To the best of our knowledge, this is the first study that applies text mining analysis to COVID-19 studies. Despite the increasing importance of the text mining approach in the COVID-19 literature, with the exception of Jahanbin and Rahmanian (2020) study, no similar study has been completed on COVID-19 either in the Asian region or in the rest of the

TABLE 3 | Details of study areas and English-language dailies searched in this study.

Country	Geographical region	Name of newspaper	First published	Daily print circulation (approx.)	Version	Position in the country[a]	Social media	Registered online users (approx.)
South Korea	East Asia	*The Korea Herald*	August 1953	35,000	Both print and online	First	Facebook, Twitter, YouTube, Instagram	Data deficient
Singapore	Southeast Asia	*The Straits Times*	July 15, 1845	968,000	Both print and online	First	Facebook, Twitter, LinkedIn, Instagram	370,000
Bangladesh	South Asia	*The Daily Star*	January 14, 1991	55,000	Both print and online	First	Facebook, Twitter, YouTube, Instagram, Pinterest	Data deficient
India	South Asia	*Hindustan Times*	September 26, 1924	945,221	Both print and online	Second	Facebook, Twitter, YouTube, Instagram, LinkedIn, news feed	2,800,000
Iran (Islamic Republic of)	West Asia	*Tehran Times*	May 21, 1979	100,000	Both print and online	First	Facebook, Twitter, Instagram, news feed	Data deficient

All the information collected from the websites of each newspaper: [a]Position in the country based on daily print circulation of English-language dailies.

world. The present study grouped all the diverse discussion points under the eight primary issues below. To examine experts' opinions related to COVID-19 and how these opinions are guiding societies in the respective countries, text mining was undertaken in alignment with these issues. Each issue was investigated by keyword searching and after the keyword search, the keyword-related concerns were carefully examined to explore why and how the experts expressed their concerns related to these keywords. These issues formed eight broad categories: (i) health and drugs, (ii) preparedness and awareness, (iii) social welfare, (iv) governance and institutions, (v) politics, (vi) the economy, (vii) the environment and wildlife, and (viii) innovation and technology (**Table 4**). This study sought to analyze how the perceptions of editors and experts and the features related to COVID-19 were being highlighted, thus shaping these critical issues in people's lives and livelihoods in the five selected countries.

Study Period

After COVID-19's emergence in China, it became the focus of the print media worldwide from mid-January 2020. The present study therefore collected data from the published Opinion sections from the five English-language daily newspapers from the selected five Asian countries between January 20th, 2020, and March 31st, 2020.

Data Analysis

The study employed a qualitative data collection technique using a checklist to collect data from the Opinion sections of the five newspapers. The checklist was developed based on the eight broad categories of primary issues, and data (using text mining) were arranged under these categories for further analysis. Before data compilation began, the checklist was thoroughly checked and edited: the data were then interpreted following the content analysis technique. During content analysis and interpretation, the study, to some extent, sought to conceptualize some theories related to the media, the press, and the sociocultural aspects of the study.

Media Theories and Theories of the Press

This study was initially motivated by the media richness theory (MRT) which was introduced by Lengel and Daft (1989). This theory is mainly used to rank and evaluate the richness of different forms of communication media. However, in the present study, instead of ranking or evaluating different forms of media, comparative perspectives of different newspapers from selected countries were examined. As the basic idea behind the MRT is that the media can be better or worse in transmitting social cues, in resolving ambiguity, or in providing immediate feedback (Hoof and Boell, 2019), this study attempted to evaluate how the selected newspapers presenting experts' concerns transmitted different aspects related to the pandemic and how they resolved ambiguity.

Different theories of the press argue that state systems, ownership, politics, and economics also shape the concerns of the media (Ostini and Ostini, 2002). Although the present study was not oriented to the media theory-based analysis of newspapers' concerns, it attempted to understand how these issues shaped the thoughts published in different newspapers.

Hofstede's Cultural Dimensions Theory

Furthermore, during this analysis of experts' views published in the newspapers from the five selected countries, the present study sought to explain the relationships between the cultural differences of these countries and their effects on the eight broad categories of issues. Hofstede (1984) model was used to explore the cultural differences between the selected countries. Hofstede's cultural dimensions theory is a framework for cross-cultural communication, developed by Geert Hofstede at the end of the 1970s (Hofstede, 1984). The theory was one of the first quantifiable theories that could be used to explain observed differences between cultures (Hofstede, 1991). Hofstede's model consists of six dimensions of culture: power

TABLE 4 | Study's scope on the role of print media in five Asian countries in the COVID-19 pandemic.

Selected countries	Selected newspapers	Section of the newspapers	Study duration	Key aspects of study focus
• South Korea • Singapore • Bangladesh • India • Iran (Islamic Republic of)	• *The Korea Herald* • *The Straits Times* • *The Daily Star* • *Hindustan Times* • *Tehran Times*	• Opinion (Editorial, Viewpoint) • Opinion (ST Editorial) • Opinion (Opinion, Editorial) • Opinion (Opinion, Editorial) • Opinion (Opinion, Editorial)	January–March	• Health and drug • Preparation and awareness • Economy (employment, Industry, production, and supply • Politics national and world • Governance and institutional • Social welfare and humanity • Sports • Environment and wildlife • Media and technology

distance, uncertainty avoidance, individualism vs. collectivism, masculinity vs. femininity, long-term orientation vs. short-term orientation, and indulgence vs. restraint (Hofstede et al., 2010). Using Hofstede's model, the similarities and dissimilarities in the highlights of the selected countries' newspapers were examined. The selected countries had different scores in these six dimensions of culture, with these scores providing some explanation regarding the priority and focus of an issue in a specific country.

RESULTS

Experts' concerns related to the COVID-19 pandemic, published as editorial thoughts or in "Opinion" sections in the leading e-newspapers of five Asian countries in the initial 3 months of the pandemic, were analyzed. The study's results are presented in this section and organized according to the eight issue categories identified as being associated with the COVID-19 pandemic, under each of the following subheadings.

How the Asian Print Media Shaped the Pandemic COVID-19 Situation

Sue Llewellyn, the famous BBC journalist, advised all media as follows: "[a]t times of crisis, we turn to experts—but news outlets and social media must be careful about the information they share, particularly informally" (Llewellyn, 2020). Her statement indicated the important role played by the media in shaping the news during this kind of health crisis. In the present study, it was noticed that the different e-newspapers from the five Asian countries had their own approach and focus when highlighting aspects of life associated with the COVID-19 pandemic. The study's findings showed that different countries took dramatically different approaches to managing the pandemic. These variations were marked by prior experience and preparation and included early reinforcement of strict vigilance, testing, and isolation vs. late enforcement; strong vs. weak levels of public awareness; self-restraint; commitment; and other factors (Djalante et al., 2020). These different approaches were reflected in the analysis and concerns of experts as expressed in the leading newspapers of the five studied countries.

Print Media in South Korea: *The Korea Herald*

Despite its role as a global manufacturing giant, South Korea is more concerned about the politics between North Korea and South Korea and "try[ing] to avoid panicking" whenever the North Korean government in Pyongyang takes apparent steps to transform its capital, Seoul, into an "ocean of fire." That same South Korea is now taking the lead and trying not to panic in the face of COVID-19, by minimizing the death toll and stopping the spread from affecting the whole nation. Following the first confirmed case of COVID-19 in South Korea on January 20th, 2020, despite a gradual rise in cases, the coronavirus was under control (Dudden and Marks, 2020). However, the whole scenario changed on February 18th with the 31st patient in Daegu. Within 2 weeks, the total number of infected people increased from 31 to 3,000 residents.

The first patient infected with COVID-19 in South Korea, a 35-year-old Chinese woman, was identified on January 20th, as confirmed by Korea Centers for Disease Control and Prevention (KCDC) (now known as the Korea Disease Control and Prevention Agency). However, the government and the KCDC were not sufficiently prepared to respond immediately. Subsequently, the whole situation developed into an epidemic when the 31st COVID-19 positive patient attended a social gathering. From that point, South Korea's news media began to track COVID-19 and all related issues, including prevention, protection, and isolation, and impacts on the economy, education, politics, and social affairs. **Table 5** below shows critical editorials published from January 20th to March 31st, 2020, in *The Korea Herald* addressing different issues associated with COVID-19. However, at different periods, the editorial focus shifted from health to the economy to politics.

Health and Protection

On January 22nd, an editorial published in *The Korea Herald* reported that the virus could be present in saliva and was possibly spread by airborne particles from coughing or sneezing. It suggested that it was wise to take simple precautions such as wearing masks and washing hands. Furthermore, the authorities raised the alert level for infectious diseases from "attention" to "caution," following the first confirmed case of the virus. Editorials published in early February 2020 in *The Korea Herald* suggested precautions against the threat of community-based

TABLE 5 | Issues related to COVID-19 addressed by *The Korea Herald* editorials (January–March 2020).

Month	Health and protection	Economy and industry	Isolation and treatment	Politics	Recovery	Total
January	4	0	0	0	0	4
February	3	4	6	7	0	20
March	3	18	4	4	7	36
Total	10	22	10	11	7	60

The Korea Herald (January 20–March 31, 2020).

transmission. Experts advised the authorities to recognize the possibility of community spread and to concentrate their efforts on the early detection of infections, symptom relief, and the prevention of further infections.

Editorials from mid-February and later clearly indicated the limitations of the local and federal governments of South Korea in controlling the spread of COVID-19. Cases were increasing sharply in Daegu and nearby North Gyeongsang Province. The rapid increase in the number of COVID-19 patients stretched the capacity of the nation's epidemiological investigators. The number of cases grew to about 140, fueling fear that the situation could be developing into an epidemic. Experts had earlier warned that it would be hard to control the spread of the coronavirus in the community and had called on the government to take proactive measures, including a temporary entry ban on visitors from all parts of China. However, the government turned a deaf ear and followed the "business as usual" strategy, seeking to minimize the COVID-19 scenario in South Korea. Experts and editors expressed views in the media that the government's limited understanding and its emphasis on fair trade and economic relations with China would cause a sharp impact.

The Economy and Industry

From the onset of the outbreak in South Korea, the COVID-19 epidemic began to affect the country's economy from consumption to production, as well as its financial market. An editorial, published in *The Korea Herald* on February 4th, highlighted concerns over the rising number of local infections, reporting that the spread of COVID-10 was expected to reduce domestic consumption by 0.3–0.4% in 2020.

Within the initial 10 days from February 1st to 10th, South Korea's stock prices tumbled 7.28%, the second steepest decline (after Hong Kong) among Asian markets, excluding mainland China.

The Editorial section published on March 2nd reported that government officials had warned the government about the potential negative impact on the economy of the coronavirus spreading. The editorial reported that South Korea's Finance Minister had indicated that the coronavirus could significantly weigh on South Korea's economy unless it was quickly addressed by the government. To overcome economic shortages and to protect low- and middle-income groups and the domestic market, President Moon Jae-in's administration proposed an extra budget worth 11.7 trillion won (US$9.86 billion) to help deal with the mass outbreak of COVID-19. The Bank of Korea has slashed its growth outlook from 2.3% at the beginning of 2020 to 2.1%.

The national debt-to-gross domestic product (GDP) ratio was projected to exceed 45% of a per capita basic income. In the same Editorial section, experts proposed a focus that would offer a range of specific support measures tailored for more vulnerable people, including small business owners, small manufacturing industries, and domestic help. Experts advised that it would be more realistic and efficient if the government pushed for an across-the-board cut in taxes at least temporarily, which would have the same effect as putting more cash into consumers' pockets and would help to ease the mounting difficulties faced by companies.

Furthermore, the unemployment issue was raised in the Editorial section as an outcome of COVID-19. South Korea has faced an unemployment surge due to the COVID-19 crisis and the job situation is rapidly worsening. Even before the outbreak, the employment situation was already in bad shape. Fiscally created part-time jobs had barely buttressed employment growth for those aged 60 and older. Jobs for those in their 40s were on the decline. Manufacturing had continually shed jobs for 21 straight months through December 2019.

Isolation and Treatment

In early March 2020, the number of confirmed cases of COVID-19 was reported as topping 3,000 on February 29th and 4,000 on March 2nd. In terms of the number of confirmed cases per one million people, South Korea had reportedly surpassed China, where the virus originated. With a surge of COVID-19 infections, South Korea had reached the pitiful state where it was being treated as a "second Wuhan" by the international community, as written on February 25th in *The Korea Herald* editorial. Countries like Hong Kong, the Philippines, the USA, Morocco, and Taiwan closed their borders to South Korea to isolate South Koreans. Some apartment buildings in Beijing, China, reportedly insisted that South Koreans quarantine themselves for 14 days before entering. Experts expressed the view that the root cause of South Koreans being shunned was that the South Korean government had not stopped the influx of COVID-19 from China.

To provide the best treatment, the government declared that it would quarantine people with mild and moderate cases of COVID-19 in public facilities, in a bid to focus on the treatment of severe cases in hospitals, with this reported in the Editorial section on March 2nd. However, the experts and the general

public thought that this decision should have been made much earlier to avoid reaching this point.

Although South Korea had about 1,000 of the negative pressure rooms needed to treat COVID-19 patients, the number of confirmed cases topped 3,000 on February 29th and 4,000 on March 1st. The Minister of Health stated the government would not hospitalize everyone with a confirmed case. Patients would be stratified into four groups depending on the severity of their illness. Only those in the two most serious categories would be admitted to hospitals for treatment, while those with less severe cases would receive medical help in other public facilities.

Based on the experience in Daegu and North Gyeongsang Province, experts warned the Seoul local government that, with the slightest slip, the situation in the Seoul area could get much worse. Seoul is a cosmopolitan city: more than 25,000 people use Guro Station every day, while about 100,000 enter and exit Sindorim Station daily. Approximately seven million people ride the Seoul subway every day. Most subway trains are crowded at rush hour, and countless buses stop near subway stations. With its understanding of the urgency, the government introduced proactive measures to encourage people to work from home. These measures also encouraged employers to offer flexible work schedules and increased distance between workers. The KCDC increased their efforts and established a system of working from home to minimize community infection.

From March 22nd, editorials focused on better treatment and control, with South Korea's COVID-19 situation still uneasy but showing signs of calming down. However, experts advised that if the authorities failed to effectively control overseas travel and entry into South Korea, the country could suffer a second wave of COVID-19 outbreaks similar to what had hit Daegu and North Gyeongsang Province.

Politics

With Daegu's rapid increase in COVID-19 infections during March 2020, the US State Department raised its travel advisory for Daegu to level 4. It warned US citizens to "not travel" to this southeastern South Korean city. It was thought that if Washington barred entry to travelers from South Korea, other countries would be likely to follow suit. The US–South Korea trade would then shrink, exposing the domestic economy to a major crunch. South Korea countered Japan's effective entry ban with reciprocal measures, but it was thought that an emotional battle or extreme confrontation would be detrimental to both countries. The fundamental solution is to contain the spread of the COVID-19 outbreak as quickly as possible.

Japan next began to restrict the entry of visitors from China. South Korea has still kept its doors open to China, except for those from Hubei Province. Some stated that Japan's restriction was meaningless and too late, as the number of confirmed infections in Japan had already topped 7,000. The concerns in South Korea about being isolated have not yet abated, with views expressed that something went wrong from the beginning.

Recovery

The important points for recovery were that the KCDC needed to precisely assess the situation and make decisions before COVID-19 did, with swift follow-up and execution by the government. These were the critical features of discussions on prevention and disease control. Experts emphasized the proactive role needed from the South Korean government to contain COVID-19. If the government waited until hospital beds ran out and did not make the mass-scale quarantine decision, this would be the worst event in South Korean history and extremely damaging for the economy.

All manufacturing industries in South Korea took a complete U-turn, while the government injected more than US$13 billion in emergency funds to stoke economic activities sapped by the fast-spreading COVID-19 and to balance international trade with neighboring economies (Yoon and Wong, 2020). The current ruling party considered the 11.7 trillion won (US$9.6 billion) extra budget bill, submitted to the parliament earlier in March 2020, as being insufficient to help with the fight against COVID-19 and to minimize its economic impact.

Print Media in Singapore: *The Straits Times*

On January 23rd, 2020, the first COVID-19 infection in Singapore was detected in a visitor from Wuhan (Young et al., 2020). Immediately after that, different forms of the news media started to focus on the news and experts' opinions related to the outbreak. *The Straits Times*, considered one of Singapore's leading English-language newspapers (based on the number of readers and circulation), began to publish regular concerns and the perspectives of scholars. These perspectives covered a wide range of issues. However, the economy, social welfare, humanity, and politics were the aspects that received the highest priority in connection to COVID-19. Preparedness and awareness generation and focusing governance and institutional efforts also received attention, whereas the environment, technology, and innovation were minimally mentioned. However, these priorities did not remain the same from January to March 2020 (**Table 6**).

As January 2020 was the beginning of Singapore's experience with the COVID-19 outbreak, January's editorial began with preparedness and awareness and then institutional efforts. Naturally, with the first case only just identified in Singapore, this was not the time to be concerned about issues such as the economy, politics, and social welfare. These critically important issues received attention from February and achieved their highest focus in March. The extent to which the different aspects of life during COVID-19 received experts' attention from January to March 2020 is analyzed in this section.

Health and Drugs

The COVID-19 outbreak was now regarded as a pandemic and treated as a global health concern (Wang et al., 2020). Health concerns were now extended and affected all aspects of life. Despite the lack of any direct opinions or concerns related to health and drugs in Singapore's leading newspaper's editorials, this was implied in all aspects of the concerns and perception expressed.

Preparedness and Awareness

Preparedness and awareness are considered vital issues in controlling and managing any risk or hazard. Scholars have advised that institutional and health care systems' preparedness be established to prevent any virus outbreaks (Jeon and Kim,

TABLE 6 | Issues related to COVID-19 addressed by *The Straits Times* editorials (January–March 2020).

Month	Preparation and awareness	Social welfare	Governance and institutions	Politics	Economy	Environment and wildlife	Innovation and technology, and media	Total
January	1	0	1	0	0	0	0	2
February	3	2	1	3	4	0	1	14
March	2	5	3	4	4	1	1	20
Total	6	7	5	7	8	1	1	36

https://www.straitstimes.com/opinion/st-editorial?page.

2016). Singapore reported its first case of COVID-19 infection on January 23rd. Since then, the country has been praised for its different preparedness and awareness initiatives. However, as of April 30th, Singapore had the highest number of infected cases in Asia, except for China, numbering 15,641, as reported at https://covidsitrep.moh.gov.sg/.

Along with the need for institutional efforts, experts focused their attention on preparedness and awareness generation, with this reflected in *The Straits Times*, the leading English-language newspaper in Singapore. In February 2020, experts sought to raise citizens' awareness of authorities' recommendations for the frequent washing of hands with soap and water which could serve as an effective safeguard. At the same time, experts attempted to increase the government's preparedness, urging that Singaporeans needed to play an essential role in minimizing the risks of local spread. It was emphasized that COVID-19 knew no borders and that distance did not matter in the age of globalization and air travel. After February 2020, when the number of cases was overwhelmed by those in March, the newspaper's editorials imposed the warning that COVID-19 would not be the last pandemic. Therefore, experts advised that countries could and should plan now for how to meet the next challenge. Editorial comments extended this concern by stating that health care systems were in danger of being overwhelmed in some countries, where it had never been imagined that they would face a crisis of such proportions.

Social Welfare and Humanity

In early February 2020, *The Straits Times* started to emphasize issues of social welfare and humanity associated with the COVID-19 outbreak. In fact, from early February 2020, people in different parts of the world started to express their hate and discriminatory attitudes toward Chinese people and people of Chinese appearance, as Wuhan, a city in China, was the epicenter of the virus. Editorials published in the leading Singaporean English-language newspaper considered this sensitive issue, warning at the very early stage of the outbreak that "creeping discrimination in Singapore is in danger of feeding into a malevolent international pattern. Sentiments against citizens of China have emerged among some groups" (Straits Times, 2020b). Editorials expressed appreciation for different forms of public support; for example, GrabCare helped health care workers to travel to and from health care facilities, donations of different forms were made such as through Courage Fund, etc., with all mentioned in the editorial to highlight and appreciate the humanitarian efforts of people and organizations.

From March 2020, along with different approaches to donations and support for frontline workers dealing with the outbreak and for the general public, humanitarian initiatives were undertaken by the Singapore government. The government initiated its own 1-month pay cut to show solidarity with Singaporeans coping with the COVID-19 outbreak. At the same time, public officers on the front line received up to one extra month's special bonus in recognition of their efforts in battling COVID-19. Newspaper editorials urged social responsibility to safeguard public health and warned that fear and panic had also led to selfish acts of self-protection. In the last part of March 2020, experts writing in *The Straits Times* initiated efforts to increase readers' sense of hope, stating how people and neighbors in different parts of the world were extending support to each other's mental health.

Governance and Institutions

Shortly after the detection of the first case of COVID-19 in Singapore, initiatives from the government and various institutions began to emerge. The present study has already highlighted that the Singapore Ministry of Health issued a health alert that patients with pneumonia and recent travel to Hubei Province should be screened for SARS-CoV-2 (now COVID-19) infection, and all individuals suspected of being infected were isolated. Extensive contact tracing was undertaken followed by the quarantine of asymptomatic contacts and hospital isolation and screening of symptomatic contacts with all strictly enforced (Young et al., 2020).

In January 2020, the editorial in *The Straits Times* expressed its first opinion regarding COVID-19 and governance, advising all institutions that the fear of infection was an understandable response. However, it continued by stating that discrimination against people was out of sync with both Singapore's moral imperatives and practical needs, with foreigners an integral part of its globalized economy. It also highlighted China's institutional efforts, referring in February 2020 to the comment made by the head of the World Health Organization (2020a) and the study by Harvard University experts that focused on Singapore's efforts. The latter study highlighted that Singapore's approach to the COVID-19 outbreak was the "gold standard." In March 2020, news editorials directed their attention to the strict rules of the government to control the coronavirus outbreak. In mid-March 2020, when over 160,000 people were stricken by COVID-19

across 118 nations, the experts' views expressed in editorials addressed the efforts of different governments over the previous 3 months to keep the virus and its rapid spread under control. Various countries' efforts, such as tightened border controls, expanded flight restrictions, and travelers banned from specific regions, were mentioned in editorial discussions. In the last part of March 2020, the editorial reflected the concerns that resulted in the government instruction to Singaporean residents or long-term pass holders who insisted on leaving the country, despite advice to not do so. The editorial reminded readers of the government instruction and mentioned that these residents would have to pay full hospital charges if they were admitted for coronavirus-related treatment when they returned.

Although Singapore was praised for its institutional initiatives and its government's active efforts to control the outbreak, the editorial concerns were not very oriented to specific institutional issues nor were institutional attempts criticized in editorials.

Politics

No concerns regarding politics were reflected in editorials in January 2020. From February 2020, views expressed in *The Straits Times* started to criticize authorities in China for the country's initial paralysis and lack of transparency about the severity of the situation. After China's discovery of the highly infectious virus in December 2019, it was allowed to spread to the far corners of the vast country and to at least another 28 countries and territories. In February 2020, experts urged the necessity of the world's two most powerful nations (China and the US) pausing in their rivalry for primacy and joining hands against COVID-19.

Singapore's general election date was a key focus of editorials in March 2020. Worries were expressed about the possibility of the election being delayed and mention was made of the Prime Minister's concern about whether to delay the election until the COVID-19 outbreak situation improved or to hold it earlier before the situation deteriorated. World politics also received attention from the experts. This mostly criticized US President Donald Trump's delayed response to taking initiatives to prepare for and manage the outbreak. During this pandemic, the timing blame game between China and the US has also been criticized by experts.

The Economy

In Singapore, experts writing in editorials focused on the economy from the first week of February 2020. They reflected on falls in oil prices of more than 15% in the peak period for oil demand in most parts of Europe, the US, and a large part of Asia. Apart from the oil price fall, editorial perceptions in Singapore focused on other issues such as severe reduction in the tourism industry, reduction of GDP, recession in the global economy, and supply chain disruption.

The editorial concerns reflected the downgraded GDP forecast from 0.5 to 2.5% to −0.5 to 1.5% provided by the Ministry of Trade and Industry: it warned of the possibility of a recession. Scholars emphasized government initiatives and budgetary strategies to support businesses, workers, families, and frontline agencies in the face of the ongoing COVID-19 outbreak. They stated that not only was the coronavirus a public health concern, but it was also an economic challenge.

The Environment and Wildlife and Innovation and Technology

While the issues of the environment and wildlife as well as innovation and technology have a close relationship with the COVID-19 outbreak, experts in *The Straits Times* only stated these crucial issues once, in March 2020. From an environmental aspect, experts' thoughts highlighted the reduction of pollution and the improvement of ecological settings. They stated that birds could be heard singing without the incessant noise of traffic and that the murky waters of the fabled canals in the Italian city of Venice had turned a bright blue-green. Experts also referred to the outcome reported by the European Space Agency which found that the levels of nitrogen dioxide in Asia and Europe were significantly lower than for the same period in the previous year. Experts also alerted readers to the fact that this drop in emissions was likely to be temporary, and that when the pandemic ended and factories reopened, cars returned to the roads, and people started to travel, carbon emissions would spike. The spread of fake news all over the world and the postponed Olympic Games also received attention in the editorials.

Print Media in Iran: *Tehran Times*

Iran in 2000 had 23 Persian-language daily newspapers, three English-language daily newspapers, and one Arabic-language daily newspaper (Joel and Kamalipour, 2000). However, between 2000 and 2004, 85 newspapers were closed down (Kokan, 2004). At present, six English-language newspapers are published in Iran: of these, considering the daily circulation, *Tehran Times* is one of the leading English-language newspapers with an online version. Considering its dominance in the local society and internationally and its online accessibility, *Tehran Times* was selected for the present study's analysis of the perceptions and thoughts of experts in relation to the COVID-19 pandemic. In Iran, the first case of coronavirus was reported on February 19th, 2020. However, even before that case, *Tehran Times* had started to focus on news related to COVID-19. From January to March 2020, the thoughts and analyses of all scholars as they related to COVID-19 were diverse. Their concerns focused on health, awareness, the economy, society, politics, governance, the environment, and technology. How these experts' concerns shaped different aspects of life in Iran with, and disrupted by, COVID-19 is discussed in this section (**Table 7**).

Health and Drugs

Few direct health-related opinions and analyses were published in *Tehran Times* from January to March 2020. In early March 2020, health-related editorial mainly addressed the emergence and nature of coronavirus-type diseases. In mid-March 2020, another health-related article highlighted the world situation with regard to the spread of COVID-19. The editorial warned that the coronavirus was spreading rapidly, from isolated cases to expanding clusters and into communities.

TABLE 7 | Issues related to COVID-19 addressed by *Tehran Times* editorials (January–March 2020).

Month	Health and drug	Preparation and awareness	Social welfare	Governance and institutions	Politics	Economy	Environment and wildlife	Innovation and technology	Total
January	0	0	0	0	0	0	0	0	0
February	0	0	2	1	1	2	0	0	6
March	2	2	1	1	3	2	1	4	16
Total	2	2	3	2	4	4	1	4	22

https://www.tehrantimes.com/archive.

Preparedness and Awareness and Social Welfare

Iran announced social distancing measures in a bid to minimize the spread of COVID-19. In relation to awareness and preparedness, another *Tehran Times* editorial criticized the current situation of armed violence in the US, seeking an answer to the following question: "Which one is the ultimate winner in the United States, COVID-19 or armed violence?" This was an approach designed to increase the world's awareness of armed forces and preparedness for health issues. In February 2020, expressing a social welfare-type concern, the editorial urged the expression of feelings of empathy toward the Chinese.

Politics

A world politics expert's view expressed appreciation for Iran's support to China by the sending of masks. The ambassador of the People's Republic of China to Tehran started direct communication *via* his Twitter account to reduce the level of fear among Iranians. However, Iran's social media were critical of Chinese tourists who were spending their New Year holidays in Iran. Experts criticized Iran's President and, at the same time, asked him to revise his actions. The Chief of the Medical Council of Iran was requested to avoid presenting a "semi-normal" picture of the situation in the country as it dealt with COVID-19. The editorial also expressed the views of doctors who warned the government not to create a false sense of security and not to undermine society's psychological health (Tehran Times, 2020). In terms of politics, the editorial criticized US President Trump's "maximum pressure" policy that slapped the harshest ever sanctions against Iran.

Governance and Institutions

In February 2020, experts writing in *Tehran Times* attempted to justify the delayed announcement of the outbreak of COVID-19 in the central Iranian city of Qom. The editorial analyzed the government's roles and duties and the mechanism for announcing the coronavirus outbreak. The editorial stated that, generally, unusual incidents, such as epidemics, should be publicly announced after conducting accurate assessments and detailed probes to avoid creating panic in Iranian society.

In March 2020, when COVID-19 was quickly spreading in Iran and had caused a significant number of deaths, experts on governance issues highlighted the government's views and recalled the public service values: equity, consistency, sustainability, adaptability, precedent, and free public services. By pointing to these principles, the government, as well as these experts, reminded and advised public service officials to extend their help and act accordingly.

The Economy

In February 2020, two perspectives related to COVID-19 were published in *Tehran Times*, with one article expressing concerns related to the oil market due to the rapid spread of COVID-19 in China. At that time, the WHO declared the accelerated dissemination of COVID-19 as an emergency for global health and that it created concerns in the world oil market. Following this reflection of oil market concerns, no articles or editorial related to COVID-19 appeared in *Tehran Times* until February 23rd, 2020. However, after the first reported case of coronavirus infection on February 19th, 2020, experts expressed their thoughts in relation to the government's role, the economy, and world politics. The government's instructions and its role were mentioned, while economy-related editorial mainly focused on low oil prices and the downward movement of US stock indices. This indicated the worries and forecasts related to COVID-19's pressure on oil prices. In March 2020, the *Tehran Times* published the opinions of experts that focused strongly on the economy. In relation to concerns about the economy, instead of job losses or losses due to the shutdown of industries, the main focus was related to the travel market and private theater viability. The editorial stated that, in contrast to any previous year, during the peak season in 2020, the travel market faced an adverse hit due to the COVID-19 outbreak, with local and government authorities issuing severe warnings to limit travel between major cities to contain the virus. The government also warned that it might use "force" to limit travel throughout the country if necessary. Furthermore, experts addressed the loss of the private theaters of Iran and urged the government to provide support to minimize the loss.

Apart from these experts' views and thoughts, different dimensions of news related to COVID-19 were reported in *Tehran Times*, mostly from February 22nd. Less focus was given to the economy, preparedness, and governance, with greater emphasis on sports and the media. The issue of the environment and wildlife, which could have been a prime focus, was missing in almost all issues of the newspaper.

The Environment and Wildlife

From January to March 2020, environmental issues received the attention of experts only once, in early March. Concern was expressed about future warnings and fears related to the environmental consequences that all countries worldwide

may need to bear due to the outbreak of COVID-19. Unlike environmental issues in newspapers in other countries which indicated the reduction of pollution, an opinion in *Tehran Times* was related to hazardous waste generation.

Innovation and Technology and the Media and Sports

With the increasing spread of COVID-19 and fatalities at a very high level in March 2020, the news and editorial focus increased in March 2020. This began in the regular news from February 22nd with thoughts and perspectives of 14 scholars in March. Among the issues raised, the media and technology received more focus than economic, social, and environmental issues. Coronavirus-related fake news, bad news, and concerns related to the reliability of news sources were highlighted in different media-related editorials. Distance learning technology for students during the outbreak of COVID-19 was addressed. Sports-related articles primarily discussed the cancellation of different sports events at national and international levels. During mid-March 2020, the worries expressed by experts were related to the Olympics, reflecting the view that the 2020 Tokyo Olympic Games could be postponed.

Print Media in Bangladesh and India: *The Daily Star* and *Hindustan Times*

From the start of the COVID-19 outbreak, Bangladesh and India have been undergoing a health emergency that experts have suspected will have potential long-term impacts on education, the economy, governance, society, health, geopolitics, and people's minds. This has been not only a time to "stay at home and be safe" but also a crucial time for the respective experts, leaders, politicians, and media staff to encourage coordinated action plans to resolve the upcoming bad situation through risk management and mitigation strategies, using the print media to transmit news. The first case of COVID-19 in India was reported on January 30th, 2020, whereas in Bangladesh, the country's Institute of Epidemiology, Disease Control, and Research (IEDCR) confirmed the spread of COVID-19 into the country on March 8th, 2020.

In Bangladesh, *The Daily Star*, a well-circulated English-language newspaper, paid sparse editorial attention to COVID-19. Initially, very limited editorial consideration was given to how to tackle the coronavirus and what type of precautionary measures should be taken, but only at airports by foreign migrants. A few commentaries had an international focus, especially on China's COVID-19 settings and future predictions of the death toll and economic effects (**Table 8**).

Hindustan Times, an English-language newspaper in India, published similar observations to those in *The Daily Star* in Bangladesh. However, in contrast, *Hindustan Times* was more proactive in highlighting the news on COVID-19 in China and on China's activities, especially with regard to the infection rate and economic analysis predicting China's slow growth in the coming decade, etc. Apart from these aspects, *Hindustan Times* focused on other areas rather than alerting Indians to the potential of COVID-19 to wreck lives and economies (**Table 9**).

In February 2020, the editors of *The Daily Star* and *Hindustan Times* had noticed little about COVID-19 on their editorial dashboards. However, different national and international op-eds on COVID-19 were being published, covering different corners of the news. It is worth mentioning that neither of these national newspapers focused on their country's context; instead, the emphasis was on international coverage. Most op-eds covered the death toll and the spread of the coronavirus, but were limited to preparedness and awareness building, which needed considerable attention due to the large populations of these two nations. *The Daily Star* sought to discover the pitfalls of the Bangladesh government's preparedness: although preparation had been far from negligible, the question was whether the government had taken the right approach.

In March 2020, the editorials of both newspapers provided massive coverage on COVID-19 after it had already been declared a pandemic by the WHO. However, this coverage saw both editors play a supportive role for their countries' governments even though they were failing to take the necessary preparatory and precautionary steps to stop the health risk to their whole nations. The editorials in both countries' newspapers also focused on the economic growth pattern, employment and displacement trends, good governance, and innovative technology for testing and the development of drugs.

Last, but not least, national op-eds and readers' commentaries covered preparedness and response measures for COVID-19, including surveillance and contact tracing, the lockdown scenario, laboratory diagnosis, risk communications, community engagement, social distancing, hospital preparedness, infection prevention and control, and implementation of containment plans. Furthermore, the various aspects of life and livelihood options that received attention from experts and scholars from January to March 2020 were analyzed. These aspects are summarized under the subheadings below.

Health and Drugs

Health and appropriate treatment are among people's basic needs according to the Constitutions of both Bangladesh and India. Hence, emergency efforts were implemented to find targeted medical products to prevent widespread infection and to diagnose and treat victims during the COVID-19 pandemic. The production and supply chains for COVID-19 candidate drugs (such as chloroquine and hydroxychloroquine) and for many other essential medical products were impaired by this crisis (Newton et al., 2020). Effective and efficient interventions were needed globally to ensure access to safe, quality-assured, and effective medical products on which the world's population would depend (Gawande, 2020). Nevertheless, editorials in both newspapers mainly discussed the death toll and, to a slightly lesser extent, took into account the health emergency or the progress of candidate drug availability issues. Price hikes of medicine and reduced availability of testing kits, personal protection equipment (PPE), health care facilities, and intensive care unit (ICU) facilities, as well as unequipped isolation rooms, also received priority news coverage in both newspapers.

Preparedness and Awareness

"Prevention is better than cure" is a well-known proverb, with this receiving much attention in both newspapers, when

TABLE 8 | Issues related to COVID-19 addressed by *The Daily Star* editorials (January–March 2020).

Month	Health and drug	Preparation and awareness	Social welfare	Governance and institutions	Politics	Economy	Innovation and technology, and media	Total
January	3	2	2	0	0	0	0	7
February	4	8	3	4	0	7	0	26
March	9	21	6	8	5	16	1	66
Total	16	31	11	12	5	23	1	99

https://www.thedailystar.net/editorial.

TABLE 9 | Issues related to COVID-19 addressed by *Hindustan Times* editorials (January–March 2020).

Month	Health and drug	Preparation and awareness	Social welfare	Governance and institutions	Politics	Economy	Environment and wildlife	Innovation and technology, and media	Total
January	6	1	6	1	0	2	0	0	16
February	8	6	2	1	0	3	1	1	22
March	14	17	3	10	5	8	1	2	60
Total	28	24	11	12	5	13	2	3	98

https://www.hindustantimes.com/editorials/.

considering the country context. From the very beginning of the COVID-19 outbreak, preparedness received the highest priority in editorials, commentary, and readers' opinions. *The Daily Star* and *Hindustan Times* sought to raise the awareness of their countries' mass populations regarding the devastation of this novel coronavirus. They published details of how awareness and preparedness activities, especially social distancing and staying and working at home, could reduce the spread of COVID-19. Both governments also planned firm action against rumormongers, urging people not to be panicked while directing all relevant government departments to become prepared to successfully handle the coronavirus. Editorials and commentary from newspapers also emphasized and raised awareness that the concerned authority should conduct widespread testing which, it was hoped, would provide the real picture of transmission.

Social Welfare

Neither Bangladesh nor India is new to disasters or significant humanitarian crises. Despite the COVID-19 pandemic, in the period of late January to February 2020, *The Daily Star* published less pinpoint news regarding social welfare activities and necessities for people living below the poverty line or depending on their daily wage. However, in the middle of March 2020, an editorial commentary tried to warn the government that it needed to increase social safety-net activities and coverage for hand-to-mouth workers who had stayed at home due to the pandemic. In contrast, *Hindustan Times* showed the opposite direction in its editorial and commentary, with the newspaper focusing more on social welfare and humanitarian concerns in January 2020, but shifting its focus to other issues in March 2020.

Governance and Institutions

Good governance and reliable institutional mechanisms are analogous in the fight against any crisis. Again, a comprehensive, multisectoral, and proactive communication strategy is crucial for effective governance during a pandemic situation *via*: (i) official communication during the outbreak, response, and control activities; (ii) scientific communications between scientists and officials; and (iii) mass communications using the media, interpersonal communication, announcements, advertisements, etc. (Ministry of Health Family Welfare, 2020). Even with their above contrast, both newspapers had a pivotal role in monitoring the governance mechanism and its execution during this pandemic situation. At this point, both *The Daily Star* and *Hindustan Times* had a similar focus on governance and institutional operations. Moreover, both countries had the capacity for sentinel-based, event-based, community-based, web-based, and cell phone-based surveillance.

The Economy

COVID-19 is a crisis of an entirely different level of magnitude and one that will require a response on an unprecedented scale. Governments alone cannot accomplish the fight against COVID-19. It will require an unprecedented level of coordination between the public and the private sector at the local and international levels (World Economic Forum, 2020). The leaders of Bangladesh's and India's public and private sectors must come together to respond to the immediate threats to their health systems and the long-term effects on their countries' economies. Considering the published editorials and commentary, the economy received the second highest priority in *The Daily Star*, whereas it had the third highest priority in *Hindustan Times*. In *The Daily Star* in Bangladesh, from the beginning of February 2020, editorials, commentary, and expert opinions

gave greater emphasis to the country's economy and probable outreach program to counter the pandemic situation. They also mentioned and calculated the growth of GDP in 2020 and 2021. Editorials and expert opinions recommended some probable solutions and pathways to tackle this situation, as well as providing information on market analysis. On the other hand, *Hindustan Times* mentioned that COVID-19 would severely impact the global economy. Businesses worldwide were reported to be temporarily halting production, and many might even face bankruptcy. With global supply chains critically dependent on imported intermediary inputs from China and other countries currently under lockdown, this would create a recession in India.

Politics

Politics are part and parcel among those of South Asian ethnicity. However, in the situation of the COVID-19 pandemic, politics have received much less attention in both newspapers. *The Daily Star* has focused only on national political opinions, while, in contrast, *Hindustan Times* has focused on geopolitical tension due to statements by the US President (Donald Trump) and the secrecy of China's government on COVID-19.

The Environment and Wildlife

The *Hindustan Times* provided only a single expert opinion, in February and March 2020, on the environment, stating that this pandemic has given pause to allow the earth to breathe itself. This was regarded as a real breakthrough for the environment as the load-bearing capacity of nature has already been overburdened.

Innovation, Technology, and the Media

Innovative technology has been crucial in the COVID-19 pandemic. However, from January to March 2020, very little news was available on this topic in either of these newspapers. Only issues associated with the development of rapid test kits received any emphasis.

DISCUSSION

Taking into consideration the findings and results of this study, the following analytical discussion is presented. This discussion is mainly oriented to the comparative analysis of the issues highlighted in newspapers on the basis of Hofstede's model of cultural differentiation in the selected Asian countries. The discussion has explored how cultural differences in the different countries influenced the news media to shape responses to the pandemic. Furthermore, the discussion aimed to relate the priorities of the newspapers to the socioeconomic and even the political structures of a country, with this aspect built on the theories of the press.

Comparative Analysis of the Studied Newspapers: Focus on Hofstede's Model of Cultural Differentiation in Different Countries

Scholars have claimed that, despite the occurrence of a concrete event, crises are highly influenced by the communicative actions taken to define, describe, and solve them (Hearit and Courtright, 2004). Other studies have also identified the role of cultural and political influences in crisis communication (Huang et al., 2016). This section seeks to depict comparative pictures of the five different newspapers representing the five selected Asian countries which have varied sociocultural and political settings. It presents the percentage distribution of the highlighted issues from January to March 2020. Results denote that these five newspapers have some similarities as well as wide dissimilarities. In **Tables 5–9**, the overwhelming concentration of experts' thoughts is shown to have been published in March 2020, even though the first case of COVID-19 was reported in January 2020 in both South Korea and Singapore. In summarizing the findings and presenting a comparative picture, **Table 10** reveals that the economy and politics received more attention in March 2020 in all the studied newspapers. However, it is natural that all countries started to highlight health, preparedness, and social issues from January 2020 and from the beginning of the COVID-19 outbreak in their country. From January to March 2020, all newspapers gave the least priority to issues like environment and wildlife, innovation and technology, and the media.

In the case of experts' concerns published in newspapers, some similarities were found between two South Asian countries, Bangladesh and India. However, these two countries reported their first case in two different months. Socioeconomic, demographic, cultural, and even geographical similarities may have shaped the thoughts of experts and scholars during the COVID-19 pandemic. Both India and Bangladesh gave the highest focus to health, preparedness, and awareness, with these issues comprising about half the editorials published in the two leading newspapers of these two countries. Social and political issues received similar priorities in experts' concerns published in the newspapers of both countries. Of all the studied countries, health infrastructure, services, and facilities were the worst in India and Bangladesh. Furthermore, a highly dense population living in poor health and hygiene conditions has influenced the focus and priorities of health, preparedness, and awareness issues in the editorials of newspapers in both countries.

Hofstede (1984, 1991) cultural dimensions scores for India and Bangladesh are similar in the case of most dimensions which could explain the reason for the similarities in the newspapers' focus. In the case of the "indulgence" dimension (the extent to which people try to control their desires and impulses), Hofstede's insights indicate a very low score for India (26) and Bangladesh (20). This low score denotes that a culture of restraint and a culture of being guided by social norms and regulations remain in both countries. This culture has influenced the editorials to instruct people, to guide them, and to be aware of them. Furthermore, India and Bangladesh have high scores in the dimension of power distance (77 and 80, respectively) (https://www.hofstede-insights.com/country-comparison), which denotes the top-down or bossy approach, with this guiding the editorial concerns.

In analyzing Hofstede (1984, 1991) cultural dimensions scores of all five studied countries, it is noticeable that, with the exception of India and Iran, all other countries have individualism scores below 20, while India and Iran have scores around 40. As all these countries still have collective

TABLE 10 | Comparison of different areas of focus of e-newspapers in five Asian countries.

Newspapers	Months	% of different broad issues highlighted among all editorials in a newspaper from January to March					Possible reasons
		Health, preparedness, and awareness	Economy, industry, production, supply, demand	Social	Governance and politics	Innovation, technology, environment, and wildlife	
The Korea Herald	January (*N* = 4)	100	0	0	0	0	
	February (*N* = 20)	45	20	0	35	0	Domestic consumption reduced, stock prices collapsed 7.28%
	March (*N* = 36)	39	50	0	11	0	Proposal of extra budget of $9.86 billion by the president's administration, Bank of Korea slashed its outlook from 2.3 to 2.1%, debt to GDP ratio projected to exceed 45%, rising unemployment issue
	Total (*N* = 60)	42	37	0	11	0	
The Straits Times	January (*N* = 2)	50	0	0	50	0	Highest affected cases in Asia after China and governmental and institutional initiatives emerged
	February (*N* = 14)	21	29	14	29	7	Falling in oil price, tourism industry, reduction of GDP, decline in the global economy, disruption in supply chain
	March (*N* = 20)	11	21	26	37	5	Due to General Election and the reasons mentioned in the month of February
	Total (*N* = 36)	17	23	20	34	6	
Tehran Times	January (*N* = 0)	0	0	0		0	
	February (*N* = 6)	0	33	33	17	0	Falling down in oil price
	March (*N* = 16)	25	13	6	25	31	Shutdown of industries, adverse hit in travel market and theater
	Total (*N* = 22)	18	18	14	27	23	
The Daily Star	January (*N* = 7)	71	0	29	0	0	Price hike of medicine and lesser availability of testing kit and PPE; hospital facilities are not up to mark
	February (*N* = 26)	46	27	12	15	0	Due to rapid outbreak in several parts of the world, as a developing country started to fight against COVID-19 by preparing and creating awareness to the people
	March (*N* = 66)	45	24	9	20	2	
	Total (*N* = 99)	47	23	11	17	1	
Hindustan Times	January (*N* = 16)	44	13	38	6	0	Mass populated country, less available facilities to fight against COVID-19, mostly rely on health and drugs, prevention and creating mass awareness
	February (*N* = 22)	63	14	9	5	9	
	March (*N* = 60)	52	13	5	25	5	
	Total (*N* = 98)	53	13	11	17	5	

societies, social issues did not receive much priority in the newspapers' editorials. However, as Singapore is a multiracial country dominated by Chinese people (and faced the risk of discrimination and violence against those of Chinese ethnicity due to the origin of the COVID-19 outbreak), social issues received more focus in Singapore's newspaper. In addition to social issues, governance and politics received the highest attention from this newspaper. Singapore's general election was due on July 10, 2020, and was one probable reason for this concern in the editorials.

In the case of the economy, South Korea showed the highest level of concern in the newspaper editorials. South Korea had a booming economy and faster development. However, COVID-19 imposed a sharp declining trend in its stock prices. In the initial 10 days from February 1st to 10th, following the COVID-19 outbreak, South Korea's stock prices tumbled 7.28%. Furthermore, Hofstede (1984, 1991) cultural dimensions can explain the high focus on the issue of the economy in *The Korea Herald*. Among all five countries, South Korea has the highest score in long-term orientation (100) and uncertainty avoidance (85). These two high scores can explain why South Korean newspapers and experts are highly concerned about the economy.

Among all five countries, Iran has a unique socioeconomic and political situation. Despite having the highest number of cases (among the studied five countries) in March 2020, *Tehran Times* published a very low number of experts' views. International sanctions and restricted diplomatic relations with the Western world have delimited Iranian experts from expressing their concerns in an English-language newspaper. Among the small number of experts' thoughts expressed, the issues of health, preparedness and awareness, the economy, innovation, technology, and the media had the same priorities in *Tehran Times*. However, compared with other countries' newspapers, the *Tehran Times* gave more attention to innovation and technology, the media, and the environment and wildlife.

One prior study has claimed that cultures and social structures of various actors in society influence risk perception, identification, and management (Dressel, 2015). Scholars have also advised that public relations practitioners must consider culture when creating messages (Wertz and Kim, 2010). It is therefore evident from prior studies that sociocultural and even political and institutional issues have roles to play in shaping crisis communications. In the present study, variations in different newspapers' concerns from the selected countries have provided evidence of the role of a country's sociocultural influence and, thus, the role of that country's newspaper in shaping the news and crisis response in that country.

Experts' Thoughts in Electronic Newspapers: Shaped by Theories of the Press

In this analysis of the five studied newspapers from five Asian countries—South Korea, Singapore, Iran, Bangladesh, and India—it has been noticed that the different newspapers had different priorities. However, in the case of all five countries, the economy was a key issue of concern. With the exception of India's *Hindustan Times*, all newspapers gave the highest level of attention to highlighting experts' concerns related to the issue of the economy. Economic issues mainly covered employment, job losses, disruption of the supply chain, negative crude oil price, and a low forecast level of GDP in all countries. To generate awareness among the mass population and to build preparedness in institutions and communities, editorials gave attention to activities related to preparation and awareness. Experts showed their concerns for the social welfare-related aspect, emphasizing the maintenance of harmony in their society, the extension of help to others, and the demonstration of mental health support to frontline workers fighting COVID-19. Among these aspects, concerns about politics also received much attention in the experts' opinions. During this devastating time, the "blame game" was being played, with one country criticizing others. Several sports events, including the 2020 Tokyo Olympics, were canceled or postponed; in some countries, sports received attention to some extent. However, the environment and wildlife, the latter suspected of being linked to the outbreak, have not been widely focused upon in the experts' opinions. Innovation and technology-related efforts have been continuing worldwide, but this issue has not been highlighted much in editorial concerns.

Experts have argued that the socioeconomic structure of the country and community has a strong link to aspects like risk perception, awareness, and response (Djalante et al., 2020). Theories of the press also support the view that the state system, ownership, politics, and the economy influence and shape the concerns of the media (Hachten, 1981). Therefore, different countries and their leading print media have shaped different aspects affected by COVID-19 according to their socioeconomic structures and even their political structures and settings. Analysis with the help of Hofstede (1984, 1991) model also denotes this relationship between the socioeconomic and cultural dimensions of a country and their influence on communication behavior.

Limitations of the Study

Within the scope of this study, five newspapers from five Asian countries have been highlighted. However, China and Japan, the two countries in which COVID-19 emerged, are not included. Newspapers of other Asian countries with different sociocultural and ethnic settings (e.g., Malaysia, Indonesia) are not included in this study.

This study considered only one leading English-language newspaper from each of the selected countries. However, other newspapers and forms of media may have addressed and shaped the pandemic situation differently. Due to time and resource limitations, it was difficult to include more countries and more newspapers and other forms of media.

This study mainly analyzed the editorials of the studied newspapers. Many other opinions and concerns were expressed by other scholars and experts in the op-eds section. However, the study, as described in this article, failed to address all experts' views, as this would considerably extend the workload and the study's scope.

This study was initiated and motivated by the MRT and theories of the press. Hofstede (1984, 1991) model of cultural differentiation was also incorporated into the analysis. However, intensive analysis based on these theories was not conducted. Analyses and discussions were limited to brief reflections of the theories.

Finally, as a further possible limitation, human errors may have occurred when conducting text mining from a large number of editorials. Therefore, despite their sincere efforts, the authors may have missed or duplicated some important observations or concerns addressed in editorials.

CONCLUDING REMARKS

From the emergence of COVID-19 in late December 2019 to April 2020, the coronavirus has not only turned into a pandemic but has also created a devastating global problem. The pandemic now shapes almost every sector of every nation. Nevertheless, the situation is not the same in all nations and all sectors. Along with the timing of the outbreak, the extent of its spread and fatalities, the socioeconomic and political conditions of a country have, to some extent, determined the preparedness, institutional efforts, socioeconomic conditions and measures, and also the political debates. All these topics are dealt with and researched by professionals, and the world's newspapers must learn from these analyses.

From the results and discussions in this study, it is understandable that cultural differentiation, the socioeconomic, political, and even the institutional setup of a country, and the media all have a remarkable influence on and a role in representing and shaping the news and thoughts expressed in a newspaper. However, scholars have advised of the need for a global standard and protocol for regional and national responses in this strongly interconnected world (Djalante et al., 2020). In this global world, addressing a national issue may have a wider global impact. Therefore, newspapers also should have decisive judgment and concern about the issues that are not only a national need but also a world need to combat global crises, such as the COVID-19 pandemic. Avoiding "blame games," fake news, exaggeration, and politics, newspapers and other forms of media should play key roles in guiding the mass population and policy makers to face crises and to bounce back in even better shape.

DATA AVAILABILITY STATEMENT

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

AUTHOR CONTRIBUTIONS

GAP: conceptualization, methodology, data collection (*The Straits Times* and *Tehran Times*), data analysis, writing, reviewing, and editing. RA: data collection, writing, reviewing, and editing. MHR: data curation, writing, and formatting. MA: methodological approaches, data collection and curation, writing, reviewing and editing, formatting, and corresponding. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fcomm.2020.557593/full#supplementary-material

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Relationship Between Problematic Social Media Usage and Employee Depression: A Moderated Mediation Model of Mindfulness and Fear of COVID-19

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Social media plays a significant role in modern life, but excessive use of it during the COVID-19 pandemic has become a source of concern. Supported by the conservation of resources theory, the current study extends the literature on problematic social media usage during COVID-19 by investigating its association with emotional and mental health outcomes. In a moderated mediation model, this study proposes that problematic social media use by workers during COVID-19 is linked to fear of COVID-19, which is further associated with depression. The current study tested trait mindfulness as an important personal resource that may be associated with reduced fear of COVID-19 despite problematic social media use. The study collected temporally separate data to avoid common method bias. Pakistani employees (N = 267) working in different organizations completed a series of survey questionnaires. The results supported the moderated mediation model, showing that problematic social media use during the current pandemic is linked to fear of COVID-19 and depression among employees. Furthermore, trait mindfulness was found to be an important buffer, reducing the negative indirect association between problematic social media use and depression through fear of COVID-19. These results offer implications for practitioners. The limitations of this study and future research directions are also discussed.

Keywords: depression, COVID-19, pandemic (COVID-19), social media, fear, mindfulness

INTRODUCTION

The past decade has seen a rapid increase in social media usage, which has stirred debate on its potential benefits and drawbacks (Panahi et al., 2016; Weinstein, 2018). According to some research, social media platforms offer multiple benefits: they satisfy the basic human need for belonging, increase life satisfaction, and reduce loneliness (Zhan et al., 2016; McLaughlin and Sillence, 2018). On the other hand, excessive use of social media has been linked to serious mental health issues such as depression and anxiety (Primack et al., 2017; Reer et al., 2019; Van der Velden et al., 2019). This debate on social media as a double-edged sword, is ongoing (Panahi et al., 2016). However,

the recent COVID-19 pandemic has highlighted the negative side of social media by indicating that excessive use is spreading panic, fear, and misinformation regarding COVID-19 among mass populations (Pennycook et al., 2020). In this study, problematic social media usage is defined as; an excessive use of social media regularly, to the extent that it seems difficult to stay away from it (Andreassen et al., 2012). A spike in social media use has been observed during the COVID-19 pandemic as more people rely on it to get the latest COVID-19 related updates (Pennycook et al., 2020). This increase in social media use has enhanced the spread of the so-called COVID-19 "infodemic" (Pulido et al., 2020). The COVID-19 infodemic is defined as an excess of information on COVID-19, some accurate and some fake which makes it difficult for people to find credible sources for guidance and updates (Pulido et al., 2020).

Social media infodemic has always been an issue but this has become an even greater challenge during the COVID-19 pandemic, which has made many people fearful (Pulido et al., 2020). Islam et al. (2020) reported that sharing fake and harmful content on social media platforms is associated with poor mental health. Similarly, another study showed that the social media infodemic was related to panic episodes among social media users (Islam et al., 2020). Fear of COVID-19 can be defined as an unpleasant emotion in which people tend to feel worried that they might get infected by COVID-19 (Ahorsu et al., 2020). As a result of the spread of fear, misinformation, and mental health issues due to problematic social media use, the World Health Organization has also advised people to spend less time on social media sites (Sohrabi et al., 2020). In summary, COVID-19 has created new challenges for the world, making it more important than ever to conduct cyberpsychology (Gao et al., 2020; Guitton, 2020).

Social media can help in disseminating information, which might be useful in dealing with the pandemic, but it is also linked to anxiety and depression (Islam et al., 2020). Depression is defined as a common mental health issue in which the individual feels fatigued as well as sad and loses interest in everything (Kroenke et al., 2001). A recent study monitored posts shared on social media, reporting that social media is overloaded with terrifying information related to COVID-19, such as details of patients who have either lost their lives due to COVID-19 or are currently fighting the disease (Hua and Shaw, 2020). Some users make the situation worse by sharing misleading information on social media (Pennycook et al., 2020). This bombardment of fear-inducing, deceptive information may depress people by spreading waves of fear (Mertens et al., 2020). Some researchers have also warned that fear of COVID-19 is associated with long-term negative outcomes, which might be an additional issue over and above the disease itself (Ren et al., 2020). Hence, it is essential to investigate the antecedents and consequences of fear of COVID-19 (Mertens et al., 2020).

The limited research available on fear of COVID-19 indicates that it is a strong predictor of mental health issues (Ahorsu et al., 2020). People with a fear of COVID-19 may constantly worry about catching the disease, which affects their mental health (Ren et al., 2020). Multiple studies have highlighted a rapid increase in mental health issues since the pandemic hit; however, the extant literature is silent on the predictors of these issues, which warrants immediate inquiry (Zandifar and Badrfam, 2020). Some studies have suggested that problematic social media use and fear of COVID-19 are important factors linked to depression (Pennycook et al., 2020). However, there is still insufficient empirical evidence to support this claim. Thus, based on gaps in the existing literature and the call for research on the negative outcomes of excessive social media use during COVID-19, the current study proposes that problematic social media use during COVID-19 may be related to fear of COVID-19, which is further linked to depression among employees.

Although a wealth of literature on the adverse psychological outcomes of COVID-19 has been generated within a short time (Lauer et al., 2020), there is a scarcity of research on potential psychological buffers for these outcomes (Duan and Zhu, 2020). It is time to shift focus from problems to solutions, which the world is looking to the research community to deliver (Zhang and Liu, 2020). In this regard, some researchers have recommended meditation practices to reduce mental health issues during the pandemic (Behan, 2020). Similarly, trait mindfulness has also received attention lately due to its extraordinary mental health benefits (Hülsheger et al., 2013). Mindfulness is defined as an extreme form of self-awareness and situation awareness alongside non-judgmental processing of events (Bishop et al., 2004). Existing research has already established the role of mindfulness in reducing the negative effect of stressors (Ireland et al., 2017; Burnett-Zeigler et al., 2018; Sagui-Henson et al., 2018; Montani et al., 2019). However, the role of mindfulness needs to be further explored in the context of the current COVID-19 pandemic (Behan, 2020). Researchers have begun to realize that mindfulness might act as a useful personal resource during a pandemic like COVID-19, which people might use to minimize the fear and negativity associated with COVID-19 (Behan, 2020; Hedderman et al., 2020). Mindfulness refers to a phenomenon in which an individual deliberately engages in non-judgmental processing with respect to present events (Brown and Ryan, 2003; Creswell, 2017). Mindfulness allows people to analyze all the available information in a non-judgmental way and promotes a high sense of self-awareness, which might help them in coping with depression and anxiety (Behan, 2020). People high in trait mindfulness might experience less fear related to COVID-19 than others despite using social media (Hedderman et al., 2020). Hence, the current study proposes that mindfulness weakens the link between problematic social media use and fear of COVID-19, and ultimately with depression. **Figure 1** contains the proposed theoretical framework.

THEORY AND HYPOTHESIS DEVELOPMENT

Supporting Theory

The current study relies on the conservation of resources (COR) theory (Hobfoll, 1989; Hobfoll et al., 2018) to support the proposed model. This theory discusses the accumulation and preservation of resources. Specifically, people make an effort to accumulate and preserve valuable physical, psychological,

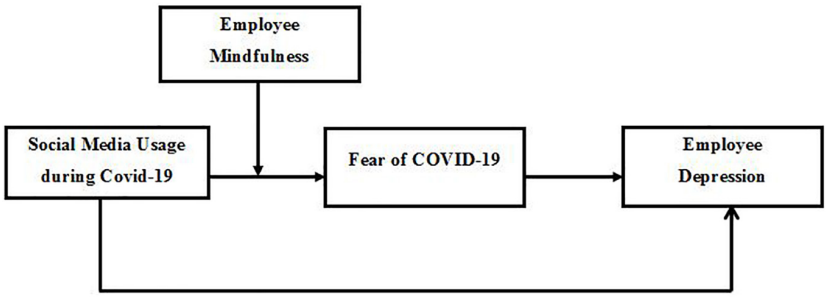

FIGURE 1 | Proposed hypothesized model.

financial, and social resources. The threatened or actual loss of these valuable resources causes stress, which gives rise to negative outcomes. In contrast, having other resources available might help in stopping resource loss as a result of exposure to stressors.

Building upon the conservation of resources theory (Hobfoll, 1989), we believe that excessive social media usage during the current pandemic might act as a stressor and thus be linked to adverse outcomes among employees. Excessive exposure to negative information related to COVID-19 on social media threatens employees' physical resources such as health and life due to the risk of getting the infection, psychological resources such as psychological health by increasing depression and anxiety, social resources such as interpersonal relationships due to social distancing, and financial resources due to the risk of losing one's job during COVID-19 (Shacham et al., 2020). This threat of resource loss may be associated with stress among employees by developing a fear of catching the infection (Hobfoll et al., 2018; Behan, 2020). According to COR theory, resource loss is more salient than resource gain, and it increases in magnitude and gains momentum over time. Fear induced by stressors might further deplete employees' resources, resulting in depression (Hobfoll et al., 2018; Majeed and Fatima, 2020; Shacham et al., 2020; van der Velden et al., 2020). Depression represents the most advanced stage of the resource loss cycle, which develops gradually over time and exhausts one's energy resources (Hobfoll et al., 2018). However, personal resources such as mindfulness may help employees to overcome fear by enhancing self-awarene8ss and helping them in interpreting situations in a non-judgmental way, which can minimize resource loss resulting from the stressor of problematic social media use during COVID-19. Drawing on the COR theory (Hobfoll, 1989; Hobfoll et al., 2018), mindfulness might be considered a personal resource that enables individuals to manage external stressors more effectively (Montani et al., 2019). Furthermore, mindfulness may also help people in gaining further psychological and emotional resources.

Relationship Between Problematic Social Media Use and Employee Depression

Researchers have reported an increase in social media use during the COVID-19 pandemic (Islam et al., 2020). Social media provides excellent ways to disseminate important information related to COVID-19 and keep people connected in this time of social distancing (Sohrabi et al., 2020). However, studies have found that there are negative outcomes from excessive social media use during the pandemic due to the spread of misinformation (Pennycook et al., 2020). For instance, one study found that the COVID-19-related infodemic, which includes rumors, stigma, and conspiracy theories, is negatively linked to public health (Islam et al., 2020). The negative consequences of social media use cannot be overlooked during the COVID-19 pandemic because conspiracy theories and misinformation about the spread of COVID-19 can be found on most social media sites (Islam et al., 2020). Previous research on problematic social media use has also reported associations with negative outcomes such as depression, poor mental well-being, anxiety, and even suicidal ideation (Primack et al., 2017; Jasso-Medrano and Lopez-Rosales, 2018; Van der Velden et al., 2019). The current COVID-19 pandemic seems to have enhanced the adverse emotional and psychological outcomes of problematic social media use (Pennycook et al., 2020).

Researchers have started to realize that psychological issues related to COVID-19-need immediate attention (Ren et al., 2020). The World Health Organization representative has also advised people to limit social media use during COVID-19 to minimize the chances of panic and mental health issues (World Health Organization [WHO], 2020). It has been noted that social media currently contains content about COVID-19 deaths, patient suffering, and even large numbers of coffins, which causes stress among social media users (Gao et al., 2020; World Health Organization [WHO], 2020). Conservation of resources theory also states that stressful situations threaten and deplete psychological resources, causing stress (Hobfoll, 1989; Hobfoll et al., 2018). It is proposed that excessive use of social media during the COVID-19 pandemic threatens and depletes employees' valuable resources, leading to stress and ultimately depression. Hence, the current study proposes:

> *H1: Problematic social media use during COVID-19 is positively linked to employee depression.*

Mediating Role of Fear of COVID-19

As the global death toll due to COIVD-19 continues to rise, many people fear catching COVID-19 (Montemurro, 2020). One of the

primary reasons behind this increased fear is the excessive use of social media. Social media platforms have become home to horrific and sometimes fallacious information related to COVID-19 (Islam et al., 2020). Social media users are spreading rumors, conspiracy theories, and even erroneous calculations of COVID-19 cases and deaths, which is spreading fear among the masses (Pennycook et al., 2020).

Another problem is the sharing of disturbing videos on social media in which nurses say goodbye to their families before leaving to treat COVID-19 patients, patient suffering, and coffins on trucks, which seems to enhance fear of COVID-19 (Li et al., 2020). Several other studies have also highlighted that fear of catching the infection is increasing with each coming day, which is linked to psychological health issues (Hong et al., 2020). Fear represents a less intense, smaller initial reaction to the stressor, which can become more severe and intense over time, leading to depression (Hobfoll et al., 2018). These negative outcomes occur due to continuous exposure to stressful news on social media, which steadily depletes personal resources. The extant research also suggests that continuous exposure to stressors consumes employee resources, leading to adverse outcomes that become more severe over time (Majeed and Fatima, 2020).

Fear of catching COVID-19 may be related to mental health issues (Mertens et al., 2020). According to recent studies, people who frequently use social media are more likely to develop a fear of COVID-19, which gives rise to depression, anxiety, and other mental health issues (Pennycook et al., 2020). Due to the severity of these issues, there has been a repeated call to study psychological and mental health problems during COVID-19. Many people are reporting symptoms of mental health problems (Zandifar and Badrfam, 2020). According to COR theory, this increase in mental health issues is due to the depletion of psychological resources (Hobfoll, 1989; Hobfoll et al., 2018). Problematic social media use is a stressor that threatens and depletes employee resources by developing a fear of COVID-19 among a workforce. This fear consumes employees and valuable resources and is linked to depression (Hobfoll, 1989; Hobfoll et al., 2018). Hence, the current study proposes:

> *H2: Fear of COVID-19 mediates the relationship between problematic social media use during COVID-19 and employee depression.*

Moderating Role of Mindfulness

While medical research on COVID-19 largely focuses on treatments and vaccinations, scholars have also started to raise awareness on maintaining psychological health during this challenging time (Qiu et al., 2020; Wang et al., 2020). The extant literature suggests that problematic social media use during the COVID-19 pandemic is associated with fear (Cinelli et al., 2020; Lum and Tambyah, 2020). This fear develops due to the spread of horrifying information related to COVID-19 (Cinelli et al., 2020; Lum and Tambyah, 2020; Pennycook et al., 2020). To combat a rapid increase in mental health problems, researchers have highlighted the importance of meditation and other mental strengthening activities to keep fear of COVID-19 away (Yanyu et al., 2020). Mindfulness is considered an important personal ability that may help people to avoid experiencing negative emotions (Conversano et al., 2020). An abundance of studies have highlighted the benefits of mindfulness (Donald et al., 2016; Huang et al., 2016; Pang and Ruch, 2019). For instance, a meta-analysis found that mindfulness is negatively related to negative emotions and positively associated with mental health among cancer survivors, as it enables them to suspend judgment and accept their current circumstances (Huang et al., 2016; Behan, 2020; Hedderman et al., 2020; Pecore, 2020). Recent studies have also shown that mindfulness interventions help employees to cope with negative emotions during the pandemic (Behan, 2020; Hedderman et al., 2020; Pecore, 2020). However, little is known about the benefits of trait mindfulness in minimizing negative emotions related to COVID-19 (Conversano et al., 2020). Hence, the current study investigates the role of trait mindfulness in reducing fear of COVID-19 due to problematic social media use. From a COR perspective (Hobfoll, 1989; Hobfoll et al., 2018), trait mindfulness acts as a useful resource that might prevent the depletion of resources due to stressors. Thus, it is proposed that highly mindful employees may experience less fear of COVID-19 due to problematic social media use. Hence, the current study proposes:

> *H3: Mindfulness moderates the relationship between problematic social media use and fear of COVID-19 in such a way that the relationship will be weaker in the case of higher mindfulness and strong in the case of lower mindfulness.*

The current study also proposes a moderated mediation model (Preacher et al., 2007) with a conditional indirect effect on employees' problematic social media use or depression through fear of COVID-19. Highly mindful employees may be less likely to experience fear despite problematic social media use. Thus, they should be less vulnerable to depression than those who are less mindful. In this way, mindfulness acts as a resource and potential buffer, which might help employees to gain new resources and reduce resource depletion in response to external stressors. The current study proposes that highly mindful employees may experience less fear and depression resulting from problematic social media use during COVID-19. Hence, the present study proposes:

> *H4: Mindfulness moderates the indirect effect of problematic social media use during COVID-19 on employee depression via fear of COVID-19 in such a way that the indirect effect will be weaker in the case of high mindfulness and stronger in the case of lower mindfulness.*

MATERIALS AND METHODS

Sample and Procedure

The current study is quantitative. Physical contact with respondents was not possible due to the COVID-19 lockdown restrictions; therefore, all respondents were contacted online. Furthermore, only currently working employees were considered for participation in the study. This study followed the CHEERIES

checklist for e-surveys and the STROBE checklist for time-lagged studies. The researchers' institutional review board approved the study. Data for all variables were self-reported, which enhances the risk of common method bias. To minimize common method bias in these self-report measures, the data were collected in three time lags with a minimum gap of 7 days between each lag, in line with the recommendations of Podsakoff et al. (2012). Multiple studies have collected time-lagged data to minimize common method bias (Irshad et al., 2020; Majeed and Fatima, 2020). The number of COVID-19 cases in Pakistan was increasing throughout the data collection process and the interval between lags was not that long. Hence, we assumed that there would not be a significant variation in social media use across different lags. Furthermore, we did not find any significant statistical differences in demographic characteristics across the three time lags.

Pakistan reported its first COVID-19 case on February 26, 2020 (Shahid, 2020). The country's COVID-19 cases began steadily increasing on March 11 (Malik, 2020). The data collection process began on March 20, 2020, and ended on April 23, 2020. A total of 1,865 confirmed cases of COVID-19 had been reported by the end of March, of which 26 patients died (Government of Pakistan, 2020). The virus was spreading fast during the data collection process, with the total number of cases reaching 4,000 on April 7, 2020, and 10,000 on April 22, 2020 (Government of Pakistan, 2020). During the data collection process, the country was in lockdown due to the sudden increase in COVID-19 patients (Shehzad, 2020). According to the official government website on COVID-19 patients in Pakistan, roughly 1,700 confirmed cases were reported in Pakistan between March 23, 2020, and April 25, 2020 (Government of Pakistan, 2020). Pakistan's nationwide lockdown during the data collection process affected all employees equally, with more than 90% of organizations bound to work from home.

We used a non-probability convenience sampling technique for data collection as the total population of employed individuals in Pakistan is unknown. The authors collected the email addresses of employees working in different organizations through personal contacts and organizations' official websites. Data were collected from 12 organizations, seven of which were universities, whereas the remaining 5 were in the IT field. Informed consent was obtained from the respondents before participation. The informed consent form explicitly mentioned that participation is voluntary and described the purpose of the study. Although no monetary benefit was given to the participants, they were promised that the survey results would be shared with them upon request. The survey was open enrollment; anyone with the survey URL could participate. We used Google Forms to implement the survey. The authors emailed the informed consent form to potential respondents. The informed consent form contained the study's purpose and participation criterion along with the URL for Time 1. Email recipients were invited to participate in the study if they met the inclusion criterion. The researchers emailed the URL for Time 2 after a gap of 7 days to all employees who had responded at Time 1. The researchers emailed the URL for Time 3 to employees who had responded at Times 1 and 2. Respondents were able to review their responses before submitting the questionnaire. In accordance with the instructions provided in the CHEERIES checklist for conducting e-surveys, only one response was allowed per email address. This restriction was applied to avoid receiving more than one response from the same respondent. The minimum time required to complete the survey at Time 1 was 10 min, whereas the survey at Time 2 required 4 min, and the survey at Time 3 required a minimum of 6 min.

As the study was time-lagged, the scales were presented in sequence. At Time 1, respondents were asked to provide data on demographics, problematic social media use, and mindfulness. Fear of COVID-19 was measured at Time 2, and employee depression was measured at Time 3. During all three time lags, the respondents were asked whether or not they had contracted COVID-19. The survey comprised three parts: (i) an informed consent form explaining the purpose of the research and ensuring the anonymity of responses; (ii) demographic variables like age, gender, education, and work experience; and (iii) study variables as per the hypothesized model. The inclusion criteria were listed in the informed consent form. Respondents were asked to complete the survey only if they (i) were employed and currently working from home, (ii) had experienced no depressive symptoms or mental health issues before COVID-19, and (iii) had an active social media account.

Twenty-five respondents were in the high-risk group as they were aged 50 and above, but none reported being infected with COVID-19. The confidentiality of the data was fully maintained. The data file was saved in a password-protected folder to which only researchers had access. We assigned a unique I.D. to each respondent and used it to match responses during all three time lags to ensure the anonymity of respondents. We ensured that their responses would be kept confidential and would only be used for the purposes of the study. Three hundred and forty-seven respondents completed the first wave of the study. At Time 2, the 347 employees were contacted again to provide data about their fear of COVID-19, and 312 respondents provided data at Time 2. Finally, these 312 respondents were asked to fill in the questionnaire about depression at Time 3, and 267 responded. These 267 responses were included in the final analysis of the hypothesized model. Thus, the final response rate was 66.7%. The final sample size for all three waves of data collection contained no missing values.

G*Power (version 3.1.9.4) designed by Faul et al. (2009) was employed to assess the sample's adequacy. The G*Power version 3.1.9.4 has a default value of 0.02 for small effect size, 0.15 for medium effect size, and 0.35 for large effect size, in effect size conventions. For calculating sample size, we selected the *F* test from the test family and selected a statistical test named "Linear multiple regression: Fixed model R2 deviation from zero" from the drop-down menu as recommended by Faul et al. (2009). The number of predictors was set to 3. The default parameters were used (i.e., the medium effect size of 0.15, α level = 0.05, high power of 0.95, number of predictors set to 3) as recommended by Faul et al. (2009). The results revealed an *a priori* sample size of 117 respondents, which is lower than this study's actual sample size. Subsequently, a *post hoc* power analysis was computed with the same parameters to calculate the power of the collected data (N = 267). The power value

TABLE 1 | Respondent characteristics.

Variable	Frequency	Percentage
Gender		
Male	177	66
Female	90	34
Age		
21–30 years	108	40.4
31–40 years	80	30
41–50 years	54	20.2
50 and Above	25	9.4
Education		
Below Bachelor	20	7.5
Bachelor	82	30.7
Masters and above	165	61.8
Experience		
Less than 1 year	70	26.2
1–3 years	100	37.5
3–5 years	43	16.1
5–7 years	34	12.7
7 and above	20	7.5

N = 267.

was 0.99, which is greater than the recommended cutoff value of 0.80 (Cohen, 1992). Based on these *a priori* and *post hoc* analyses, our sample size of 267 is appropriate for testing the proposed model.

The current study is time-lagged, which has the drawback of a lower response rate, as this design requires researchers to approach respondents more than once and most respondents fail to respond at all time lags. Several other time-lagged studies have also shown a very low response rate. For instance, a study in which data was collected in two waves showed a response rate of 49%, only as 162 out of 320 respondents filled in the survey at both time lags (For reference, see Fallman et al., 2019). In a similar time-lagged study conducted with nurses, the response rate dropped from 80% at Time 1 to 43% at Time 2 (Laschinger and Finegan, 2008). The relatively low response rate in the present study is also consistent with the response rate in previous time-lagged studies on COVID-19 in Pakistan (Irshad et al., 2020).

Of the final 267 respondents, 177 were male and 90 were female. 70% of respondents were aged 21–40 years old. 92% had bachelor's degrees or higher. 63.7% had less than three years of work experience, while the remaining 36.3% had more than 3 years of work experience (see **Table 1**).

Instruments

The questionnaires were adapted and distributed in the English language. The vast majority of employees in Pakistan speak English well (Irshad et al., 2020). Earlier studies have also collected data in English and did not face any language-related issues (e.g., Fatima et al., 2020). The items in each scale were presented sequentially.

Problematic Social Media Use

Problematic social media use was measured with a 6-item scale adapted from a previously published source (Andreassen et al., 2012). The scale was constructed using the Bergen Facebook Addiction Scale (BFAS), which contained 18 items on six dimensions, namely salience, relapse, conflict, mood modification, tolerance, and withdrawal. Andreassen et al. (2012) condensed this down to a final six items, one for each dimension, based on high corrected item-total correlations. The final scale used in this study was a unidimensional scale. Each question was answered on a 5-point Likert scale ranging from very rarely (1) to very often (5). The wording of the items was modified to capture social media use during COVID-19. For example: "During COVID-19, how often did you feel an urge to use social media more and more?". The scale's Cronbach's alpha was found to be satisfactory, at 0.83. Other researchers have also used this 6-item scale to measure problematic social media use (Shensa et al., 2017; Kircaburun et al., 2018; Worsley et al., 2018).

Fear of COVID-19

Fear of COVID-19 was measured using a 7-item scale recently developed by Ahorsu et al. (2020). Ratings were given on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). A sample item is "I am most afraid of COVID-19 " and "My heart races or palpitates when I think about getting COVID-19." The measure's Cronbach's alpha was found to be satisfactory, at 0.84.

Mindfulness

The 15-item Mindful Attention and Awareness Scale (MAAS) developed by Brown and Ryan (2003) was used to measure employees' mindfulness. In the current study, mindfulness is taken as a trait and considered a personal resource. Respondents were asked to rate statements based on a five-point Likert scale ranging from 1 (almost always) to 5 (almost never). A sample item is "I find it difficult to stay focused on what's happening in the present" (reverse-coded). Cronbach's alpha was found to be satisfactory, at 0.94. Other studies have also used the Mindful Attention and Awareness Scale (MAAS) to measure employees' mindfulness (e.g., Hülsheger et al., 2013).

Depression

Depression was measured using the brief 9-item Patient Health Questionnaire PHQ-9 developed by Kroenke et al. (2001). The statements were adapted to the context of COVID-19 by asking respondents to rate their depressive symptoms during COVID-19. This variable was measured on a 5-point Likert scale ranging from very rarely (1) to very often (5). A sample item is "Feeling down, depressed, or hopeless." Cronbach's alpha for the scale was satisfactory, at 0.86.

Another recent study also used the Patient Health Questionnaire PHQ-9 with a 5-point Likert scale format to measure depression (e.g., Hong et al., 2020). **Table 2** shows the prevalence and severity of depression among respondents. The cutoff value for a 5-point Likert scale ranging from 1 to 5 is equivalent to the cutoff criteria for a 5-point Likert scale ranging from 0 to 4 based on percentages. The cutoff

TABLE 2 | Prevalence rates of depressive syndromes.

	No. of respondents	Percentage
Minimal 1–7	0	0
Mild 8–15	8	3.00
Moderate 16–23	51	19.10
Moderately Severe 24–32	114	42.69
Severe 33–45	94	35.21

N = 267, PHQ-9 scores on 5 point Likert scale.

criteria provide different ranges for minimal (1–7), mild (8–15), moderate (16–23), moderately severe (24–32), and severe depression (33–45).

Data Analysis

The Statistical Package for Social Sciences (SPSS) Research Version 21, Process macro by Hayes plugin extension, and AMOS Version 21 were used for data analysis. We confirmed that the data fulfilled all regression assumptions, including linearity, normality, homoscedasticity, multicollinearity, and autocorrelation, before testing the proposed hypotheses. The data was found to be linear, and the error terms were homogenous. Likewise, multicollinearity is not an issue that affects our data because all correlations were well below the cutoff value of 0.70. Additionally, the variance inflation factors (VIF) for all variables were well below the cutoff value of 10 (Myers and Myers, 1990), and all tolerance values lay above the threshold value of 0.2 (Menard, 1995). We also conducted a Durbin-Watson test to confirm that there were no issues regarding autocorrelation. The rule of thumb is that a value of less than 3 but greater than 1 indicates no problems concerning independence of error (Field, 2009, p. 221). In our data, the Durbin-Watson test value is 2.24, which is within the acceptable range. The skewness and kurtosis values for all variables ranged between −1 and +1, the cutoff criteria (Blanca et al., 2013). The skewness values were −0.58 for problematic social media use, −0.69 for fear of COVID-19, −0.22 for depression, and −0.35 for mindfulness. The kurtosis values were −0.21 for problematic social media use, 0.01 for fear of COVID-19, −0.64 for depression, and −0.90 for mindfulness.

The analysis for regression assumptions, means, standard deviations, analysis of variance, correlations, reliability coefficients, and demographic frequency distributions were all conducted using SPSS. Confirmatory factor analysis (CFA) was conducted using AMOS. We used the maximum likelihood method (ML) for estimating parameters in the CFA model. Researchers recommend ML for social sciences research involving Likert scales (Bai and Li, 2016).

The factor loadings for each variable were checked to confirm the convergent validity of the study variables. The factor loadings were greater than 0.4 for all items, which shows that the items load strongly on their respective latent variable. The average variance extracted (AVE), maximum shared variance (MSV), and composite reliability (CR) were calculated to test discriminant validity. Additionally, a four-factor CFA was conducted to further confirm the discriminant validity. For this purpose, we examined the values of model fit indices, including model chi-square (χ^2), degrees of freedom (df), comparative fit index (CFI), incremental fit index (IFI), Tucker Lewis index (TLI), and the root mean square error of approximation (RMSEA).

Model 7 of the Process macro was used to test the moderated mediation model. The number of bootstrapped samples was set to 5,000, and a 95% confidence interval was specified. The current study utilized a bias-corrected method for constructing confidence intervals.

Confirmatory Factor Analysis

In line with Anderson and Gerbing's (1988) recommendation, several CFA tests were also performed to analyze whether the responses matched the hypothesized four-factor model. The results of the CFA are provided in **Table 3**. For this purpose, five different three-factor models were analyzed by loading the items for two variables onto a single factor. Then, two-factor models were analyzed by loading all the items onto two factors. Finally, the one-factor model was tested by loading all the items onto a single factor. Comparing the results of these three, two, and one-factor models to the four-factor model, the four-factor model yielded better fit indexes, $\chi 2 = 1064$, $df = 623$, $\chi 2/df = 1.70$, $p < 05$, $CFI = 0.90$, $TLI = 0.90$, $IFI = 0.90$, $RMSEA = 0.05$, all of which are in the acceptable range of model fitness criteria (Hair et al., 2014). The standardized root mean square residual (SRMR) value for the four-factor model is 0.05, which is lower than the cutoff value of.08, thus indicating a good fit (Hu and Bentler, 1999). RMSEA for the four-factor model is.05. Its lower 90% confidence interval (CI) is 0.04 and upper 90% confidence interval (CI) is 0.05, whereas $P = 0.30$. The p-value for the close-fitting model is insignificant ($p > 0.05$). The four-factor model yielded better model fit indices compared to the one-factor model. Different alternative models were also tested to check whether the respondents were able to distinguish the different variables from one another. The alternative models showed poorer model fit indices than the hypothesized four-factor model, confirming discriminant validity.

RESULTS

Correlation Analysis

Table 4 provides the results for descriptive statistics, average variance extracted (AVE), maximum shared variance (MSV), composite reliabilities (CR), and correlations among the variables of this study. Before computing the correlations, an analysis of variance (ANOVA) test was performed to check the variance in depression and fear of COVID-19 due to demographic variables, i.e., gender, age, education, and experience. ANOVA results for all the demographic variables were found to be non-significant; thus, the demographics relating to respondents were excluded from all further analyses, except the correlation analysis. The problematic use of social media by employees during COVID-19 is significantly correlated with fear of COVID-19 ($r = 0.38$, $p < 0.01$) and depression ($r = 0.41$, $p < 0.01$). Fear of COVID-19 also has a significant positive correlation with employee depression ($r = 0.45$, $p < 0.01$). The mindfulness of employees was found to be significantly negatively correlated with problematic social media use during COVID-19 ($r = -0.22$, $p < 0.01$), fear of COVID-19 ($r = -0.27$, $p < 0.01$), and depression ($r = -0.12$,

TABLE 3 | Confirmatory factor analysis and alternative models

Model	χ^2	df	χ^2/df	CFI	TLI	IFI	SRMR	RMSEA
Hypothesized four factors Model (PSMU, FOC, DEP and M)	**1064**	**623**	**1.70**	**0.90**	**0.90**	**0.90**	**0.05**	**0.05**
One factor (Combine all variables into one factor)	2921	629	4.64	0.51	0.48	0.51	0.15	0.12
Two factor (Combine "PSMU and EM" and " FOC and DEP")	1952	628	3.11	0.71	0.70	0.72	0.11	0.09
Two factor (Combine "SMU and FOC" and " EM and DEP")	2270	628	3.61	0.65	0.63	0.65	0.13	0.10
Three factor (Combine PSMU and EM)	1622	626	2.59	0.78	0.77	0.79	0.10	0.08
Three factor (Combine FOC and DEP)	1394	626	2.22	0.83	0.82	0.83	0.08	0.07
Three factor (Combine PSMU and FOC)	1421	626	2.71	0.83	0.82	0.83	0.06	0.07
Three factor (Combine PSMU and DEP)	1434	626	2.91	0.82	0.81	0.83	0.07	0.07
Three factor (Combine EM and FOC)	1621	626	2.59	0.78	0.77	0.79	0.11	0.08

N = 267. PSMU, Problematic Social Media Use during COVID-19; EM, Employee Mindfulness; FOC, Fear of COVID-19; DEP, Employee Depression. Model fit indices for hypothesized model are given in bold.

TABLE 4 | Reliabilities, convergent and discriminant validity, descriptive statistics and intercorrelations.

S. N	Variable	*M*	*SD*	AVE	MSV	CR	1	2	3	4	5	6	7
1	PSMU	3.53	0.80	0.54	0.09	0.81							
2	FOC	3.46	0.76	0.51	0.21	0.84	0.38**						
3	DEP	3.23	0.76	0.52	0.20	0.86	0.41**	0.45**					
4	EM	3.22	0.86	0.59	0.16	0.94	−0.22**	−0.27**	−0.12**				
5	Gender	–	–	–	–	–	0.04	0.09	0.01	0.05			
6	Age	–	–	–	–	–	0.01	0.07	0.09	−0.07	−0.02		
7	Experience	–	–	–	–	–	0.00	0.07	0.15*	−0.01	0.12**	0.45**	
8	Education	–	–	–	–	–	0.09	−0.02	0.03	0.01	−0.05	0.11	0.30**

*N = 267; *p < 0.05, **p < 0.01. PSMU, Problematic Social Media Use during COVID-19; FOC, Fear of COVID-19; DEP, Employee Depression; EM, Employee Mindfulness; M, mean; SD, standard deviation; AVE, average variance extracted; MSV, maximum shared variance; CR, composite reliability.*

$p < 0.05$). AVE scores for all variables were greater than 0.50 and lower than the CR, hence establishing convergent validity. Moreover, the AVE scores for all study variables were greater than the MSV scores, thus establishing discriminant validity.

Hypothesis Testing

Table 5 provides the results for the direct, mediation, moderation, and moderated mediation hypotheses. Hayes (2017) Model 7 of the PROCESS macro was employed to test the hypothesized model. In line with Hypothesis 1, employees' problematic social media use during COVID-19 was significantly associated with depression ($\beta = 0.26$, $p < 0.01$); thus, the H1 of the study was accepted. Furthermore, problematic social media use during COVID-19 was significantly associated with fear of COVID-19 ($\beta = 0.37$, $p < 0.01$), and fear of COVID-19 was significantly associated with depression ($\beta = 0.34$, $p < 0.01$). The results for the indirect effects confirm the significant mediating role of fear of COVID-19 in the relationship between problematic social media use during COVID-19 and depression (*indirect effect* = 0.12, 95% *CI* with *LL* = 0.07 and *UL* = 0.20). The lower and upper limits of the 95% confidence interval both contain non-zero values. Hence, H2 is also accepted.

Before testing Hypothesis 3, on problematic social media use during COVID-19 and mindfulness were mean-centered by employing Model 7 of Hayes (2017) Process macro, thus following Aiken et al. (1991) recommendation for testing moderations. The interaction effect of mindfulness and problematic social media use during COVID-19 on fear of COVID-19 was found to be negative and significant ($\beta = -0.15$, $p < 0.01$). The moderation graph in **Figure 2** shows that mindfulness weakens the relationship between problematic social media use during COVID-19 and fear of COVID-19. Hence, H3 is also supported.

Table 5 also presents results for the conditional indirect effect of employees' problematic social media use during COVID-19 on depression via fear of COVID-19 at high and low values (±1 *SD* from mean) of mindfulness. The indirect effect of problematic social media use during COVID-19 on depression through fear of COVID-19 weakened at a high level of mindfulness (+1 *SD* from the mean; $\beta = 0.07$, *LL 95% CI* = 0.02, *U.L. 95% CI* = 0.16), but grew stronger at a low level of mindfulness (−1 *SD* from the mean; $\beta = 0.17$, *LL 95% CI* = 0.10, *UL 95% CI* = 0.25). Additionally, the negative and significant moderated mediation index (*Index* = −0.05, *LL95% CI* = −0.11, *UL95% CI* = −0.02) indicates that mindfulness significantly moderates the indirect effect of problematic social media use during COVID-19 on employee depression via fear of COVID-19. Hence, H4 of the study was also strongly supported by the results.

Table 6 contains a summary of the results for all proposed hypotheses.

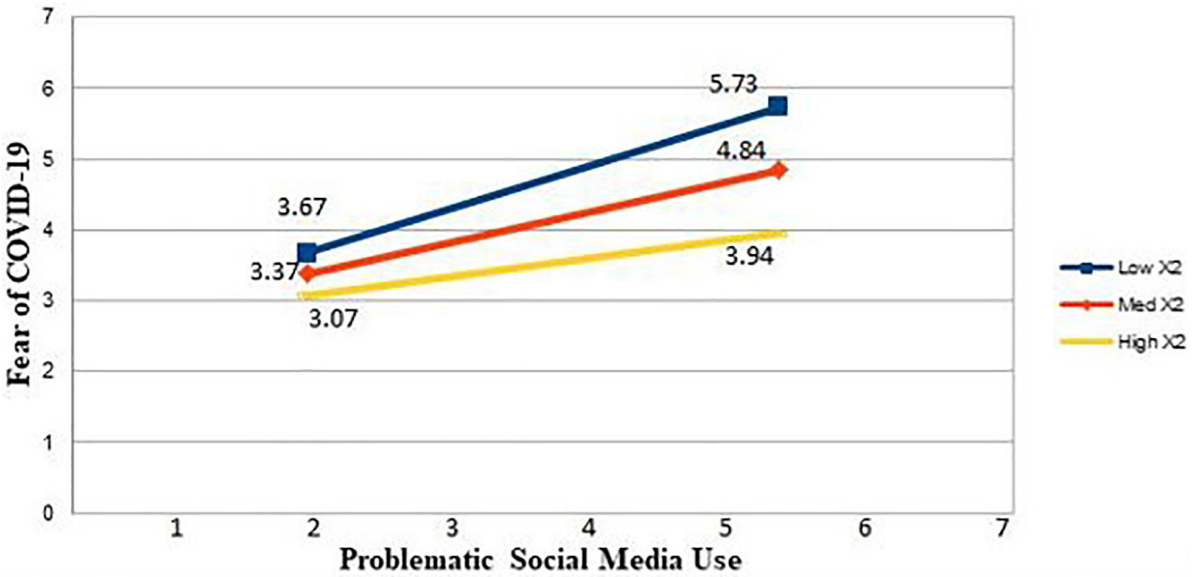

FIGURE 2 | Employee mindfulness as a moderator in the relationship between problematic social media use and fear of COVID-19.

TABLE 5 | Conditional process analysis.

	Unstandardizedβ	SE	LLCI	ULCI
Mediator variable model				
PSMU → FOC	0.37**	0.06	0.25	0.48
EM → FOC	−0.15**	0.05	−0.25	−0.10
PSMU x EM → FOC	−0.15**	0.06	−0.27	−0.10
Dependent variable model				
FOC → DEP	0.34**	0.06	0.22	44
PSMU → FOC	0.26**	0.05	0.15	0.36
Indirect effect				
PSMU → FOC → DEP	0.12*	0.03	0.07	0.20
Conditional indirect effect (s) of PSMU on DEP through FOC at values of E.M. Mean, ±1 SD				
	Effect	**Boot SE**	**Boot LLCI**	**Boot ULCI**
EM Low -1 SD (2.35)	0.17	0.04	0.10	0.25
EM Mean (3.22)	0.12	0.03	0.07	0.20
EM High + 1 SD (4.09)	0.07	0.03	0.02	0.16
Index of Moderated Mediation	−0.05	02	−0.11	−0.02

*N = 267, Model 7 results, Bootstrap = 5000, 95% confidence interval. *p < 0.05, **p < 0.01. LL, lower limit; UL, upper limit; SE, standard error. Boot, Bootstrap; PSMU, Problematic Social Media Use during COVID-19; EM, Employee Mindfulness; FOC, Fear of COVID-19; DEP, Employee Depression.*

TABLE 6 | Summary of hypothesis results.

H. No	Hypothesis	Support
H1	Problematic social media use during COVID-19 is positively linked to employee depression.	Supported
H2	Fear of COVID-19 mediates the relationship between problematic social media use during COVID-19 and employee depression.	Supported
H3	Employee mindfulness moderates the relationship between problematic social media use and fear of COVID-19 such that the relationship will be weaker in the case of higher employee mindfulness and strong in case of lower employee mindfulness.	Supported
H4	Employee mindfulness moderates the indirect effect of problematic social media use during COVID-19 on employee depression via fear of COVID-19 such that the indirect effect will be weaker in case of high mindfulness and stronger in case of lower mindfulness.	Supported

DISCUSSION

Despite the potential drawbacks of problematic social media use during COVID-19, there is little research on its association with adverse psychological outcomes, particularly mental health issues, among employees (Pennycook et al., 2020; Zandifar and Badrfam, 2020). The current study aimed to extend research on the negative mental health issues related to COVID-19 by testing a moderated mediation model of problematic social media use and its outcomes. The first objective of the study was to test the association between problematic social media use during COVID-19 and depression among employees. The results supported the first hypothesis by showing that problematic social media use during COVID-19 is strongly associated with an increase in depression among employees (Lum and Tambyah, 2020; Ren et al., 2020). The study's second aim was to investigate the mediating role of fear of COVID-19 in the relationship between excessive social media use and depression. The results supported our hypothesis that excessive use of social media during COVID-19 is related to fear of COVID-19 among employees, and that fear of COVID-19 is associated with depression. Existing studies also support these results (Li et al., 2020). For instance, several studies found that social media use led to terror and panic during the COVID-19 outbreak (Gao et al., 2020). Prior studies have also found an association between social media use and mental health issues, such as anxiety and depression (Primack et al., 2017; Jasso-Medrano and Lopez-Rosales, 2018; Van der Velden et al., 2019). Similarly, fear of COVID-19 has been linked to severe mental health issues (Ren et al., 2020).

This study further tested the moderating role of mindfulness on the relationship between problematic social media use and fear of COVID-19, and the conditional indirect effect of problematic social media use on employee depression via fear of COVID-19 when mindfulness is high vs. low. The data supported the moderation and moderated mediation hypotheses. This shows that employees with a higher level of mindfulness experience less fear of COVID-19 despite excessive social media use. Hence, they also report experiencing a lower level of depression than employees with a lower level of mindfulness. A few existing studies have come to similar results (Hong et al., 2020). For instance, studies have shown that mindfulness decreases negative emotions experienced during COVID-19 (Conversano et al., 2020). Similarly, there are an abundance of studies on the benefits of mindfulness for mental health (Donald et al., 2016; Huang et al., 2016; Pang and Ruch, 2019).

Despite the potential benefits of social media, problematic use is associated with a chain of negative outcomes that gain momentum over time, ultimately leading to serious outcomes. This study investigated the negative outcomes associated with problematic social media use in the context of a life-threatening pandemic. The study also introduced mindfulness as an important trait to help in dealing with external stressors. This study suggests that employees should refrain from excessive social media use due to its association with negative health outcomes. The study results support the conservation of resources theory in the context of the pandemic by supporting the notion that stressors like excessive and problematic social media use act as a threat to employee resources and are therefore associated with negative outcomes like fear. These negative outcomes then gain momentum and magnitude, and could ultimately take the form of more intense and negative outcomes such as depression. However, personal resources like mindfulness may help employees and protect valuable resources after exposure to such stressors and assist in further resource gains.

Theoretical Implications

The current study adds to the limited body of knowledge on the psychological outcomes of COVID-19. The use of social media has risen since the onset of the COVID-19 epidemic, and this study showed that problematic social media use during COVID-19 is linked to negative emotional and mental health outcomes. Thus, this study responds to the call for research on the antecedents and consequences of fear of COVID-19. It further contributes to ongoing scholarly discussion that the fear associated with COVID-19 is linked to mental health issues by studying excessive social media use during COVID-19. Additionally, this study identifies trait mindfulness as a useful personal resource by demonstrating that it may help employees to control their fear of COVID-19. Another contribution of this study is that it shines a spotlight on factors linked to depression among employees during the current pandemic. This needs to be addressed quickly, as mental health issues might impede progress and can adversely affect the overall operations of an organization.

Practical Implications

This study also offers important insights that may have implications for practitioners. Managers could recruit a mental health professional to offer free-of-cost consultations to employees. These consultations may also be provided online, as it is still not safe to meet in person due to the high risk of infection. This could help in resolving employees' mental health issues. Managers could also increase employees' awareness about COVID-19, particularly its symptoms and preventive measures so that they are not misled by the misinformation available on social media. One way of doing this is to share research and reports from credible resources on employee email or WhatsApp groups, as accurate information can bust many of the myths linked to COVID-19 and reduce employees' fear of getting COVID-19. Managers could also conduct regular mindfulness training sessions for their employees, as mindfulness is linked to not only reduced fear of COVID-19 but also lower symptoms of depression and various other mental health issues. Mindfulness training experts could be hired to provide online sessions to employees in their homes.

The findings of the current study could also have implications for policymakers. Policymakers may start campaigns to enhance public awareness of the potential drawbacks of excessive social media use. Government authorities may also wish to create official pages on different social media platforms where people can get accurate information on COVID-19.

Limitations and Future Research Directions

The current study should be seen in light of its limitations. It investigated the problematic use of social media as a whole rather than the use of any specific platform. Future studies may collect data on the use of specific platforms and their comparative impact on the mental health of users, as each platform has a different user base. This study did not investigate differences in fear of COVID-19 between employees working from home and the office during the lockdown. Multiple organizations required their employees to continue working from the office, including banks and telecom firms. It would be worth studying the difference in fear of catching infection among employees working from home and working from the office in future studies. As another limitation, the scale used to measure problematic social media use did not include the option "Never," even though some participants might have never "felt an urge to use social media more and more." Thus, future studies should use a scale containing the "Never" option.

The data of the current study were collected at three different time lags to address common method bias, but this method also has its drawbacks. First, respondents' social media use, fear of COVID-19, and depression may vary across different time lags. Future studies may wish to collect data for all the variables at all three time lags to compare variations in social media and depression at different time points. Furthermore, this study only highlighted one mental health outcome linked to problematic social media use and fear of COVID-19, namely depression. Future studies might also test for the association between problematic social media use and other psychological health outcomes, such as anxiety, hypertension, and negative emotions, etc. It would also be fruitful to study the link between mental well-being and problematic social media use during COVID-19. This study identified only one dispositional resource, namely mindfulness, which weakens the negative association between problematic social media use during COVID-19 and fear of COVID-19. Future studies might also introduce other personal and situational resources linked to reduced negativity during COVID-19. For instance, it would be useful to test the moderating role of psychological capital, self-efficacy, and family support. Finally, this study only collected data from currently employed individuals, excluding unemployed individuals. Future studies might also seek to collect data from students and unemployed individuals, especially those who lost their job during the pandemic.

Another limitation of this study is the modification of the rating scale for measuring depression. The original scale for depression ranged from 0 and 4; we modified it to have a 1–5 range to maintain a uniform scale for all of the other variables, which were measured on five-point Likert scales ranging from 1 to 5. The Patient Health Questionnaire (PHQ-9) scale for measuring depression severity makes it possible to calculate the prevalence of minimal to severe depression. The cut-off values for minimal to severe depression for the 5-point Likert scale we used might differ slightly from the original measure. This is a potential limitation that could affect the results for depression severity. Future studies might therefore wish to use the original PHQ-9 scale to measure depression.

CONCLUSION

COVID-19 is reducing humanity's economic, physical, social, and now psychological resources. The novel coronavirus continues to infect people worldwide, with the WHO issuing a recent warning that this pandemic is not over and the world will have to face more devastating outcomes. Although social media can help us stay connected with the world in this time of isolation, it is very important to ensure its moderate and controlled use to avoid spreading fear of COVID-19 and prevent further depressive symptoms in people. Building and maintaining psychological and mental health is crucial for preventing adverse outcomes linked to problematic social media use during COVID-19. Mindfulness practices might help in relaxing tension in a difficult environment and may also help in strengthening people's mental ability to deal with the fear of COVID-19 and other mental health issues.

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 departmental Ethics Approval Committee at The University of Lahore (UOL). The Faculty of Management Sciences, Lahore Business School UOL Research Ethics Board, reviewed "Detrimental Health Outcomes of Social Media Usage during COVID-19 Outbreak: The Moderating Role of Mindfulness" research proposal and considers the procedures, as described by the applicant, to conform to the University's ethical standards and university guidelines. Moreover, the participation in the survey was voluntary, and study participants were first explained about the details of the project. It was assured to them that their responses will be kept in strict anonymity and will be reported as aggregate results. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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Framing Messages to Deal With the COVID-19 Crisis: The Role of Loss/Gain Frames and Content

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The goal of this study was to test the role of message framing for effective communication of self-care behaviors in the context of the COVID-19 pandemic, contrasting health and economic-focused messages. We presented 319 participants with an unforced choice task where they had to select the message that they believed was more effective to increase intentions toward self-care behaviors, motivate self-care behaviors in others, increase perceived risk and enhance perceived message strength. Results showed that gain-frame health messages increased intention to adopt self-care behaviors and were judged to be stronger. Loss-framed health messages increased risk perception. When judging effectiveness for others, participants believed other people would be more sensitive to messages with an economic focus. These results can be used by governments to guide communication for the prevention of COVID-19 contagion in the media and social networks, where time and space for communicating information are limited.

Keywords: framing effects, health communication, COVID-19, risk perception, behavioral science

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INTRODUCTION

The pandemic caused by the novel coronavirus COVID-19 (World Health Organization [WHO], 2020a) during 2020, has resulted in hundreds of thousands of deaths around the world, and has consequently led governments to take extraordinary measures to face it. The development and commercialization of a vaccine for COVID-19 will be a long and expensive process. The cost of developing a vaccine for an infectious disease is estimated to be between 1.2 and 8.4 billion dollars (Gouglas et al., 2018), and the process to produce a licensed vaccine typically takes many years (Lurie et al., 2020). Therefore behavioral change and modification (i.e., hand washing, physical distance and staying home) is one of the main strategies to manage the pandemic (World Health Organization [WHO], 2020b). Governments have encouraged the population to adopt these behaviors through messages in mass media and social networks, hoping people would develop new habits and in doing so help reduce or postpone the number of contagions and the strain on health systems.

Behavioral economics has shown that using gain-loss frames to communicate information impacts decision making, risk perception, and behavioral intention (Kahneman, 2003). In the context of health communication, gain-framed messages emphasize the benefits or the positive outcomes that are accrued through adopting the behavior. On the other hand, loss-framed messages attempt to persuade by pointing at the negative consequences or costs incurred by not adopting

the recommended behavior (Rothman and Salovey, 1997). Research in this field has found that, for example, gain-framed messages are more effective in motivating healthy eating behaviors (Roberto and Kawachi, 2014), while loss-framed messages are more effective to motivate breast self-examination (Williams et al., 2001) and to quit smoking (Nan et al., 2015).

Recently, several systematic and theoretical reviews have been conducted to propose how behavioral sciences could contribute to managing the COVID-19 outbreak (Lunn et al., 2020a; Van Bavel et al., 2020). However, the empirical evidence is scarce. Lunn et al. (2020b) used negative-framed messages to effectively motivate social distancing in Ireland. However, this study aimed to identify effects of communication strategies already implemented. So far there have been no studies to systematically identify the characteristics and structure that messages should have in order to effectively motivate population to change or adopt new behaviors such as frequent hand washing and physical distancing.

It is also plausible that cultural variation can play a role in the impact of these messages. We foresee two dimensions along which cultural differences could emerge. First, focusing on a particular content and/or frame might be more or less effective depending on particular countries and communities. Many citizens and national governments around the world have expressed concerns about the economic impact of public health measures implemented (McKee and Stuckler, 2020). Some even ponder whether the public health measures centered around stringent lockdowns could result in even worse consequences due to the psychological and economic consequences of unemployment, bankruptcies and social isolation (Singer and Plant, 2020; Tankersley, 2020). An open question is whether the public is also sensitive to these concerns and whether its effect would interact with a loss/gain frame. This question is especially relevant for societies where economies are more fragile and thus their citizens are more likely to be more responsive to economic concerns.

Second, personal and injunctive norms vary greatly between societies. Injunctive norms refer to perceptions of what others approve or encourage and have been shown to be closely related to personal intentions (Ball et al., 2010; Smith et al., 2012). There is evidence that misperception or underestimation of these social norms has an impact on engaging in behaviors falsely believed to be common or accepted in a group or community. Research and interventions based on social norms has mostly been done on alcohol and substance abuse related behaviors (McAlaney et al., 2011), but we believe it offers an interesting tool in the context of COVID-19. By identifying and assessing the gap between what one believes would be a good message for oneself versus others in one's context, not only makes it possible to map out the extent of the misperception but also to intervene to correct it (Dempsey et al., 2018).

The objective of the present study was thus to evaluate the impact of gain-loss frames and the content of the message (health/economy) on self-reported motivation to engage in self-care behaviors (i.e., hand washing, physical distance, and staying home), engage others in the same self-care behaviors, risk perception of contagion and perceived message strength. The results of this study will help policy makers to design more effective messages to mitigate the impact of COVID-19.

In line with this objective and previous research, we expected that gain-frames were more effective to motivate low-risk behaviors (i.e., hand washing) while loss-frames were more effective to motivate high-risk behaviors like staying at home, because for many this latter behavior jeopardizes employment. Thus, the effectiveness of the message depends both on the content (economic versus health) and the frame (low risk behaviors might be more effectively framed as gains while high cost behaviors could be better framed as losses). The preregistration, hypotheses, analysis plan, materials, raw data, and scripts for analysis are available online at the Open Science Framework[1], in line with best practice in reproducible science.

MATERIALS AND METHODS

Participants

A convenience sample of 319 subjects (69.9% female, 30.1% male), ranging from 18 to 60 years of age (M = 27.01, SD = 9.37) participated in the study. Participants were originally contacted through student's university mailing lists from different faculties (e.g., social sciences, engineering, medicine, basic sciences, among others) and from one to final year, and through Facebook postings, where a short description of the study was included. Our sample comprised participants from the main cities in Colombia, all native Spanish speakers.

The sample was divided randomly into two groups: Frame message group (gain/loss) (n = 160) and Content message group (economy/health) (n = 159). Sample size was decided based on *a priori* power analysis for a crossed random effects design, assuming a power of d = 0.35 (f = 0.175) for a power of 0.95 to detect simple effects (and of 0.70 for a two way interaction) (see **Supplementary Material**). **Table 1** summarizes the basic demographic characteristics of the sample.

Stimuli

We created eight messages related to consequences of following, or not, the self-care recommendations issued by public health authorities, so that half of these messages were gain-framed and the other half were loss-framed. In turn half the messages portrayed health consequences of the measures and the other half economic consequences. Each message was written in a white font on a black background to make them easy to read in either a mobile cellphone or a computer screen.

Design and Procedure

The experiment used a 2 Frame (gain/loss) × 2 Content (health/economy) both-within-condition design (Westfall et al., 2014). Dependent variables were: (a) intentions of self-care behaviors, (b) perceived efficacy to motivate others to perform self-care behaviors, (c) perceived risk, and (d) perceived message strength (i.e., attention, importance, consequences expressions, and perceived effective to engage in self-care behaviors)

[1] https://osf.io/mxa3q/

TABLE 1 | Demographic characteristics of the sample.

	Frame group (n = 160)	Content group (n = 159)	χ^2 or t	p
Age (years) [mean (SD)]	29.94 (9.34)	27.08 (9.44)	−0.13	0.89
Sex (% male)	33.1	27	1.40	0.23
Sex (% female)	66.9	73		
Educational level				
Medium (%)	45	45.3	0.003	0.95
High (%)	55	54.7		
Perceived socioeconomic status (range: 1–10) [mean (SD)]	5.98 (1.87)	5.98 (1.74)	0.001	1.00
Left–right political orientations (0: left, 100: right) [mean (SD)]	37.53 (22.29)	40.19 (22.61)	−1.05	0.29

Educational level: Medium (participants who were currently in or finished high school or technology careers). High (participants who were currently in or finished university or postgraduate studies). SD, standard deviation.

(Nan et al., 2015). We decided to use this design because a fully factorial design would have likely led to effects of practice and fatigue (Bradley, 2009; Gantiva et al., 2019). The study was conducted between April 19th and 28th of 2020.

A Web-based experiment was conducted in Spanish on the *Qualtrics* platform. After digitally signing the consent form, participants were randomly assigned to one of the experimental conditions (*Frame* or *Content*). In both conditions participants had to choose one of the messages in an unforced choice task, for four pairs of messages. In the *Frame* condition, the two messages of each pair had the same content (either both on Health or both on Economics) while the frame (Gain/Loss) was systematically varied. On the *Content* condition, the two messages of each pair shared the same frame but varied in content (always Health vs. Economics). The display order of the stimuli pairs and the location (right or left) of each message were randomly determined.

After seeing each pair of messages, participants had to choose the message of their preference for each dependent variable using a Visual Analog Scale (VAS) (see **Figure 1**). At the end of the experiment, participants responded to a set of questions on several demographic characteristics. The median duration time of the task was 10 min.

This study was carried out in accordance with the recommendations of the IRB of the University of los Andes (Approval #1169/2020), with written informed consent from all participants in accordance with the Declaration of Helsinki.

RESULTS

We derived a score per message by calculating the difference between the indifference point in the scale (50) and the final position of the slider selected by each participant for each pair. For example, when comparing two health messages, one with a gain-frame (left side of **Figure 1**) and the other with a loss-frame (right side of **Figure 1**); a participant might have selected 90, choosing the target on the right. In this case, this means that the loss-framed health message got assigned a score of 40 (i.e., subtracting the indifference point from the score, in this example 90 minus 50) while the gain-framed health message got a score of zero. When participants chose the indifference point, both messages got a score of zero. Manipulation checks showed that participants indeed recognized gain/loss-framed messages as such (over 91% of participants for all messages). Results below include the whole sample, since excluding data based on the manipulation check did not result in any difference.

We derived a perceived message strength index by averaging the scores assigned to the messages across the questions on attention, importance, consequences and perceived effective to engage in self-care behaviors (Nan et al., 2015). A reliability analysis showed very good internal consistency for these items (Cronbach's $\alpha = 0.85$, McDonald's $\omega = 0.87$), as expected.

Analyses were conducted using the R statistical language (R Core Team, 2020). We fitted a series of linear mixed models with the *lme4* library (Bates et al., 2015) and performed corrected pairwise comparisons with the Tukey method with the *emmeans* library (Lenth, 2020), as per preregistration. However, all models resulted in singular fits, suggesting overcomplex model structures (Barr et al., 2013). Therefore, we fitted the same nested models as generalized linear models, omitting the random effect term for participants. Overall results are summarized in **Table 2** and **Figure 2**.

The best model for each dimension, except perceived message strength, includes simple and interactive effects for the main experimental variables: Content Type, Frame, and Experimental Condition. For perceived message strength, there was also an effect of perceived socio-economic status, so that people with higher status tended to perceive messages as stronger. However, this coefficient is not significant. Including other variables, such as gender and age, did not improve the models fit (e.g., including them did not result in greater variance explained in our dependent variables).

There are main effects of both *Content* and *Frame* type for all dimensions examined except when judging how good the messages were at convincing others to wash their hands. In all models fitted, gain-frames and Health-themed messages were always considered better [bearing in mind that interpretation of the main effects can be problematic in the presence of interactions (Salkind, 2010)].

We will now focus on the two-way interaction between *Content* and *Frame*, the main point of the study. There is an overall effect of *Content* for all dimensions so that

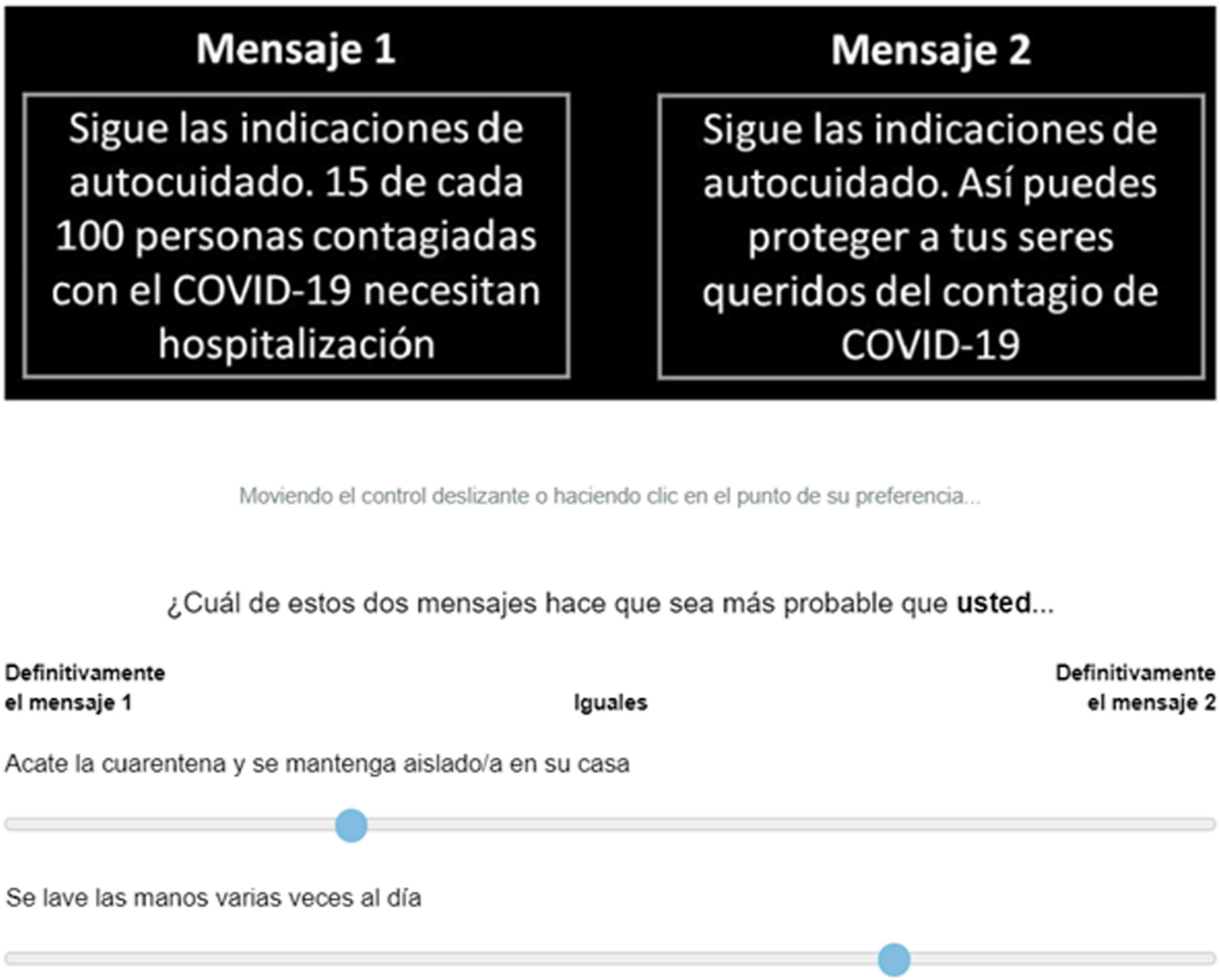

FIGURE 1 | Example of message pairs in the *Frame* condition.

health messages were considered more effective, better at communicating risk, and better to persuade oneself and others, except when assessing the impact of health messages on others regarding the lockdown. Messages focused on health and with a gain-frame were generally perceived as stronger than both loss-framed health messages ($M_{\text{HealthGain}}$ = 22 vs. $M_{\text{HealthLoss}}$ = 17.4, $z = -4.90$, $p < 0.001$) and gain-framed economics messages ($M_{\text{EconomicsGain}}$ = 8.2, $z = -12.80$, $p < 0.001$), as can be seen in **Figure 2A**. On the other hand, loss-framed health messages were judged as better to communicate risk than any other type of message (all comparisons significant at $p < 0.001$).

The assessment of message impact on oneself and others is very similar for the two behaviors evaluated (hand washing and lockdown compliance). While in all cases the gain-framed health messages are considered more effective both for oneself and for others, the magnitude of the differences is smaller when judging the impact on others versus oneself. That is, people believed that others are more susceptible to economic-themed messages than they are. When considering the impact of messages on self-isolation measures (see **Figure 2B**), participants believe that other people are as receptive to gain-framed health messages as they would be to loss-framed economic messages (**Figure 2B**, lower right) while they considered themselves to be more influenced by gain-framed health messages and indifferent between loss and gain-framed economic messages ($z = -1.30$, $p = 0.59$). The pattern is similar for hand washing, but not as pronounced.

This pattern itself interacted with the experimental condition. This three-way interaction shows that the differences identified were stronger when the comparisons were between-content than when they were between-frames. That is, when people compared health versus economic messages, especially for gain-framed health messages, the differences tended to be larger than when the same message was paired with a loss-framed health message. This suggests an interesting joint evaluation effect, with potential real world repercussions (Hsee et al., 1999). We refrain from putting too much stock into this

TABLE 2 | Summary of models fitted for each dimension.

	Risk	Strength	Hands/self	Hands/other	Lockdown/self	Lockdown/other
Health	26.00***	14.00***	22.00***	26.00***	20.00***	7.10***
	(23.0, 29.0)	(12.0, 16.0)	(20.0, 25.0)	(23.0, 30.0)	(17.0, 23.0)	(3.9, 10.0)
Loss	−0.71	1.70*	0.98	3.60**	2.90*	3.70**
	(−3.6, 2.2)	(−0.2, 3.7)	(−1.6, 3.6)	(0.4, 6.8)	(−0.2, 6.0)	(0.4, 7.0)
Frame condition	−0.56	−1.40**	8.60***	13.00***	6.10***	−0.63
	(−3.4, 2.3)	(−2.8, −0.04)	(6.0, 11.0)	(9.8, 16.0)	(3.0, 9.3)	(−3.9, 2.6)
Perceived social status		0.25				
		(−0.1, 0.6)				
Health: loss	3.80*	−6.30***	−1.40	−7.20***	−4.40*	−6.00**
	(−0.3, 7.8)	(−9.1, −3.6)	(−5.1, 2.3)	(−12.0, −2.7)	(−8.8, 0.05)	(−11.0, −1.4)
Health: frame condition	−19.00***		−17.00***	−21.00***	−12.00***	1.50
	(−23.0, −15.0)		(−20.0, −13.0)	(−26.0, −17.0)	(−17.0, −8.0)	(−3.1, 6.0)
Loss: frame condition	19.00***		1.50	−4.40*	5.20**	8.40***
	(15.0, 23.0)		(−2.2, 5.2)	(−8.8, 0.08)	(0.7, 9.6)	(3.8, 13.0)
Health: loss: frame condition	−8.20***		−9.70***	−1.40	−8.90***	−10.00***
	(−14.0, −2.4)		(−15.0, −4.5)	(−7.7, 4.9)	(−15.0, −2.6)	(−17.0, −3.6)
Constant	5.50***	7.40***	3.90***	5.30***	6.30***	12.00***
	(3.5, 7.6)	(4.7, 10.0)	(2.0, 5.7)	(3.0, 7.5)	(4.1, 8.6)	(9.6, 14.0)
N	2552	2552	2552	2552	2552	2552
Log likelihood	−11,079.00	−10,957.00	−10,825.00	−11,300.00	−11,289.00	−11,369.00
AIC	22175.00	21926.00	21665.00	22615.00	22594.00	22753.00

****p < 0.01; **p < 0.05; *p < 0.1. Number in brackets are the confidence intervals for each coefficient. Reference category is the economics content, gain frame, and content condition.*

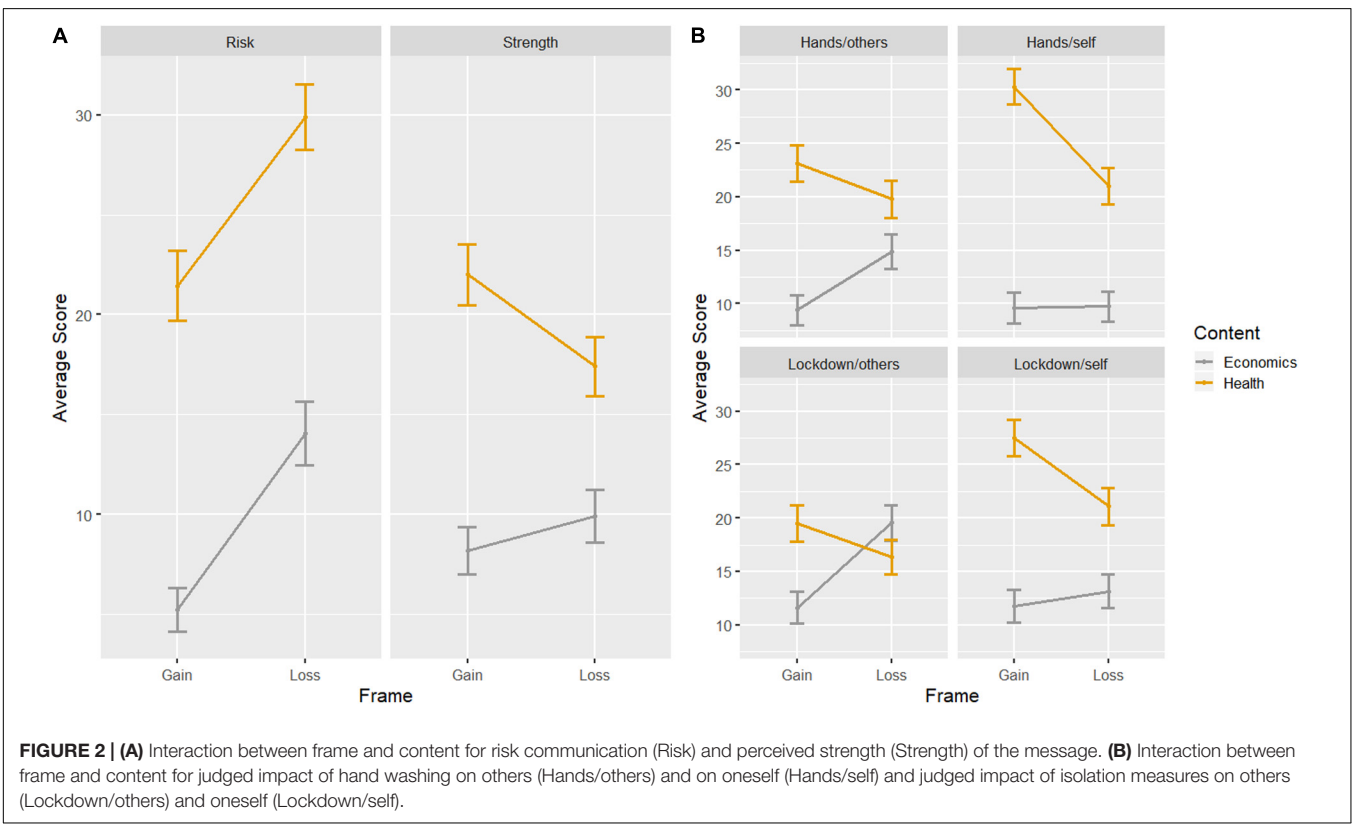

FIGURE 2 | (A) Interaction between frame and content for risk communication (Risk) and perceived strength (Strength) of the message. **(B)** Interaction between frame and content for judged impact of hand washing on others (Hands/others) and on oneself (Hands/self) and judged impact of isolation measures on others (Lockdown/others) and oneself (Lockdown/self).

interpretation, since we did not make any predictions on this aspect of our design.

DISCUSSION

The aim of the present study was to evaluate the impact of message framing and content (health/economy) on several measures related to self-care behaviors (i.e., motivation to engage in self-care behaviors, engage others in the same self-care behaviors, risk perception of contagion and perceived message strength) in the context of the COVID-19 pandemic. The results showed that gain-framed messages were more effective to generate motivation to engage in self-care behaviors and were perceived as stronger. On the other hand, loss-framed messages were more effective at increasing awareness of risks. We also found that health messages were overwhelmingly preferred for all the measures, even though there is a tendency to judge that others may be more susceptible to economic messages than oneself. Our results suggested that gain-framed health messages are more effective to motivate self-care behaviors, whereas loss-framed health messages are more effective to communicate the risk of contagion.

Contrary to our expectation, gain-framed messages were more effective to motivate both self-care behaviors (i.e., not only hand washing, but also staying home). This result may have occurred because self-care behaviors have been previously associated with the avoidance of contagion with COVID-19, and avoiding contagion is a form of gain. In short in length messages (like the ones used in this study), it is easier to execute the frame (gain or loss), with which the behavior has been previously associated. In a similar vein, since the spread of COVID-19 is already associated with negative consequences in public awareness, a loss-frame might be more effective to increase risk perception despite the short length of the message. Similar results were found previously in warning labels in the context of quit smoking (Goodall and Appiah, 2008; Nan et al., 2015).

In mass media and on social networks space is limited (e.g., the maximum length of a tweet is 280 characters); our study results thus suggest that messages designed in this kind of media to motivate self-care behaviors to avoid the spread of COVID-19 should use a gain-frame structure. Conversely, if the target is to improve risk perception, a loss-frame message will be more effective.

Health content messages had a greater impact on the main variables studied, however, participants tended to assess other people as more influenced by economic content than themselves. This result may indicate the beginning of a growing concern about the economic situation of the country, although reflected for now in the economic situation of other people (McKee and Stuckler, 2020; Singer and Plant, 2020; Tankersley, 2020). Because the participants of the present study belonged to a medium-high socioeconomic level, they have not yet experienced the negative economic consequences of the lockdown, but they are aware of the economic difficulties of other citizens through the media, social networks, and direct experience, especially in a country with a fragile economy. Notice that this study was conducted at a moment when the lockdown was the only widespread measure against the spread of the virus in the country and other measures that have proven successful had not been implemented (e.g. mask wearing), which needs to be factored in when judging the behavior of others (complying with the stay at home orders). This mismatch between preferences reported by participants and those attributed to others opens the way for potential interventions based on social norms feedback (Dempsey et al., 2018): since larger misperceptions tend to be associated with a greater likelihood of engaging in negative behaviors (e.g., in this context, not complying with self-isolation recommendations), message delivery based on adequately communicating true rates of observance of recommendations could be a promising strategy.

Governments are going to great lengths to communicate and persuade the general population of the best measures to prevent COVID-19 spread. Many of these messages are disseminated through mass media and social networks, where time and space are limited. The results of the present study suggest that gain-framed health messages are more effective to motivate people to engage in self-care behaviors, additionally, these increase the attention, perceived importance, consequences expressions, and perceived effectiveness (i.e., increase perceived message strength). Conversely, loss-framed health messages improve risk perception. This is especially important in some populations where risk perception is usually low (e.g., adolescents), and because recent studies have found that risk perception is significantly correlated with reported adoption of self-care behaviors to prevent COVID-19 contagion (Dryhurst et al., 2020; Lohiniva et al., 2020). These results may be used to develop more effective messages by policy makers.

The present study has several limitations. First, only self-report measures were evaluated, we do not have behavioral measures (e.g., behavior frequency) that allow us to corroborate the results. However, although several models identified that intention is not sufficient to adopt a new behavior, intention is a necessary step to adopt it (Prochaska, 2008; Schwarzer, 2008). Second, our results are not necessarily applicable to countries, regions or communities with different socioeconomic or cultural conditions. It is possible that high-income or very low-income countries or regions may have different responses to message framing and content. These results are then more likely to generalize to middle-income countries, in particular middle-class urban settings. Lastly, in a rapidly changing situation, our results offer only a snapshot of a set of concerns that evolve as the pandemic changes.

DATA AVAILABILITY STATEMENT

The preregistration, hypotheses, analysis plan, materials, raw data, and scripts for analysis are available online at the Open Science Framework (https://osf.io/mxa3q/).

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Institutional Review Board of the Universidad de los Andes (approval #1169/2020). The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

CG and WJ-L are responsible for the original design of the experiments, stimuli design, data analysis, and writing of the manuscript. JU-R contributed to materials design, conducted the experiments, and contributed substantially to data analysis and drafting of the manuscript. All authors approved the final version of the manuscript for submission.

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SUPPLEMENTARY MATERIAL

The Supplementary Materials are available at the Open Science Framework repository: https://osf.io/mxa3q/

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Warning Messages in Crisis Communication: Risk Appraisal and Warning Compliance in Severe Weather, Violent Acts, and the COVID-19 Pandemic

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Background: In crisis communication, warning messages are key to informing and galvanizing the public to prevent or mitigate damage. Therefore, this study examines how risk appraisal and individual characteristics influence the intention to comply with behavioral recommendations of a warning message regarding three hazard types: the COVID-19 pandemic, violent acts, and severe weather.

Methods: A cross-sectional survey examined 403 German participants from 18 to 89 years (M = 29.24; 72% female). Participants were allocated to one of three hazard types (COVID-19 pandemic, violent acts, severe weather) and presented with warning messages that were previously issued via an official warning app. Four components of risk appraisal—perceived severity (PS), anticipated negative emotions (AE), anticipatory worry (AW), and risk perception (RP)—were assessed before and after presenting the warning message. Path models were calculated to predict the intention to comply with the warning message, controlling for age, gender, and previous hazard experience.

Results: For the COVID-19 pandemic, higher age (β = 0.18) predicted warning compliance (R^2 = 0.05). AE (β = 0.20) predicted compliance in the case of violent acts (R^2 = 0.09). For severe weather, PS (β = 0.28), age (β = 0.29), and female gender (β = 0.34) lead to higher compliance (R^2 = 0.27). Changes across risk appraisal components were not consistent, as some facets decreased after the receipt of a warning message.

Discussion: Risk appraisal has shown a marginal yet differential influence on warning message compliance in different types of hazards. Regarding the COVID-19 pandemic, the impact of sociodemographic factors on compliance should be studied more intensively. Moreover, integrating intermediary variables, such as self-efficacy, is necessary.

Keywords: COVID-19, severe weather, violent acts, warning message, risk appraisal, risk communication, warning compliance

INTRODUCTION

Crisis communication aims to inform the public about various kinds of impending threats and hazards. Warning messages are a means of communicating risks and giving advice on how to act correctly in case of such hazards (Mileti and Peek, 2000; Mayhorn and McLaughlin, 2014). This is as important for everyday perils as it is for new or still unknown threats and crises.

The outbreak of the novel coronavirus COVID-19 in 2019 and the ongoing pandemic pose new challenges in this respect: At the end of April 2020, more than 2.5 million people have become infected with this respiratory disease, and more than 180,000 thousand died (World Health Organization, 2020b). At this point in time, further development seemed yet unclear, as various factors were still unknown. Challenges arose, for example, from an uncertain case fatality rate, duration of infectiousness, pre-symptomatic infectiousness, as well as asymptomatic courses (Anderson et al., 2020; Peeri et al., 2020).

To flatten the pandemic curve, a quick adaption to this new threat is necessary. This means *inter alia* that the public at large must be provided with information and recommendations for protective measures, as effective vaccination is not yet available. Therefore, the World Health Organization (2020a) gives a series of advice for the public to control the further spread of COVID-19. Among others, recommendations include maintaining social distance, respiratory hygiene, washing hands, and not touching eyes, nose, and mouth as well as following advice given by healthcare providers and public health services. For these measures to be effective, they must be shared with as many people as possible. Moreover, they must also be implemented and complied with by the public. Warning messages, again, are essential for this purpose.

To construct effective warning messages, several factors must be considered. In addition to characteristics of the warning message itself, these include contextual factors, such as the communication channel, as well as characteristics and processes on the receiver's side (Mileti and Sorensen, 1990; Mayhorn and McLaughlin, 2014; Bean et al., 2015). Among other theoretical frameworks addressing such processes, the Protective Action Decision Model (PADM) focuses on human responses toward threats (Lindell and Perry, 2012). According to the PADM, warning messages as well as contextual cues can initiate pre-decisional processes (exposure, attention, and comprehension of the cue or warning message) that, in turn, influence three core perceptions, namely perceptions of risk or threat, possible protective actions, and stakeholder perceptions. These pre-decisional processes and core perceptions are key to decision-making for those at risk. Characteristics of the warning message receiver, his or her channel access, and channel preference, as well as the source of the incoming information, are also considered in the PADM. In light of this theoretical background, warning messages can start multi-stage processes by communicating risk and giving recommendations on protective actions, with the appraisal of risk being pivotal.

Risk Appraisal and Information Processing

Risk perception can be defined as a person's beliefs about the vulnerability toward experiencing a potential threat. It is often operationalized as a subjective judgment of likelihood and thus conceived as a cognitive appraisal. Though, beyond this cognitive conceptualization, risk appraisal as well includes affective components that address feelings associated with a threat, for example, fear, sadness, or anger (Slovic, 1987; Sheeran et al., 2014). Previous research on risk appraisal toward threats and hazards, for instance, SARS or the avian flu (Leppin and Aro, 2009; Sheeran et al., 2014), points to a broad variation in conceptualization and assessment. This applies as well for natural hazards (Wachinger et al., 2013) or health-related behaviors (Sheeran et al., 2014), making it difficult to derive consistent conclusions and compare findings across scenarios, situations, and settings.

Seminal theoretical frameworks have focused either on the role of cognitions or affect toward risk and related attitudes and behaviors, such as the extended parallel process model (Witte, 1994; Popova, 2012), and the affect heuristic (Finucane et al., 2000; Slovic and Peters, 2006; Slovic et al., 2007). According to the extended parallel process model, cognitive threat appraisal as well as efficacy appraisal influence the likelihood of considering protective action, whereas affective appraisal (i.e., dread) can also lead to maladaptive behaviors, namely fear control, if efficacy is perceived as low. The affect heuristic focuses on the impact of affect and illustrates decision-making in high pressure situations. Consequently, under threat, negative affect activates the experiential system (i.e., automatic, intuitive information processing) that fosters swift action toward survival. The analytic system, on the other hand, represents a slower and more effortful way of processing information that is connected to information seeking, actively weighing pros, and cons before performing behaviors. Regarding disaster scenarios, analytic processing is likely if one has enough lead time to seek and process further information, prior experience, and knowledge of the disaster and protective behaviors. If information and lead time are scarce, experiential processing is more likely. Thus, depending on the situation, both cognitive and affective risk appraisals are important to compliance. This reasoning is echoed by research on health behaviors: A meta-analysis found that heightening and combining cognitive and affective appraisals of risk appraisal increases the intention to act and behavior itself (Sheeran et al., 2014).

For the ongoing COVID-19 pandemic, findings on risk appraisal and the adoption of protective measures are still preliminary. In a Hong Kong population at the beginning of the outbreak, participants of a survey reported high perceived susceptibility and high perceived severity toward COVID-19. In contrast, the willingness to distance oneself socially in the sample varied, with 39%–88% intending to take this action (Kwok et al., 2020). In another study with a US American sample, risk perception (assessed as infection likelihood and severity for oneself and others) increased during the first week of the pandemic in northern America, while participants' risk

perception was higher for others than for themselves. In this sample, the adoption of protective measures, such as social distancing and hand-washing, increased as well during this first week, with protective measures being predicted by the perceived likelihood of becoming infected (Wise et al., 2020). Moreover, the role of individual characteristics on the appraisal of risk and the adoption of protective measures becomes apparent: In a German population, younger age was associated with a higher perceived likelihood of becoming infected by COVID-19 (for self, others, and in general), while females and the elderly worried more about becoming infected (Gerhold, 2020). Also, female gender and higher subjective knowledge of COVID-19 made it more likely for Hong Kong inhabitants to socially distance (Kwok et al., 2020). Findings on prior pandemics show a similar picture: For several infectious diseases, such as avian influenza, SARS, or swine influenza, older age, female gender, higher education, being non-white, as well as perceived susceptibility and severity of the respective disease predicted the adoption of protective measures (Bish and Michie, 2010).

To provide context for the analysis of warning communication in the COVID-19 pandemic, the present study aims to compare the ongoing pandemic to two additional hazard types, namely severe weather and violent acts, with varying degrees of severity and familiarity. On the one hand, severe weather, such as thunderstorms or heavy rainfalls, is a familiar event in Germany and mostly characterized by moderate severity, with yet increasing economic damages (Coronese et al., 2019). Violent acts, on the other hand, are comparatively rare but of tremendous impact (Sheppard, 2011). That a comparative approach might be useful is shown by a broad body of research that focuses on specific hazards or singular events only while assessing risk appraisal inconsistently. Also, to our knowledge, only a few studies aim to compare different hazards in terms of risk appraisal. Their findings show that various hazard types are perceived differently in terms of risk appraisal (Rahn et al., 2020) and vary in how likely protective measures are intended, for example, due to a variation in threat imminence or risk level (Ho et al., 2008; Heilbrun et al., 2010). The type of hazard as well influences cognitive and affective components of risk appraisal when receiving warning messages, including interactional effects of hazard type and characteristics of the message receiver (Rahn et al., 2020). Consequently, it is of interest whether the different components of risk appraisal influence the compliance of the protective measures and whether the hazard types differ in this respect.

Severe weather (e.g., thunderstorms, lightning, heavy rain- or snowfall) is experienced frequently by the public. This hazard type can be subsumed as a natural hazard, for which previous experience is a factor that is associated with the perception of risk (Ho et al., 2008; Olofsson and Rashid, 2011; Wachinger et al., 2013; Frondel et al., 2017). Despite a broad body of research, the relationship between risk appraisal, previous experience, and the adoption of protective measures is inconclusive, as findings are inconsistent and additional factors, as well as complex pathways, were found (Wachinger et al., 2013). Yet, warning messages regarding severe weather can lead to faster adoption of protective measures, for example, in the event of a thunderstorm (Markwart et al., 2019). In the present study, we used a warning message addressing a thunderstorm with chances of lightning and storm.

In contrast to severe weather, violent acts are experienced less likely, while being fairly severe, and therefore serving as an upper limit when comparing risk appraisal. In this study, violent acts are defined as directed, mostly planned acts of violence against people, which usually occur unexpectedly and cause deaths or injuries. In the early onset of a violent act, it is often unclear whether it is a rampage, terrorist threat, or any other kind of assault. For terror threats, risk perceptions toward terror as well as sociodemographic factors are associated with the anticipated emergency response (Gibson et al., 2015). Individual characteristics, such as trait anxiety, as well as perceptions of vulnerability and self-efficacy, were found to be associated with preparedness behavior in terror threats, too (Wirtz et al., 2019). Again, in the case of violent acts of all kinds, warning messages are a key to providing the public with information in near real-time (Reuter et al., 2017). The warning message used in this study addressed a rampage in a city center, with a still unknown number of active shooters on the run. In this case, a violent incident had already occurred, so that a warning was indispensable. However, the exact outcome (number of deaths or injuries, unclear number of suspects) and the background of the violent act were still unknown at the time when the public received the warning message.

The influence of risk appraisal on warning message compliance regarding different types of hazards seems unclear. This applies especially to the new COVID-19 pandemic. Moreover, individual characteristics of those at risk, such as previous experience with a hazard or sociodemographic factors, play an important role in risk appraisal and the adoption of protective measures. While controlling for characteristics on the receiver's side, the present study aims to explore the links between cognitive and affective components of risk appraisal on the intention to comply with protective measures given in a warning message. Moreover, these interrelations are examined for three different types of hazards, namely severe weather, violent acts, and the COVID-19 pandemic.

MATERIALS AND METHODS

The present study was approved by the ethical committee of the University Medicine of Greifswald (BB 169/18) and included informed consent in alignment with the Declaration of Helsinki.

Sample

Participants were recruited via internet forum posts and flyer advertising. As incentives, they were offered 5 € or a voucher of the same value as compensation of expense. Data was collected online (questionnaire via hyperlink) and offline (via paper-pencil questionnaire) for severe weather and violent acts. For COVID-19, data collection took place online only.

For severe weather and violent acts, a subsample was collected during a period of eight months from May to December 2019. Data collection regarding the COVID-19 pandemic took part between March 13 and March 27, 2020. The latter period covers

the beginning of the COVID-19 outbreak in Germany and the start of large-scale measures by the German government, such as social distancing and closing of public institutions.

Materials

Participants were presented warning messages that had been previously used to warn the German public of severe weather, a violent act, and the COVID-19 pandemic. Because of that, wording, content, and sender of the warning message were already fixed. The warning messages were staged into the format of a warning application for smartphones, called NINA (BBK, 2020). NINA is free of charge for the public and provided by the Federal Office of Civil Protection and Disaster Assistance. It is used by the German government, federal states, and local communities to provide location-based warning messages via push notifications. Hazards to which the app refers include threatening weather situations as well as large-scale emergencies and national or local threats (Petridou et al., 2019).

Before receiving the warning messages, participants received a short description of the hazard, which was presented in German:

- Severe weather: Severe weather is an umbrella term referring to different weather-related events. Severe weather can have immense consequences and threaten public safety. Among others, severe weather comprises heavy rain, severe storms, thunderstorms, or extreme snow.
- Violent acts: Violent acts are targeted, mostly planned acts of violence against people, which usually occur unexpectedly. Often people are injured or killed.
- COVID-19 pandemic: Coronaviruses cause a variety of diseases in humans, ranging from common colds to dangerous or even potentially fatal diseases. The novel coronavirus (COVID-19) is transmissible from person to person. The main mode of transmission is droplet infection.

All warning messages included information about the particular hazard, as well as recommendations for action. The warning message regarding severe weather referred to a heavy thunderstorm with possible lightning and storms. The message on the violent act warns about a yet unknown violent incident in the center of a city, with suspects still on the run. The message regarding COVID-19 as well consisted of information about COVID-19 (e.g., number of cases confirmed to date and action taken by the authorities) and recommendations for action to prevent an infection. The latter warning message was used in March 2020 in a district of Northern Germany.

For severe weather and violent act, warning messages (including English translations) can be found elsewhere (Rahn et al., 2020). The English translation of the warning on COVID-19 is provided in the supplementary.

Measures

Sociodemographic data included age, gender (1, female; 2, male), and previous experience with severe weather, violent acts, or pandemics. For previous hazard experience, participants were asked whether they or a person close to them (e.g., family, friends) had ever experienced the hazard. Experience was given, when one of these questions was answered with "yes" (0, no previous experience; 1, previous experience).

For the assessment of risk appraisal, a facetted approach was chosen in this study, measuring risk with four components: (1) perceived severity (PS), (2) anticipated negative emotions (AE), (3) anticipatory worry (AW), and (4) risk perception (RP) (Sheeran et al., 2014). PS and RP are considered cognitive facets, while AE and AW are considered affective components of risk appraisal (Leppin and Aro, 2009; Sheeran et al., 2014). Risk appraisal was assessed at two points in time, before (1) and after (2) the receipt of a warning message regarding one out of three hazards. For PS ("How serious would the consequences be for you if _____ happened?"), AE ("How would you feel if _____ happened?" [anxious, tense, sad]), and AW ("How worried are you that you might be affected by _____?"), five-point Likert scales were used ranging from 1 (*not at all*) to 5 (*very much*). For AE, mean values of the three negative emotions were calculated, showing good internal consistency (Cronbach's $\alpha = 0.82–0.84$). RP ("How likely is it that you could be affected in the future by _____?") was assessed via visual analog scale ranging from 0% to 100%.

To assess the intention to act, the participants were asked how likely they would follow with the particular recommendations given in the warning message using five-point Likert scales (1, *not at all* to 5, *very much*). For each participant, a mean value was calculated for the intention to act. Protective measures for the three hazard types included:

- Severe weather (four recommendations): Close windows and doors; secure objects outdoors; keep away from buildings, trees, scaffolding, and power lines; avoid staying outside.
- Violent acts (four recommendations): Avoid streets and public places; turn on radio and television; stay at home; share the warning message.
- COVID-19 (nine recommendations): Cover mouth and nose with elbow or tissue when coughing; not shaking hands; avoid touching eyes, nose, and mouth; use and safe disposal of used tissues; intensive room ventilation; maintain hand hygiene; stay at home in case of illness/symptomatic; avoid contact with possibly ill persons; avoid mass events.

Design and Study Procedure

A cross-sectional survey design was conducted. All participants received study information and stated their informed consent before starting the survey. For severe weather and violent acts, participants were randomly allocated to one of the two disaster types. To avoid ambiguity, participants received a short explanation of their hazard type. After that, previous experience and the four components of risk appraisal were assessed. Participants then received a warning message with the instruction to imagine that they were affected by the hazard described therein. Lastly, risk appraisal was assessed again, as well as the

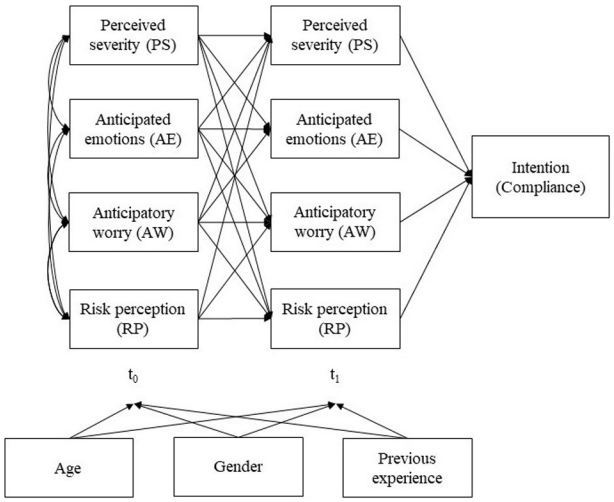

FIGURE 1 | Simplified path model. Four components of risk appraisal (PS, AE, AW, RP) before (t_0) and after (t_1) the receipt of a warning message regarding one of three hazard types (severe weather, violent act, or the COVID-19 pandemic).

intention to comply with the specific recommendations given in the presented warning message.

Statistics

IBM SPSS 25 and IBM Amos 25 were used for the statistical analyses. First, tests were conducted to investigate the links between hazard type and age (univariate ANOVA), previous experience, and gender (Chi-square tests). Bivariate (Pearson) correlations were then used to explore associations between all examined variables. To examine the influence of all four components of risk appraisal combined on warning message compliance, path models were calculated for each hazard type, controlling for age, gender, and previous hazard experience. Path models were estimated using the Full Information Maximum Likelihood method in consideration of missing data (Enders, 2001) and calculated without and with the control variables. A simplified path model for all three hazards is shown in **Figure 1**.

RESULTS

Descriptive statistics can be found in **Table 1**, with pairwise correlations in **Table 2**. A total of 403 adults (M $[SD]_{age}$ = 29.24 [13.99], 72.2% female) took part in the survey. In total, 33.5% of the participants had previous hazard experience, ranging from 7.7% (pandemics) to 77.2% (severe weather). Participants allocated to the three hazard types did not differ by age [$F(2, 402) = 2.23$, $p = 0.109$]. Thus, they did differ by gender [$\chi^2(2) = 7.68$, $p = 0.021$] and previous experience [$\chi^2(2) = 158.69$, $p = 0.001$]. The latter seems reasonable, as severe weather is experienced far more often than violent acts or pandemics.

Bivariate correlations showed significant positive associations of all variables with the intention to comply with the warning message, except for previous experience ($r = -0.14$, $p < 0.01$), RP1, and RP2 ($r = 0.06$–0.08, $p > 0.05$). Also, positive correlations were found for age, PS1, and PS2 ($r = 0.16$–0.17, $p < 0.01$) as well as age and RP2 ($r = -0.11$, $p < 0.05$). For gender, positive correlations were found for all components of risk appraisal, except for PS1 and PS2. For previous experience, significant positive (RP1, RP2) and negative (AE1, AE2) correlations were found.

Interestingly, there was no consistent trend in the change of risk appraisal after the receipt of a warning message. Some components decreased while others increased: For COVID-19, AW ($M_{AW1} = 2.93$; $M_{AW2} = 2.68$) and RP ($M_{RP1} = 61.40$; $M_{RP2} = 59.97$) decreased, while severe weather and violent acts showed an increase after the receipt. In contrast to that, AE decreased in all hazard types.

Path models for severe weather, violent acts, and the COVID-19 pandemic can be found in **Table 3**. For the three types of hazards, path models including all covariates (model 2) revealed different factors that had a direct influence on the intention to comply with the warning message, while showing good to moderate model fits.

For severe weather, the path model showed a significant influence of PS (β = 0.28), higher age (β = 0.29), and female gender (β = 0.34) on the intention to comply with the recommendations given in the warning message ($R^2 = 0.27$; CFI = 0.999; TLI = 0.984; RMSEA = 0.033).

For violent acts, AE (β = 0.20) predicted the intention to comply ($R^2 = 0.09$; CFI = 0.994; TLI = 0.922; RMSEA = 0.078).

For the COVID-19 pandemic, higher age (β = 0.18) predicted warning compliance ($R^2 = 0.05$; CFI = 0.999; TLI = 0.990; RMSEA = 0.028).

DISCUSSION

The present study examined warning message receipt, risk appraisal, and the intention to comply with a warning message while applying a consistent methodology in assessing risk appraisal with two cognitive and two affective components. Additionally, three types of hazards were compared: severe weather, violent act, and the COVID-19 pandemic. Sociodemographic factors were taken into account as well. As seen in preceding research (Ho et al., 2008; Heilbrun et al., 2010; Rahn et al., 2020), heterogeneous results between the hazard types were found.

For severe weather, perceived severity (PS) led to a higher intention to comply with the warning message. The more severe the hazard is perceived, the more likely it is to carry out the recommendations. This finding is consistent with the theoretical assumption of the PADM, as the perception of the impending threat and its severity play an important role in the adoption of protective measures (Lindell and Perry, 2012). Besides, in the event of a thunderstorm, in most cases, it is possible to prepare for the hazard for a certain period. The pros and cons of implementing protective measures can be considered. This time lead could result in an analytical processing and, in turn, the cognitive component of risk appraisal influencing the intention to act. Also, higher age and female gender were associated with

warning message compliance. This goes with prior research that found an association between age and female gender regarding warning message response, and the likelihood of seeking shelter in the case of severe weather or tornados (Ryherd, 2016). Other findings show that persons over 35 years show a better understanding of warning messages regarding weather events, report a better understanding of possible outcomes, and report a higher concern toward the event as well as higher intention to adopt protective measures (Potter et al., 2018).

Looking at violent acts, an influence of anticipated negative emotions (AE) on warning message compliance was found: The more anxious, tense, or sad participants felt about becoming involved in a violent act, the more likely it was for them to comply with the warning message. The occurrence of violent acts is associated with high potential threat and to some point unknown consequences for the ones involved. This may have an influence on which processes they cause in individuals when becoming confronted with a warning message regarding a violent

TABLE 1 | Descriptive statistics of age, gender, previous hazard experience, the components of risk appraisal before (1) and after (2) the receipt of a warning message, and the intention to comply with a warning message, displayed for the complete sample and separated by hazard type.

		Hazard type		
	Complete sample ***N* = 403**	**Severe weather** ***n* = 123**	**Violent act** ***n* = 125**	**COVID-19** ***n* = 155**
Gender				
% male	27.8 (112)	33.3 (41)	32.0 (40)	20.0 (31)
% female	72.2 (291)	66.7 (82)	68.0 (85)	80.0 (124)
Previous experience (% yes)	33.5 (135)	77.2 (95)	22.4 (28)	7.7 (12)
	***M* (SD)**	***M* (SD)**	***M* (SD)**	***M* (SD)**
Age	29.24 (13.99)	31.28 (15.73)	29.10 (15.32)	27.73 (10.98)
Risk appraisal				
Perceived severity 1	3.05 (1.12)	2.84 (1.00)	3.86 (1.00)	2.59 (0.95)
Perceived severity 2	3.01 (1.14)	2.76 (1.01)	3.78 (1.07)	2.60 (0.98)
Anticipated emotions 1	2.95 (1.07)	2.35 (0.83)	3.85 (0.91)	2.71 (0.87)
Anticipated emotions 2	2.84 (1.10)	2.26 (0.84)	3.79 (0.90)	2.54 (0.93)
Anticipatory worry 1	2.56 (1.11)	2.40 (1.03)	2.26 (1.10)	2.93 (1.09)
Anticipatory worry 2	2.57 (1.05)	2.55 (0.98)	2.45 (1.15)	2.68 (1.01)
Risk perception 1	50.99 (27.01)	55.78 (27.02)	34.10 (24.78)	61.40 (21.52)
Risk perception 2	52.33 (26.76)	58.51 (26.96)	36.09 (24.51)	59.97 (22.60)
Intention to comply	4.33 (0.66)	4.13 (0.85)	4.33 (0.69)	4.49 (0.36)

M, mean; SD, standard deviation. Risk appraisal measured before (1) and after (2) the receipt of a warning message including the components perceived severity, anticipated emotions, anticipatory worry (five-point Likert scales from 1, not at all to 5, very much), and risk perception (%).

TABLE 2 | Pairwise (Pearson) correlations of age, gender, previous experience, risk appraisal before (1) and after (2) the receipt of a warning message, and the intention to comply, *N* = 377–403.

		1	2	3	4	5	6	7	8	9	10	11	12
1	Age	1											
2	Gender	−0.21***	1										
3	Previous experience	0.05	−0.06	1									
4	Perceived severity 1	0.17**	0.03	−0.05	1								
5	Perceived severity 2	0.16**	0.02	−0.05	0.83***	1							
6	Anticipated emotions 1	0.06	0.14**	−0.19***	0.61***	0.60***	1						
7	Anticipated emotions 2	0.05	0.15**	−0.14**	0.60***	0.61***	0.91***	1					
8	Anticipatory worry 1	0.06	0.12*	−0.05	0.24***	0.32***	0.28***	0.25***	1				
9	Anticipatory worry 2	0.10	0.19***	0.02	0.37***	0.48***	0.34***	0.36***	0.69***	1			
10	Risk perception 1	−0.07	0.16**	0.15**	−0.24***	−0.16**	−0.28***	−0.29***	0.33***	0.21***	1		
11	Risk perception 2	−0.11*	0.21***	0.20***	−0.20***	−0.15**	−0.25***	−0.25***	0.29***	0.27***	0.89**	1	
12	Compliance	0.16**	0.20***	−0.14**	0.17**	0.13**	0.17**	0.15**	0.17**	0.15**	0.08	0.06	1

*Gender (1, male; 2, female); previous experience (0, no previous experience; 1, previous experience given). Risk appraisal before (1) and after (2) the receipt of a warning message: Perceived severity, anticipated emotions, and anticipated worry were assessed on five-point Likert scales from 1 (not at all) to 5 (very much); risk perception was assessed in %. *p < 0.05, **p < 0.01, ***p < 0.001.*

TABLE 3 | Path models for the hazard types severe weather, violent act, and COVID-19, with (model 2) and without age, gender, and previous experience (model 1) as covariates.

	Severe weather		Violent act		COVID-19	
	Model 1	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Chi squared test (goodness-of-fit test)	3.203 (df = 6)	6.805 (df = 6)	11.533 (df = 6)	10.559 (df = 6)	6.151 (df = 6)	6.735 (df = 6)
CFI	1.000	0.999	0.992	0.994	1.000	0.999
TLI	1.000	0.984	0.943	0.922	0.999	0.990
RMSEA	0.000 [0.000;0.078]	0.033 [0.000;0.125]	0.086 [0.000;0.160]	0.078 [0.000;0.154]	0.013 [0.000;0.105]	0.028 [0.000;0.111]
Variables						
RP1 → RP2	0.883***	0.848***	0.908***	0.880***	0.814***	0.801***
AW1 → AW2	0.416***	0.421***	0.702***	0.709***	0.388***	0.384***
AE1 → AE2	0.709***	0.705***	0.879***	0.865***	0.916***	0.911***
PS1 → PS2	0.532***	0.513***	0.625***	0.642***	0.852***	0.828***
RP2 → compliance	0.141	0.122	0.011	0.025	0.043	0.052
AW2 → compliance	0.065	−0.068	−0.052	−0.058	0.090	0.083
AE2 → compliance	0.013	0.016	0.253*	0.200*	0.106	0.097
PS2 → compliance	0.249	0.279*	0.005	0.003	−0.102	−0.153
Age → compliance	–	0.292***	–	0.160	–	0.176*
Gender → compliance	–	0.338***	–	0.123	–	0.060
Previous experience → compliance	–	0.004	–	−0.059	–	0.014
R^2 (compliance)	0.126	0.265	0.059	0.091	0.021	0.051

*Standardized model results; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; brackets indicate 90% confidence interval. CFI, comparative fit index; TLI, Tucker-Lewis index; RMSEA, root mean square error of approximation. Components of risk appraisal: RP, risk perception; AW, anticipatory worry; AE, anticipated emotions; PS, perceived severity. Risk appraisal was measured at two time points, before (1) and after (2) receiving a warning message.*

act. Media coverage of terror threats, for example, has been shown to induce fear (Slone, 2000). According to the affect heuristic, affective reactions toward stimuli (e.g., a feeling state of badness toward violent acts) influence judgments, decisions, and behavior. These so-called affect-based evaluations appear to happen quickly and are therefore mostly applied under time pressure, as they are processed through the experiential system (Finucane et al., 2000; Slovic et al., 2007). The warning message used for this study was issued during a violent act in a German city. It comprised a short text about a somewhat unknown and rare threat and was not able to determine full information of the exact nature of the hazard (rampage, terror threat, or else) at the same time. Additionally, the protective measures given in the message required a prompt reaction. In line with the affect heuristic, this could promote an experiential processing of the warning message, which, in turn, could be a possible explanation of the identified link between an affective component of risk appraisal, namely anticipated negative emotions, and the intention to comply in case of violent acts (Lerner et al., 2003). In contrast to severe weather and violent acts, no relationship between risk appraisal and the intention to comply with the warning message was found for COVID-19. These results seem to be in line with other research that also found little or no impact of risk perception on compliance regarding COVID-19 (Clark et al., 2020). Pandemics could be perceived as more controllable than violent acts, for instance, as there are a variety of protective measures for this hazard that can be consciously integrated into everyday life. In this context, the usage of protective measures can lead to risk appraisal being nullified or reduced, as if someone already carries them out, perhaps he or she will appraise the risk of becoming infected lower (Brewer et al., 2004; Leppin and Aro, 2009). Thus, this could turn pandemics into special cases. Ongoing investigations should address whether this also applies to the COVID-19 pandemic as well, as changes in risk appraisal seem to be possible in the further development of this pandemic. Yet, when looking at the covariates, a higher age was a significant predictor for the intention to comply. The latter finding is consistent with prior results regarding the beginning of the COVID-19 pandemic (Tomczyk et al., 2020) as well as other infectious diseases (Bish and Michie, 2010). In the COVID-19 pandemic, persons with a higher age were considered a high-risk group from the very beginning, for example, due to more severe disease progression and higher mortality (Bhopal and Bhopal, 2020; Kang and Jung, 2020). This might result in a higher appraisal of risk, particularly perceived susceptibility, among older persons, which in turn could lead to the adoption of protective measures (Barr et al., 2008).

In the comparison of the three hazard types, no consistent influence of age, gender, and previous experience on the intention to comply with a warning message were found. This applies as well for risk appraisal and the intention to comply: While a cognitive component of risk appraisal showed an influence on warning message compliance in the case of severe weather, affective appraisal seemed to predict the intention to comply in case of violent acts. Besides, no trend in the changes of risk appraisal after the receipt of a warning message was found, as for some hazard types components increased while others decreased. For violent acts and severe weather, the trend after receiving the warning is a slight decrease in perceived severity and anticipated negative emotions. Despite these being marginal changes, participants seemed to rate these hazards as less severe and have less negative emotions toward them when receiving a warning message. On the other hand, risk perception and anticipatory worry increased. By issuing a warning message including protective measures, people at risk could develop a feeling of preparedness, which, in turn, could result in fewer negative emotions and the feeling of the hazard being less severe for oneself. Risk perception, here assessed as the probability of becoming affected by the hazard, and worry of becoming affected may increase due to the confrontation with a possible threat that requires a rather fast response. For COVID-19, a slightly different image becomes apparent: For almost every component, a decrease can be observed. Participants felt fewer negative emotions, less worry, and less susceptible after the receipt. As already mentioned above, pandemics could constitute an exception in this context since warning messages could deliver a feeling of security by giving sufficient information and enough time for the implementation of protective measures. Additionally, data collection took place at a very early stage of the pandemic in Germany. At this time, the COVID-19 pandemic had just reached Germany, and in some areas of the country, there were only a few or no cases. Besides, pandemics of this extent are rather rare in Central Europe, so that there was hardly any contact or previous experience with this topic before. The collection of data in the further course of this pandemic can bring exclusion here and is therefore desirable.

In summary, the given results lead to the point that risk appraisal should be assessed with both cognitive and affective components. Also, it becomes clear that findings in warning research regarding different hazard types cannot be transferred straightforwardly, as there are indications for varying processing. Especially concerning the COVID-19 pandemic, future research on risk appraisal and warning compliance should look at already existing research on other hazard types in a comparative rather than a separate way.

Limitations

The present study certainly has some limitations: Our research aimed to compare three different hazards that varied in terms of several characteristics (e.g., frequency, extent of damage, proximity). Original, but anonymized, warning messages were presented to the participants. These warning messages had already been used to warn the public in Germany and, therefore, the content and design of the messages were not varied. Yet, empirical research shows that a variation of hazard characteristics, such as proximity of the hazard source, influences perceived risk, for example, in hurricanes, chemical hazards, and floods (Zhang et al., 2010). The psychometric paradigm (Slovic et al., 1986; Marris et al., 1997), according to which risk perception is influenced by common risk characteristics, such as controllability, dread, and knowledge of different hazards, could provide an additional perspective. On the other hand, the usage of original warnings in this study leads to a higher ecological validity of the presented results. Yet, future research should

proceed with the use of authentic warning messages and also aim toward a systematical variation of the messages. Regarding the COVID-19 pandemic, the collected data only show a small part of a complex and fast process. Like others, we aimed to capture this process at an early stage, namely at the beginning of the restrictions in Germany. Further research must continue to collect data repeatedly in order to be able to make statements in the long term. This way, for example, a change in cognitive and affective appraisals of risk over time, as well as a change in behavioral intention and the adoption of protective measures, can be unveiled (Leppin and Aro, 2009). By doing so, upcoming studies should examine representative samples, as the presented findings are based on a convenience sample.

Also, further research should focus on additional variables that are included in the PADM, such as stakeholder perceptions or social norms, to improve the understanding of the link between risk appraisal and behavior. In the context of health-related behaviors, self-efficacy and response efficacy were shown to play important roles in the association between risk appraisal and behavioral intention or behavior (Sheeran et al., 2014) and should thus be considered for civil protection as well. This applies as well on the assessment of protective measures carried out by the public, as this study was scenario-based and therefore only able to assess behavioral intention. Nevertheless, recent research shows that experimental studies (in the sense of scenario-based studies) and field studies are equally suitable for the investigation of warning message understanding and response (Weyrich et al., 2018).

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee of the University Medicine of Greifswald. The participants provided their written informed consent to participate.

AUTHOR CONTRIBUTIONS

MR, ST, and SS: conception and design of the study. NC: preparation of the warning messages for severe weather and violent acts. MR and ST: collection of data. MR: organized the database and writing the first draft of the manuscript. ST: calculating path models. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.557178/full#supplementary-material

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Exploratory Study of the Relationship Between Happiness and the Rise of Media Consumption During COVID-19 Confinement

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The confinement of the population into their homes as a result of COVID-19 has entailed a notable increase in the consumption of diverse media. This exploratory study aimed to examine how the increase in media consumption was related to subjective happiness and psychological well-being. For this purpose, a questionnaire was administered to a sample of Spanish adults (n = 249; 53.8% women; aged between 18 and 75, M_{age} = 42.06, SD = 12.37) to assess their consumption of different media before and during confinement. Moreover, participants were evaluated for hedonic, eudaimonic, social, and experienced happiness by using the *Pemberton Happiness Index* (PHI). The results underlined the great increase in the consumption of TV for entertainment and social networking sites (SNS) during confinement. Furthermore, it was found that higher consumption was negatively correlated with the level of happiness, so that, people who reported greater well-being, both subjective and psychological, spent less time watching TV and using SNS. In contrast, no association was found between the level of happiness and the consumption of news (regardless of the media) and radio. Therefore, it seems that far from cultivating greater happiness, those who engaged in heavy consumption of TV entertainment and SNS during confinement were less happy than those who did so more moderately and spent more time using other media or performing other activities.

Keywords: media consumption, well-being, happiness, confinement, COVID-19

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INTRODUCTION

The main tragedy of COVID-19 has been the death and illness of millions of people around the world. But, the pandemic has also led to an unprecedented situation for most of the world population: home confinement for many weeks at a time. Thus, individuals and families across were suddenly forced to rethink a daily routine to be carried out entirely inside their homes. It was necessary to reconfigure the daily habits that characterized the previous normal life. During quarantine period, some daily behaviors disappeared, while new ones would emerge, and in most cases their duration changed.

Media consumption was one of the habits with a greater increase during confinement. Various studies confirm this result (Casero-Ripollés, 2020), as well as reports from the media

industry, such as the Spanish Association for Media Research (AIMC), who measured media consumption during confinement through various waves of weekly monitoring. For instance, the second report during the week of 13–19 April (the 5th week of confinement in Spain) shows an increase in the consumption of digital magazines and radio. Furthermore, in the third assessment (week from 20 to 26 April), it was observed that "radio exceeds 20.5 million listeners per day with an increase in all time slots, especially from 6 to 10 in the morning" (AIMC, 2020a). In addition, "62% of Internet users have increased their viewing time for both free-to-air and pay channels to combat boredom [and] subscriptions to OTTs continue to grow with a 7.6% increase in recent weeks" (AIMC, 2020b).

Along the same lines, the study of Comscore (2020) pointed out an increase in media consumption in several European countries, i.e., France, the United Kingdom, Germany, Italy and Spain. In these countries, the consumption of contents such as general information and local news apps rose, specifically during the months of March and April. The same study also showed a similar peak in the use of instant messaging applications and social networks during those same months of the year 2020.

Barlovento Comunicación (2020) released another report highlighting the historical record of Internet and TV consumption in Spain, with 2 h and 56 min per person/day in the case of web access (an increase of 37 min compared to the same month in 2019) and an average TV consumption of 5 h and 10 min. This study coincides with Kantar consulting findings (Nafría, 2020), which suggest a sustained growth in TV consumption exceeding 40%. Kantar's results have highlighted the time devoted to news, both in terms of reach (33% more) and intensity, reflected by the time allotted to this type of content more than doubling. In this sense, Masip et al. (2020) and Rodero (2020) argued that in crisis situations, audiences tend to focus on traditional media, especially TV, followed by radio. However, this crisis appears to involve a great increase also in social network use.

According to data from the latest report prepared by Hootsuite and "We are social" (Fernández, 2020), in Spain, 47% of Internet users said they were spending more time on social networks and 23% of them said that they spent "much more" time on the networks, compared to their pre-quarantine habits. As the report indicates, social networking site (SNS) had a significant rise in their number of active users during the first quarter of 2020. The greatest growth occurred in Twitter, with an increase in user about 14% (Fernández, 2020). In Spain, the platform preferred during confinement was Instagram, which has reported an increase of 6% in active users (more than 1 million people). Thus, Spain was the third European country in terms of its activity increase on this network during the COVID-19 crisis (Fernández, 2020).

The resurgence of the hegemony of TV during the pandemic (Casero-Ripollés, 2020) is not a great surprise, given that, it remained one of the most widespread leisure activities even before confinement (Frey et al., 2007; Frey, 2018). However, the increase in TV consumption during confinement was paradoxical, considering that the vast majority of scientific evidence (Robinson and Martin, 2008) suggests an inverse relationship between excessive TV consumption and individual happiness.

Psychological studies on the effects of TV on the well-being and health of the audience have a long tradition, with the work by Argyle and Lu (1992) as pioneer. In this line, special attention has been paid to children (Hamer et al., 2009; McDade-Montez et al., 2015), reaching certain consensus on the harmful effect that excessive hours of TV may have on both child physical and mental health. Studies on the adult population show similar results, as well. Thus, Lu and Argyle (1993) found that TV consumption in general was associated with lower happiness, as measured by the Oxford Happiness Inventory (OHI), although specific consumption of Soap Operas correlated with higher happiness. The authors warned, however, about the possible mediation of personality differences in such results. In other study, Hills and Argyle (1998) examined the same relationship between viewing TV Soap Opera and happiness, and found no significant relationship. Furthermore, Frey et al. (2007) found that intensive TV users in general reported lower life satisfaction, more material aspirations and a higher level of anxiety. Cuñado and Pérez de Gracia (2012) also showed an association between TV consumption and negative affect.

It should be noted that TV consumption can be very heterogeneous, given the variety of broadcast content, as Gui and Stanca (2009) underlined. These authors pointed out the need to highlight qualitative aspects in the studies exploring the relationship between TV consumption and well-being. Thus, Kim et al. (2017) focused on viewing live sports events. As these authors suggested, well-being improves when hedonic, eudaimonic, and social needs are satisfied, and watching sports on TV seemed to be favorable for all of them. Sports broadcasting may involve different characteristics compared to other TV contents. However, live sports on TV were not available during confinement.

There was a controversy concerning causality in the relationship between those two variables, as Bayraktaroglu et al. (2019) highlighted. Many studies have found a negative interrelation between TV viewing time and different indicators of well-being. However, for these authors, causality is not clear in that previous evidence. Moreover, they advocate an inverse causal relationship: lower happiness, in hedonic terms, may be the cause for more TV watching, rather than increased TV watching causing unhappiness. As the same authors said, people try to distract themselves with TV expecting to feel better, so unhappiness would be what causes the increase in TV consumption. In any case, such consumption does not seem to significantly improve hedonia neither for a desirable period, but may have a detrimental effect.

In any case, until now the relationship between both variables, hours of TV and happiness, have been studied in normal conditions, and not in such an exceptional and unprecedented situation, nor under the widespread uncertainty in social, economic, and health terms of a worldwide pandemic. Therefore, it seemed more than pertinent to observe if the relationship between the two variables might vary in such a unique scenario.

Moreover, it is also interesting to examine the separate effect by general entertainment on TV and fiction-related (series and movies) consumption from news' consumption. Concerning the consumption of series and movies on TV, it is possible to find a source of psychological well-being that goes far beyond mere audiovisual entertainment (Oliver and Bartsch, 2010). Fiction series and movies, as cultural products, can also provide an intellectual and cognitive stimulation, i.e., it can become an eudaimonic entertainment source, and not just a hedonic one (Vorderer and Reinecke, 2015; Lozano Delmar et al., 2018; Oliver and Raney, 2019).

Furthermore, regarding the increase in news consumption, it is expected an inverse relationship with the level of happiness, regardless of the media. In a situation like the current one, where most of the news are negative and directly related to the pandemic and its consequences, it seems plausible to think that a greater and intensive monitoring of news could have adverse effects on the happiness of the audience. This is shown by studies not only previous to the pandemic (Johnston and Davey, 1997; Havrylets et al., 2013) but also studies conducted during confinement (Masip et al., 2020).

In contrast, the starting point for radio was different from that of TV. Although its relationship with happiness may be detrimental, the mass media par excellence has always demonstrated a leading role in times of crisis, as Rodero (2020) and others remind us. It is worth noting that radio, due to its versatility and technological simplicity compared to other mass media, has been a preferential mean of information in turbulent times. In addition to informing, radio has a traditional power to comfort and to provide companionship. Thus, it is considered the most intimate media, partly due to the "particularly intense sense of presence that radio possesses" (Karathanasopoulou, 2014, p. 97). In relation to radio consumption during confinement, it may be expected a positive relationship between increased consumption time and happiness, or at least, no decrease in happiness, as pointed out Cuñado and Pérez de Gracia (2012). It is important to note that the radio, by its acoustic nature, enables doing something else while listening. Consequently, the effects of its consumption on well-being can be mediated by other simultaneous activities with listening.

With regard to the use of SNS and their relationship with happiness, some studies have shown a variety of results. Among those studies which indicated a positive effect of social networks on the users' well-being, Chan (2018) observed a positive relationship between subjective well-being (SWB) with the number of friends or contacts on Facebook, especially among young people. Hu et al. (2017) also noticed some benefits of using Facebook, in terms of psychological well-being, although they were conditioned by the online-offline social contexts and personality characteristics (with stronger relationship among introvert people). Huang (2016) detected some beneficial effects of individual self-disclosure on SNS through social support and online social well-being. In the same line, Gilmour et al. (2019) conducted a review of studies on Facebook and its association with social support and health. They found that overall Facebook-based social support predicted better outcomes in both mental and physical health, although they also found considerable exceptions. They acknowledged that the study was not about general Facebook use, but about whether users seek and find social support through Facebook. Similarly, Clark et al. (2018) argued that, if used to make meaningful social connections, SNS can be beneficial to well-being. However, these authors also warned about the danger of becoming a trap of isolation and social comparison, which that are not conducive to happiness (Smith et al., 1989; Yamada and Takahashi, 2011).

Thereby, Liu and Yu (2013) argued that although the use of Facebook certainly implies a perception of greater social support, this is weakly linked to well-being, because this relationship is mediated by general social support, received outside SNS. Lima et al. (2017) highlighted the positive effects of online friendships compared to face-to-face relationships. Furthermore, Arampatzi et al. (2018) established that online social contacts will never replace the role and prominence of real-life social contacts in the human pursuit of happiness. But apart from the specific usage profile in qualitative terms, the quantitative increase in SNS usage time seems clearly detrimental on well-being. Besides the fact that personal and cultural variables may mediate online behavior and its psychological consequences (Castellacci and Tveito, 2018), most recent studies are concluding, i.e., more time spent on SNS is associated with a lower level of happiness (Arampatzi et al., 2018; Faelens et al., 2021). Only a study, among teenage students in Turkey (Dogan et al., 2018), presented a positive relationship between time spent using SNS (Facebook and Twitter) and increased happiness. In contrast, Twenge (2019) concluded that while moderate use of SNS could be beneficial, an excessive increase is clearly negative to well-being. In the same vein, Frost and Rickwood (2017) found in their meta-analysis that intense use of Facebook could be associated with mental health problems such as anxiety, depression, addictions, or eating disorders. Andreassen et al. (2016) or Tang et al. (2016) or Hussain and Griffiths (2018) found a strong association between problematic use of SNS and symptoms of psychiatric disorders, especially among adolescents. Consequently, it seems unlikely that this increase in SNS time during confinement would imply a higher level of happiness or well-being.

So, following the studies mentioned above, the aim of this work was to examine the relationship between media consumption and psychological well-being in a new and ever seen situation due to the confinement during Spring 2020 in Spain. Given that media consumption experienced a huge growing during that period of confinement (Casero-Ripollés, 2020), which in Spain began in mid-March of the year 2020, it can be assumed that people increased their media consumption in order to find a source of some kind of well-being, if not eudaimonic, at least hedonic, during their daily confinement at home.

THE PRESENT RESEARCH

The aim of the present study was to explore whether the supposed increase in media consumption, as several sources

have already indicated, during the weeks of confinement at home because of the COVID-19 pandemic was positively or negatively related to the level of happiness and well-being. First, it is aimed to study if there was in fact a significant increase in the use of the different media. Second, the relationship between media consumption and happiness was explored, as well as the relationship between the change in media consumption during confinement and the levels of happiness. On the basis of previous literature, the hypotheses were:

> H_1: Higher daily consumption of audiovisual fiction (TV series and movies) and higher increase compared to pre-confinement are expected to be associated with greater happiness.
> H_2: Higher daily TV consumption (general entertainment) and higher increase in consumption compared to pre-confinement, are expected to be associated with lower happiness.
> H_3: Higher daily news consumption and higher increase in consumption compared to pre-confinement, are expected to be related to lower happiness.
> H_4: Greater daily radio consumption and greater increase in the consumption during confinement, are expected to be related to be associated with greater happiness.
> H_5: Greater daily consumption of social networks (SNS) and greater increase during confinement are expected to be associated with lower happiness.

Sample and Procedure

A questionnaire was administered using Qualtrics,[1] and distributed through different digital channels and networks (WhatsApp, Twitter, Facebook, and mailing). The sample was composed of 249 adults (53.8% women) aged between 18 and 75 (M_{age} = 42.06, SD = 12.37), by carrying out a non-probabilistic snowball sampling procedure (the participants helped to share the link of the online survey through their own SNS). Most participants were Spanish (99.1%), did not lose their job (91.9%), did not contract the virus (95.1%), and did not lose a loved one (95.9%). Furthermore, 72.2% knew someone infected by the virus. In terms of social comparison of the situation during this confinement ("In general and compared to other citizens, how do you think that your situation is during pandemic?"), 4.5% of the respondents reported their situation as being worse than average, 26.1% indicated that their situation was similar to average, while 69.4% indicated being better than average. Responses, collected in April and May of the year 2020, were anonymous and confidential, since no personal data were requested to identify the participant.

The questionnaire comprised different sections. First, some socio-demographic questions were included, as well as employment and contextual variables. These questions covered both generic items and those related to the particular pandemic situation. Second, the subjects were asked about their average media consumption time, estimated in minutes per day. The question (and the answer) was double, referring to the time spent before confinement, and the time spent during confinement (e.g., *How many minutes on average per day did you dedicate before confinement and now during the confinement dedicate yourself to listen to the radio?*) Time scale ranged from a daily average of 0–150 min or more, with the more common intervals that are used in daily life (up to 10 min/around 15 min/around 20 min/around 30 min/around 40 min/around 45 min/around 50 min/around 1 h/around 1 h and a quarter/around 1 h and a half/around 1 h and three quarters/around 2 h/around 2 h and a half or even more).

In relation to TV, participants were separately asked about their consumption of generic entertainment, and fiction content (series and movies), while the consumption of news was asked regardless of the media. Regarding the use of radio and SNS, they were asked about time spent on both without distinguishing the nature of the content.

There are numerous instruments for measuring happiness and well-being (Cooke et al., 2016; Frey, 2018). Each one emphasizes certain aspects over others, according to the theoretical approach (see Veenhoven, 2017). Thus, it is interesting to take into account the two great dimensions of human happiness: hedonia and eudaimonia. They continue to have elusive and multifaceted definitions (Huta, 2013). The first one could be summarized as the subjective well-being that implies a generalized life satisfaction, where positive emotions are more prevalent than negative ones. The latter can be defined as that psychological well-being that stems from an optimal and purposeful life, where a sense of vital fulfillment prevails, while maintaining the ethical sphere of the human being. It is worth remembering that both play a complementary role in the overall human happiness (Huta, 2015), so that they cannot be fully understood without each other.

An instrument was used to equally cover both dimensions and not being excessively long and complex, given the conditions of online administration. Pemberton Happiness Index (PHI; Hervás and Vázquez, 2013), was used, because tool it has already demonstrated its cross-cultural validity (Ribeiro Paiva et al., 2016; Wade et al., 2018). This scale provides a measure of complete well-being, assessing both hedonia and eudaimonia, and also a social dimension and experienced happiness. For example, with items such as "Yesterday, I felt satisfied by something I did," or "Yesterday, I allowed myself a whim," with concrete actions from the previous day, of special interest for the study during the confinement situation, where monotony might be problematic. Overall, PHI has 11 items following a 11-point Likert scale, and 10 dichotomous items, similar to those already outlined. **Table 1** collects the descriptive statistics of happiness dimensions and overall PHI index. Results showed notable scores in happiness dimensions, with the highest mean found in eudaimonic well-being and the lowest one, on social well-being. The overall PHI index reached a noteworthy mean score, with 7.68 (SD = 1.26) over a maximum of 10. Regarding reliability, overall scale presented excellent internal consistency (α = 0.89). As well, excellent reliability was also observed in the dimensions: general

[1]www.qualtrics.com

TABLE 1 | Descriptive statistics of happiness dimensions.

	Minimum	Maximum	*M*	*SD*
General well-being	2.50	10	7.64	1.60
Eudaimonic well-being	1.33	10	8.06	1.32
Hedonic well-being	0	10	7.36	1.85
Social well-being	0	10	6.42	2.16
Experienced well-being	2.00	10	7.37	1.78
PHI	3.42	10	7.68	1.26

well-being (α = 0.76), eudaimonic well-being (α = 0.87), and hedonic well-being (α = 0.90).

Data Analysis Design

First, descriptive statistics (i.e., mean and SD) of habits (i.e., watching TV: series and movies; watching TV: general; following news; listening to the radio; using social network sites; and participating in fan communities), before and during confinement were studied. Second, repeated measures variance analyses were conducted to examine change in habits after and during confinement, calculating partial eta squared as size effect indicator.

Third, Pearson bivariate zero-order correlations were calculated to analyze the associations between the frequency of habits during confinement and the scores in happiness dimensions and PHI index. Confidence intervals for correlations were also calculated. Fourth, correlation analyses were also carried out to assess the interrelations between the change in habits during confinement and happiness. The variables of change were determined by calculating the difference between the frequency of each habit during confinement and before confinement. These statistical analyses were all conducted using SPSS 21.0.

RESULTS

Descriptive Statistics of Media Consumption

Table 2 presents means in minutes per day spent on the aforementioned habits before and during confinement. Concerning habits before confinement, participants reported having spent more minutes a day watching series and movies on TV, watching other contents on TV, and using social networks. During confinement, these same habits were also the most frequent, followed by keeping up with the news. The lowest mean scores, before and during confinement, were detected regarding participation in fan communities.

Analysis of the Change in Habits During Confinement

Table 2 also reflects the analysis of the change in the minutes spent in each habit before and during confinement. Significant increases in the frequency were observed in watching TV (series, movies, and general entertainment), following news, using social networks. The time spent in watching TV series and movies increased the most, around half hour during confinement. Furthermore, an increase of around 20 min was observed in social network use, as well as watching general contents and following news. No remarkable changes were found in listening to the radio nor in participating in a fan community.

Associations Between Habits During Confinement and Happiness

Table 3 shows bivariate correlations between habits during confinement and happiness dimensions and overall PHI index. PHI scores were negatively associated with watching TV, both series/movies and general contents, with using social networks and creating/sharing contents online. Watching series and movies was negatively related to all types of well-being, i.e., general, eudaimonic, hedonic, social, and experienced. Furthermore, watching TV in general presented negative associations with both hedonic and social well-being. Using social networks was negatively associated with general, hedonic, and experienced well-being. Finally, no significant correlations were detected between happiness' indicators and the habits of listening to the radio and following news.

Associations Between Change in Habits During Confinement and Happiness

Table 4 describes the bivariate correlations between the changes in consumption habits comparing before and during confinement and happiness indicators. Results showed that greater increase in watching series and movies on TV and greater increase in using social networks were associated with lower PHI score. A greater increase in the consumption of series and movies was specifically related to lower scores in hedonic and experienced wellbeing. Moreover, a higher increase in the use of social networks was associated with lower eudaimonic, hedonic, and experienced well-being. The changes in other consumption habits did not show significant associations with happiness indicators.

DISCUSSION

As findings of this exploratory study indicated, for all cases except for the radio, the daily media consumption during confinement at home because of the COVID-19 increased considerably, at least among the sample of participants.

With regard to the initial hypotheses, which linked this rise of media consumption to happiness and well-being, some different results were observed. In the case of H_1, the consumption of fiction on TV and its positive association with happiness (PHI), was not supported by our data. Indeed, the resulting relationship was inverse. That is, the greater the consumption of fiction on TV during confinement and the greater the increase in that consumption with respect to pre-confinement, the subject reported less happiness (PHI). The same direct relationship was found between general entertainment on TV during confinement and happiness, but not between happiness and the increase in that behavior compared to pre-confinement; thus, our results partially supported H_2.

TABLE 2 | Descriptive statistics of habits before and during confinement, and analysis of the change.

	Before confinement		During confinement		Change analysis	
	M	*SD*	*M*	*SD*	*F*	η^2_p
Watching TV: series and movies	53.27	36.57	83.56	49.78	131.53***	0.37
Watching TV: general	40.86	41.22	62.61	53.22	78.56***	0.26
Listening to the radio	34.57	39.85	33.27	47.33	0.29	0.01
Following news	33.76	28.12	53.06	37.19	84.91***	0.28
Using SNS (Facebook, Instagram…)	41.27	36.76	63.19	49.53	117.78***	0.35

***$p < 0.001$.

TABLE 3 | Pearson bivariate correlations between habits during confinement and happiness dimensions.

	General well-being	Eudaimonic well-being	Hedonic well-being	Social well-being	Experienced well-being	PHI
Watching TV: series and movies	−0.14* (−0.28, −0.01)	−0.14* (−0.27, −0.02)	−0.30*** (−0.42, −0.17)	−0.17* (−0.29, −0.03)	−0.18** (−0.31, −0.04)	−0.22** (−0.35, −0.09)
Watching TV: general	−0.12 (−0.26, 0.03)	−0.12 (−0.24, 0.02)	−0.18** (−0.31, −0.04)	−0.14* (−0.26. −0.01)	−0.05 (−0.17, 0.09)	−0.16* (−0.28, −0.01)
Listening to the radio	0.11 (−0.01, 0.21)	0.07 (−0.03, 0.18)	0.11 (−0.01, 0.20)	0.05 (−0.08, 0.17)	0.05 (−0.08, 0.18)	0.10 (−0.01, 0.21)
Following news	−0.06 (−0.20, 0.09)	−0.05 (−0.18, 0.09)	−0.13 (−0.27, 0.03)	0.03 (−0.13, 0.18)	−0.11 (−0.26, 0.02)	−0.08 (−0.22, 0.07)
Using SNS	−0.21** (−0.34, −0.06)	−0.12 (−0.26, 0.01)	−0.21** (−0.33, −0.08)	−0.06 (−0.20, 0.08)	−0.28*** (−0.41, −0.15)	−0.20** (−0.33, −0.07)

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

TABLE 4 | Pearson bivariate correlations between change in habits and happiness dimensions.

	General well-being	Eudaimonic well-being	Hedonic well-being	Social well-being	Experienced well-being	PHI
Change in watching TV: series and movies	−0.11 (−0.24, 0.02)	−0.12 (−0.24, 0.01)	−0.29*** (−0.40, −0.16)	−0.10 (−0.25, 0.04)	−0.14* (−0.27, −0.01)	−0.19** (−0.31, −0.06)
Change in watching TV: general	−0.07 (−0.20, 0.06)	−0.06 (−0.18, 0.07)	−0.13 (−0.26, 0.01)	−0.04 (−0.19, 0.11)	−0.07 (−0.20, 0.07)	−0.09 (−0.22, 0.05)
Change in listening to the radio	0.04 (−0.08, 0.15)	0.01 (−0.11, 0.10)	0.06 (−0.07, 0.19)	0.06 (−0.08, 0.19)	0.07 (−0.10, 0.23)	0.04 (−0.08, 0.15)
Change in following news	−0.01 (−0.14, 0.11)	0.03 (−0.08, 0.14)	−0.02 (−0.14, 0.10)	0.03 (−0.12, 0.17)	−0.04 (−0.16, 0.09)	0.01 (−0.11, 0.13)
Change in using SNS	−0.13 (−0.28, 0.03)	−0.14* (−0.33, −0.08)	−0.20** (−0.32, −0.06)	0.01 (−0.11, 0.12)	−0.20** (−0.33, −0.05)	−0.17* (−0.34, −0.01)

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

TV use is mostly a passive habit, from a physical perspective, it encourages a sedentary lifestyle that is detrimental to both physical and mental health (Shiue, 2015). At a Cognitive level, fiction and general entertainment on TV do not involve any intellectual effort, which could not fulfill expectations in terms of well-being. The reward that this use provides may reward at a very short term or even decrease well-being.

Thus, Gui and Stanca (2009) consider TV consumption as a clear example of an overestimation of the reward obtained for a self-determined behavior, which could be related to its possible addictive component. In this sense, an easy and immediate relaxation is obtained, with little or no involvement by the consumer.

A possible cause of the decrease in well-being as a consequence of time spent watching TV could be the excessive availability of channels, contents, and possibilities that the "small" screen offers nowadays. Here, the evidence of the relationship of the overabundance of consumption choices in many product categories and happiness has been already pointed out (Schwartz, 2005). The same consequence was observed in relation to the oversupply of channels, content, and OTTs, as concluded by Gui and Stanca (2009), or Benesch et al. (2010), particularly among intense TV viewers.

Although the negative relationship between TV consumption and happiness seems clear, its causality is not, as pointed out by Bayraktaroglu et al. (2019). However, thanks to the possibilities of assessment of experienced well-being provided by PHI, when exploring the activities performed the previous day, added to the conditions of confinement that implied a certain "freezing" of life, it seems reasonable to estimate some causality between the activities undertaken the previous day and the hedonic and eudaimonic state at the time of the survey.

When we face psychologically adverse situations, as Taquet et al. (2016) pointed out, it seems natural to seek refuge in pleasant short-term activities, which have an immediate effect, although this has its dangers. An example would be watching

TV passively and excessively, without greater emotional or cognitive involvement. The benefits of this type of activity are so short term that it is plausible to expect the emergence of a negative causal spiral. We would, therefore, be far from what is known as an optimal experience (Csikszentmihalyi, 1990), which besides reducing the time available for other more profitable (in terms of hedonia and eudaimonia) activities, and they clearly present risks for both physical health, due to sedentarism, and mental health, i.e., depressive symptoms (Bin et al., 2019).

Furthermore, there was no significant relationship, either positive or negative, between daily consumption of news and happiness, regardless the media. No association was neither observed concerning the change between news consumption before and during confinement, so that H_3 was not supported by our data. In other words, neither more exposure to the news, nor a greater increase in relation to pre-confinement, was associated with neither less nor more happiness. This is contrary from what was found in other studies already mentioned (Johnston and Davey, 1997; Havrylets et al., 2013; Masip et al., 2020), but is consistent with works such as those by Cuñado and Pérez de Gracia (2012), who found a negative effect of TV on happiness, but they did not find that association with reading news and newspapers. Robinson and Martin (2008) suggested that the happiest people were those who spent less time watching TV and, conversely, more time reading newspapers. Also, Hall (2016) found that among those who spent more time on the Internet looking for information, those seeking news content scored higher in happiness, also with eudaimonia.

Perhaps an explanation for the fact that a high news consumption during the confinement did not imply a lower happiness could be the proliferation and bombardment of bad news (health, social, and economic issues), which may serve to compare the global situation with the individual in positive terms. As mentioned above, most of the sample was not experiencing the worst consequences of the tragedy directly, what fortunately could be extrapolated to the general population. Thus, the comparison would be positive. In fact, the questionnaire also explicitly asked if the respondent considered his or her own circumstances better or worse than the global situation lived in the worldwide. The results indicated that the majority, almost 70%, considered their circumstances better than the others' circumstances.

Regarding the time spent listening to the radio, within the sample, there was no significant increase in the number of consumption minutes during confinement at home. Apart from this, the results showed that a higher level of radio use does not implied a higher level of happiness (H_4), neither lower. It should be noted that this is the media whose reception is the least passive, compared to, for example, TV. That is, in the vast majority of cases, the radio listener is doing something else while listening. If before confinement, for example, radio was listened while commuting to work, during confinement, the people could listen to the radio, for example, while exercising, cooking, or doing other housework (Rodero, 2020), which somehow allowed him or her to feel in the company of others. As Rodero (2020) states, the radio is considered the closest media, which simulates companionship and drives away the feeling of loneliness, something that in many circumstances of confinement may have been important. In any case, the effect of listening to the radio on happiness level could be mediated by those other tasks or activities carried out while people listen to the radio.

With respect to the last hypothesis (H_5), results clearly supported it. That means, the greater the use of SNS, the lower the happiness rate. In addition, the greater the increase in use during confinement with respect to consumption prior to it, the lower the level of happiness. This result is also in line with other studies prior to confinement (Arampatzi et al., 2018). Among the explanations for this result, there are several possibilities. The problem of social comparison has already been mentioned. Networks facilitate social comparison, which under normal conditions tends to have adverse effects on the happiness of individuals who see their lives as less exciting than what is apparent from the profiles of many of their contacts (Ayala et al., 2017). Bollen and Gonçalves (2018) assert that, in spite of social media apparently satisfying an essential human need, in terms of social relations, their use can lead to higher levels of psychological and social dysfunction. The aforementioned social comparison could be one of the main reasons.

But in addition to all this, and other disorders caused by SNS abuse, also mentioned above, the decline in happiness associated with it during confinement may have been driven by additional factors. For example, the frustration or nostalgia of seeing situations, places and events that were left behind and forbidden *sine die* due to confinement. Secondly, the impotence of seeing contacts in the timeline who are also known in real life, and with whom one could not be or meet face-to-face. Thirdly, the unease generated by growing social and political polarization and tension as a result of the pandemic and its management by the public authorities. A tension that, at least in Spain, has been considerable. In this sense, Hong and Zhang (2020) found that the influence of exposure to news, e.g., political news, on happiness was not the same whether the exposure was through traditional or digital means (e.g., social networks or electronic devices). Thus, traditional media increased the level of happiness, while digital media decreased it. Both effects, however, were mediated by other variables. In the case of traditional media, their positive effect on happiness occurred through the enhancement of public trust in government (GT), while the negative effect of new media on happiness occurred through the increase of perceived social risks (PSR). These results are intriguing, given the nature of contemporary Chinese society and its pattern of government intervention in the media. However, this dichotomy could be extrapolated to the data presented here.

The time spent in SNS, similar to that devoted to the TV, has led to less time available for other types of activities or habits that may positively correlate with well-being during confinement (i.e., more active lifestyles, both physically and

cognitively, are more rewarding). This is the case, for example, of sport and physical exercise (Schuch et al., 2018), or reading (Billington, 2011).

As Twenge (2019) points out, perhaps the issue is not the use of SNS, but the excessive use of them. As Mochón (2018) suggests, excessive consumption could imply less well-being as an indirect consequence of displacing other activities that are more beneficial, related, for example, to sleep time, face-to-face social interaction, and upward social comparison (Twenge, 2019). In short, it seems clear that a greater well-being level does not seem to correlate with the increase in SNS consumption, as well as a higher TV consumption. In other words, a more moderate consumption of both media could imply a higher level of happiness, both in terms of hedonic, eudaimonic, and social well-being.

The present study is not exempt from some limitations. Among them, it should be acknowledged that variables such as personality traits may have a relevant impact (Lu and Hu, 2005). With regard to the sample, it would have been desirable to reach a greater number of respondents. In addition, in order to be able to generalize the results to the Spanish population, a study with a representative sample using probability sampling is necessary. In this sense, snowball sampling is a convenience sampling method usually used when it is difficult to access the sample under study, as is the case in this study (Naderifar et al., 2017). It could be interesting to combine the measurement of happiness with some other instrument that complemented the 22 items of PHI, but the fact is that this would have risked, making the questionnaire excessively long, possibly reducing the number of participants. PHI is a more complete and richer measure than many others, as discussed above, which covers different aspects of human happiness. Like all self-reports, there is also a risk of social desirability bias. However, the fact that the questionnaire was completely anonymous and remote may partly reduce this risk.

A future line of research, beyond the situation of confinement, should be to further explore causality in the relationship between media consumption and happiness. Given that the design of the study is cross-sectional, we can only draw conclusions based on the associations between the variables, without knowing the directionality of the effects, which requires a longitudinal design, nor the causality, which requires experimental manipulation. As pointed out by Bayraktaroglu et al. (2019), the possible causality between the two is still a matter of discussion. The heterogeneity of means, uses, situations, etc., raises the need to combine studies with other types of methodologies.

Finally, it is worth mentioning that among the comments that many respondents left after completing the questionnaire, almost all were positive. They said that they had enjoyed the questions and that many of them had raised interesting issues that were not previously noticed. This served, at least, to ensure that the development of this research itself did not imply any harm, but that even the subjects could have some benefit, at least for a few minutes, from their long confinement.

CONCLUSION

The main conclusion of this study suggests that the higher media consumption did not seem to help so mucho to well-being and happiness, specially TV and Social Networks. However, it is important to avoid demonizing either of these media. The effects of SNS, TV, and the media as a whole on well-being, like almost every human tool, depend on quality and quantity of use. A rational and rationed use, as Mochón (2018) points out, may not diminish happiness but rather have positive effects. These can even be used as means to enjoy not only hedonic happiness, but also to exercise eudaimonia, as shown by various interventions from Positive Psychology (Niemiec and Wedding, 2014; Rieger et al., 2014; Yu, 2020).

Thus, the proposal could be a more moderate in time terms, but also a more virtuous media consumption. That is, going beyond mere hedonic entertainment and looking for more eudaimonic enjoyment, more rigorous information media, etc. We should remember once again that hedonia and eudaimonia need each other (Huta, 2015), that happiness and virtue nourish each other in a virtuous cycle (Kesebir and Diener, 2013), as Aristotle or Seneca (2018) argued hundreds of years ago.

If all this is true in normal times, it may be also true in times of confinement and pandemic, as also Eden et al. (2020) point in their recent study. In the late Middle Ages, Bocaccio (2013) wrote his famous Decameron. He narrated how 10 young people fled from the plague that devastated Florence and took refuge, confined, in a beautiful country villa. To pass the days, they combined routine tasks with storytelling sessions. They did this for entertainment, but also to draw lessons from each story. Just like them, in our confinement days, we had to learn to entertain ourselves, and to do so in a way that would also make us genuinely happier. Nowadays, a personal media environment should really serve as an ally for such aim.

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 from Universidad Loyola Andalucía. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

JM-V was involved in the conceptualization, design, data collection, and writing of the manuscript. DG-B was involved in the conceptualization, planning, and data analysis. JL was involved in writing and reviewing of the manuscript. All authors contributed to the article and approved the submitted version.

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Social Media Use, Self-Efficacy, Perceived Threat, and Preventive Behavior in Times of COVID-19: Results of a Cross-Sectional Study in Pakistan

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Although the role of social media in infectious disease outbreaks is receiving increasing attention, little is known about the mechanisms by which social media use affects risk perception and preventive behaviors during such outbreaks. This study aims to determine whether there are any relationships between social media use, preventive behavior, perceived threat of coronavirus, self-efficacy, and socio-demographic characteristics. The data were collected from 310 respondents across Pakistan using an online cross-sectional survey. Reliability analyses were performed for all scales and structural equational modeling was used to identify the relationships between study variables. We found that: (i) social media use predicts self-efficacy ($\beta = 0.25$, $p < 0.05$) and perceived threat of coronavirus ($\beta = 0.54$, $p < 0.05$, $R^2 = 0.06$), and (ii) preventive behavior is predicted by self-efficacy and perceived threat of coronavirus ($R = 0.10$, $p < 0.05$). Therefore, these results indicate the importance of social media's influence on health-related behaviors. These findings are valuable for health administrators, governments, policymakers, and social scientists, specifically for individuals whose situations are similar to those in Pakistan.

Keywords: coronavirus, social media use, prevention, infection management, infection control, regulation

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INTRODUCTION

The current COVID-19 pandemic is the most significant public health crisis of this century (World Health Organization, 2020). Up to mid-May 2021, the COVID-19 pandemic has had devastating consequences, with more than 161 million confirmed cases and more than 3.35 million deaths globally (World Health Organization, 2021). In a severe public health emergency like this, people seek information from all available sources—including traditional media, interpersonal communication, and social media (Perez-Lugo, 2004). For instance, traditional media play an important role in mobilizing the community, providing authoritative information and emotional support, helping isolated people feel connected, and allocating resources (Wicke and Silver, 2009). In such circumstances, people seek information from the media in order to understand the severity

of the situation, and to protect themselves (Heath and Gay, 1997). As different forms and degrees of lockdown measures were imposed to control the coronavirus outbreak (Marzouki et al., 2021), there was very limited face-to-face contact (Liu et al., 2021). Thus, people have had to rely much more heavily on social media to keep informed and stay connected (Liu, 2021). Consequently, social media usage has escalated, and it has quickly established itself as a critical medium of communication for information generation, distribution, and consumption (Effenberger et al., 2020; Fischer, 2020). Compared to conventional media (electronic and print), social media allows for quick and easy access to information, making its impact more effective than ever (Cuello-Garcia et al., 2020). Scholars have also studied the influential mechanism of health risk information on social media on individual cognition, attitudes, and actions (Lin et al., 2020).

People's perceptions of pandemic-associated risk are key factors contributing to increased public participation in disease-prevention measures (Shahin and Hussien, 2020). The majority of people around the world have heard of the coronavirus, and most of them are aware of the need to practice preventive behaviors in order to reduce its spread (Balkhi et al., 2020). Although some people follow the rules strictly, others neglect or postpone them and congregate in large groups in public areas or in their homes (Nofal et al., 2020). The fact that people behave so differently during times of collective action suggests that their perceptions of the threat posed by this virus vary greatly depending on where they live and who they are (Zhang et al., 2020).

According to Kaplan and Haenlein (2010), social media is a term that refers to a variety of applications, such as social networking sites and blogs, that are built on web 2.0 (e.g., Facebook, YouTube, and Twitter) and enable users to create, share, and engage in various activities. The term "social media" is a catch-all term for websites that offer a variety of social activities. Social networking is a web-based, electronic-mediated platform that allows users to create profiles and exchange thoughts, images/clips, and information in a virtual network system.

Previous studies have shown that people have preferred social media platforms over traditional media to obtain disease-related information in recent infectious disease outbreaks (Jang and Baek, 2019). During the H1N1 outbreak in 2009, people relied on Twitter (Chew and Eysenbach, 2010) and Facebook groups (Davies, 2009) for the exchange of information, opinions, and experiences. The public was also somewhat dependent on social media platforms to access and share MERS-related information in 2015 (Jang and Baek, 2019). But in the case of the ongoing COVID-19 pandemic, social media use has reached unprecedented levels compared to the pre-pandemic period. People may be using social media during corona-led social distancing for stress relief and with the aim of accessing entertaining content, such as movies, comedies, and communication with family and friends (Whiting and Williams, 2013). As work and schooling have been transferred to an online-based format, people are also spending a lot of time using social media to meet their professional and educational needs (Prem et al., 2020). However, social media has become more significant as these platforms have emerged as a useful medium to disseminate health messages and contribute to the betterment of psycho-behavioral responses to COVID-19.

Studies indicate that people primarily use social media, rather than other media outlets, to access information related to the coronavirus pandemic. As a result, social media platforms have been utilized for maintaining quarantine, alerting the public about high-risk areas, and providing awareness about health maintenance and treatments (Chan et al., 2020). Moreover, empirical evidence shows that the use of social media as an information-seeking platform has altered preventive behavior related to coronavirus. The results of these studies are consistent with previous research on the function of social media in improving health-related preventive behaviors during pandemic situations (Shi and Smith, 2016; Yoo et al., 2016). However, more scientific research is needed to explore the critical role of social media in coronavirus prevention and treatment. Since individual disease prevention behavior is the only known way to avoid the spread of COVID-19 (Ning et al., 2020), it is critical to recognize the factors, along with social media use, that motivate individuals to participate in disease prevention behavior. This study aims to examine how social media has played an essential role in formulating preventive behavior during the COVID-19 outbreak in Pakistan.

Situation in Pakistan

In Pakistan, there are currently over 46 million social media users. Between 2020 and 2021, this number increased by 9.0 million (+24%) (Kemp, 2021). After the start of the coronavirus pandemic and its related measures of social isolation, the number is estimated to have risen dramatically. The coronavirus pandemic hit Pakistan in February 2020, and social distancing started to be implemented across the country in mid-March 2020 (Mahmood et al., 2020). Social media has been one of the main outlets providing news and information about the coronavirus and attempts at prevention due to social distancing (Nazir et al., 2020). Even before the outbreak of COVID-19, social media was acknowledged for its value in disseminating information about basic health awareness, health literacy, hygiene, sanitation, and nutrition (Nisar and Shafiq, 2019; Zakar et al., 2021).

The government of Pakistan released a new social media regulation policy in January 2020, but this policy still fails to include social media's role in health risk communication and health literacy. Due to the outbreak of coronavirus, the government decided to review the country's social media regulations in order to maximize its potential for improving health literacy among the general population. In this pandemic situation, the government should use social media to provide therapy to people in order to improve their mental health and coping skills (Nisar and Shafiq, 2019). As a result, empirical research on the role of social media in encouraging potentially protective and health-seeking behavior is needed.

Theoretical Framework

In order to understand infectious disease outbreaks, a systematic review of the literature was carried out (Yang, 2015). It was found that predicting preventive behaviors during infectious disease

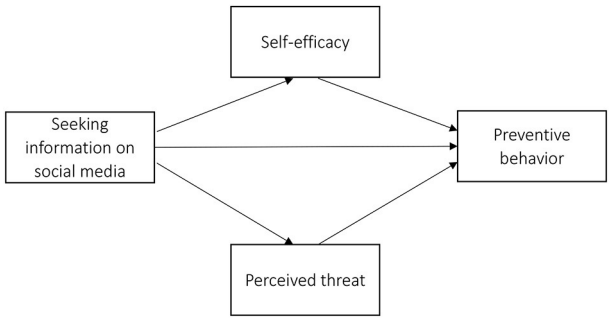

FIGURE 1 | Conceptual model of the study based on the theory of EPPM.

outbreaks has been the focus of many studies. Furthermore, most of these studies used the extended parallel process model (EPPM) (Witte, 1992, 1994) in order to understand how individuals experience and respond to an infectious disease. The EPPM has been used in previous empirical studies conducted on preventive behaviors during infectious disease outbreaks (Siu, 2008; Balicer et al., 2010; Zhang et al., 2015) and, more specifically, in studies showing the relationship between social media usage and preventive behavior during pandemics (Zhang et al., 2015; Shi and Smith, 2016).

This study also uses the EPPM as its conceptual background (**Figure 1**). This model develops the significance of rational considerations and emotional reactions in determining health-related behavioral decisions (Witte, 1992, 1994). The degree to which a person feels threatened by a health issue determines his or her motivation to act, while one's self-efficacy or confidence to effectively reduce the threat determines the action itself. In other words, self-efficacy and the perceived level of threat of any disease influence the extent to which people opt for preventive behavior (Witte, 1992, 1994). When both self-efficacy and perceived threat are high, individuals are likely to employ recommended preventive behaviors in order to avoid the danger (Yoo et al., 2016).

Perceived threat refers to the subjective evaluation of the threat contained in the message. It is a cognitive construct that comprises two dimensions: perceived severity of the threat and one's perceived susceptibility to that threat (Popova, 2012). Perceived severity is defined as "one's feelings concerning the seriousness" of a threatening event (Gore and Bracken, 2005), whereas perceived susceptibility refers to beliefs about the probability of personally experiencing the threat (Witte et al., 1998). In the EPPM, self-efficacy is defined as beliefs about one's ability to carry out the recommended response (Witte, 1996). Individuals' beliefs about their capabilities influence their behavior, such as what they choose to do or how they respond, in order to effectively manage situations (Bandura, 1997). Based on the EPPM, the existing literature affirms the relationship between self-efficacy and preventive behavior in relation to infectious disease. Similarly, the perceived threat of any infectious disease leads to the adoption of preventive behavior related to that infectious disease.

Research Hypothesis

The following research hypotheses were made:

(1) There is a positive relationship between social media use and self-efficacy among the respondents.
(2) There is a positive relationship between social media use and perceived threat of COVID-19 among the respondents.
(3) Social media use predicts the preventive behavior related to COVID-19 among the respondents.
(4) Perceived threat of COVID-19 explains the preventive behavior related to COVID-19 among the respondents.
(5) Self-efficacy explains the preventive behavior related to COVID-19 among the respondents.

METHODS

Data Collection

In these days of social distancing and lockdown, we opted for an online survey using Google Survey. Participants were recruited via announcements published on social media (Facebook, LinkedIn, and WhatsApp). A link to the questionnaire was also posted on the social media pages of various universities in Pakistan. Data was collected during the period April 10–30, 2020. For this study, the age limit was set at 18 years and above. Respondents were briefed about the objectives of the study by means of a cover letter, and informed consent was taken electronically. Participation in the study was voluntary and no incentives were provided to respondents. Each question in the questionnaire was compulsory and the respondent could not submit the form without answering all the questions. If any respondent did not want to answer all the questions, he or she was allowed to exit the survey. Overall, 310 respondents successfully completed the survey. The questionnaire was administered in English, as this is the official working and study language in Pakistan (**Supplementary Appendix 1**).

Measures

Sociodemographic Characteristics

Information about age, gender, provincial belonging, area of residence (urban vs. rural), marital status, monthly family income, and occupation of the respondents were collected in order to control for the effects of socio-demographic characteristics on social media use, self-efficacy, perceived threat, and preventive behavior.

Perceived Threat of COVID-19

In order to develop the scale to measure perceived threat of COVID-19, the authors reviewed the existing scales that have previously been developed to assess perceived threat during infectious disease outbreaks. For instance, a scale was developed by Yang (2015) to assess the perceived threat of H1N1. Similarly, a scale was derived from it to measure the perceived threat of MERS (Yoo et al., 2016). In this study, the authors modified this scale to make it suitable for measuring the perceived threat of COVID-19. To measure perceived susceptibility, three items were used ("COVID-19 could happen to me," "it could happen my family," and "it could happen to my neighbors and friends"). Perceived severity was measured with four items ["COVID-19

causes death quickly," "Many people can die from COVID-19," "A person who contracts COVID-19 will die if not treated," and "COVID-19 is fatal," strongly disagree (1) to strongly agree (5)].

Self-Efficacy

In earlier studies, a four-item scale was used to measure self-efficacy for MERS (Yoo et al., 2016). The authors modified this scale to measure self-efficacy for COVID-19 using following four items ("I can figure out how to avoid COVID-19 infection," "I can avoid COVID-19 infection," "I can recover even if I contract COVID-19," and "I am fully informed about COVID-19"). A five-point Likert scale, strongly disagree (1) to strongly agree (5), was used for this scale.

Preventive Behavior

In order to control outbreaks of infectious diseases like COVID-19, health experts and global health agencies [e.g., the World Health Organization (WHO)] recommend a series of preventive behaviors, such as hand hygiene, and avoidance behaviors, such as social distancing or (voluntary) quarantine (Karimi et al., 2015; Weston et al., 2018; Lewnard and Lo, 2020). The authors developed a preventive behavior scale consisting of three constructs (handwashing, cough etiquette, and social distancing behavior). This scale was constructed using the guidelines for COVID-19 prevention recommended by the WHO. Handwashing behavior was measured with five items (using hand sanitizer, washing hands before making and eating food, and washing hands whenever they feel dirty and after using the bathroom). Cough etiquette behavior was assessed with three items (covering the mouth and nose while sneezing, coughing or sneezing into the arm if having no tissue, putting the used tissue into a covered dustbin). In measuring social distancing behavior, five items were used (avoiding shaking hands with people, maintaining social distancing when going outside, avoiding going out unnecessarily or visiting sick people, and not touching body parts). A five-point Likert scale, not at all (1) to always (5), was used for this scale.

Social Media Use

Social media usage during COVID-19 was measured using two constructs: for medical information (related to COVID-19) and for general information. Retrieving or sharing general information on social media included: homebased remedies and the names of herbal medicines useful for boosting immunity in response to COVID-19, the names of tablets or injections being used for the treatment of COVID-19, and religious texts for protection from sickness and ailments. Five items were used to measure medical information received or shared using social media [appropriate techniques for wearing a face mask, the availability of hand sanitizer and face masks, consulting doctors if feeling unwell, and keeping oneself updated on the situation of the pandemic; strongly disagree (1) to strongly agree (5)].

Reliability Analysis

The reliability analysis revealed that the scales used to measure the study variables (perceived threat of coronavirus, preventive behavior, social media use, and self-efficacy) were highly reliable in the Pakistani context. The values of Cronbach's Alpha for perceived susceptibility and perceived severity were 0.815, and 0.762, respectively. The scales used for preventive behavior also showed high reliability. Cronbach's Alpha was 0.751 for handwashing, 0.708 for cough etiquette, and 0.830 for social distancing behavior. The reliability was higher for the scale of medical social media use (0.823) than for general use (0.622). For self-efficacy, it was also satisfactory, at 0.700 (**Table 1**).

TABLE 1 | Psychometric properties of the study variables.

Scales	α	Mean	SD	Min.	Max.	Number of items
Perceived threat related to COVID-19						
Perceived susceptibility	0.815	13.44	9.626	4	20	4
Perceived severity	0.762	13.37	9.715	4	20	4
Preventive behavior						
Handwashing	0.751	22.19	10.543	6	25	5
Cough etiquette	0.708	13.09	5.312	3	15	3
Social distancing behavior	0.830	21.54	3.713	5	25	5
Social media use						
Medical use	0.823	15.69	17.386	5	25	5
General use	0.622	13.80	9.748	4	20	4
Self-efficacy	0.700	14.85	2.64	4	20	4

Data Analysis

The data analysis was conducted using SPSS Amos. We derived frequencies and percentages in order to describe the sociodemographic characteristics of study participants. *T*-tests were used to check differences between genders, social media use, perceived threats, and preventive behavior. The Pearson correlation coefficient was calculated to investigate the roles of age and income in explaining perceived threats related to the coronavirus, preventive behavior, and social media use. Based upon previous research conducted to predict preventive behavior during infectious disease outbreaks (Yoo et al., 2016), we performed structural equation modeling (SEM). We combined exploratory factor analysis and multiple regression as a confirmatory technique to investigate the relationship between the dependent variable (preventive behavior), independent variable (social media use), and mediating variables (perceived threat related to the coronavirus and self-efficacy). The significance level was assigned at 95% for all tests.

RESULTS

Sociodemographic Characteristics

Table 2 presents the sociodemographic characteristics of the sample. Of the 310 respondents, slightly more than half were women (54.2%, $n = 168$) and the majority were unmarried (72.3%, $n = 224$). More than half of the participants were students (56.1%, $n = 174$), leading to an overall young sample. The majority had a combined family income of less than or equal to PKR 100,000 (74.5%, $n = 231$). A considerable number of respondents used social media for more than 4 h a day (42.3%,

TABLE 2 | Sociodemographic characteristics ($n = 310$).

Variables	*n*	%
Gender		
Female	168	54.2
Male	142	45.8
Marital status		
Single	224	72.3
Married	82	26.5
Divorced/widowed	4	1.3
Occupation		
Employed	85	27.4
Unemployed	30	9.7
Self-employed/housewife	21	6.8
Student	174	56.1
Age		
18–20 years	74	23.9
21–30 years	176	56.8
31–40 years	47	15.2
41–50 years	7	2.3
>50 years	6	1.9
Monthly family income		
≤PKR 100,000	231	74.5
PKR 10,0001 to 200,000	54	17.4
>PKR 200,000	25	8.1
Daily social media use		
<1 h a day	29	9.4
1–2 h a day	65	21.0
3–4 h a day	85	27.4
>4 h a day	131	42.3
Relying on social media for information during COVID-19		
Yes	184	59.4
No	90	29.0
At times	36	11.6

$n = 131$), and more than half of the participants (59.4%, $n = 184$) relied on social media for information about COVID-19.

Gender Differences

We conducted an independent sample *t*-test to determine the effect of gender. Overall, there was no statistically significant effect of gender on perceived threat related to the coronavirus or social media use among the respondents, except for a higher general use of social media among women. Furthermore, women displayed significantly better preventive behaviors on all three scales (**Table 3**).

Pearson Correlation

The Pearson correlation coefficient was computed to investigate the role of age and economic status in explaining the perceived threat of COVID-19, self-efficacy, preventive behavior, and social media use. The results reveal that there was no statistically significant association between age and preventive behavior. Respondents' age was negatively and very weakly correlated with perceived severity and social media use for medical purposes. The findings also suggest that economic status does not matter because monthly family income did not correlate with preventive behavior or social media use. Monthly family income was only correlated with perceived threat of coronavirus. This relationship was negative in nature and also very weak (**Table 4**).

Structural Equation Model

Table 5 illustrates fit indices for the following model. The chi-square test ($\chi^2 = 2.23$, $p < 0.05$) and goodness of fit index (GFI = 0.95) demonstrated a good model fit. Moreover, alternate fit indices (CFI = 0.92, AGFI = 0.92, RMSEA = 0.06) confirmed the acceptable fit of the sample.

Table 6 depicts path coefficient estimates for the observed variables loaded on three latent variables for this study. All of the coefficients between the perceived threat of coronavirus and its observed variables were found to be significant ($p < 0.005$). This result supports the assertion that the two observed variables—perceived susceptibility ($\beta = 0.83$) and perceived severity ($\beta = 0.61$)—significantly explained the perceived threat of coronavirus. Similarly, the coefficients between preventive behavior and its observed variables are also significant ($p < 0.005$). This result confirms that the three observed variables—handwashing ($\beta = 0.61$), cough etiquette ($\beta = 0.67$), and social distancing ($\beta = 0.72$)—have a significant positive effect on preventive behavior. In addition, the observed variables medical use ($\beta = 0.88$) and general use ($\beta = 0.23$) significantly load on the latent variable of social media use among the respondents.

The results (**Figure 2**) show that there is a relationship between social media use and self-efficacy ($\beta = 0.25$, $R^2 = 0.06$, $p < 0.05$), and social media use and perceived threat of coronavirus ($\beta = 0.54$, $p < 0.05$). In addition, perceived threat of coronavirus ($\beta = 0.14$, $p < 0.05$) and self-efficacy related to coronavirus ($\beta = 0.22$, $p < 0.05$) significantly explain preventive behavior related to coronavirus among the respondents ($R = 0.10$, $p < 0.05$).

DISCUSSION

The COVID-19 pandemic has permanently altered the global landscape. The crippling consequences of the lockdown have been felt in all spheres of life (Bae et al., 2021), including a crumbling health system (Miller et al., 2020; Mahmood et al., 2021), panic buying (Ahmad and Murad, 2020; Arafat et al., 2020), a severe and difficult-to-resolve economic and labor crisis (Sukharev, 2020), high levels of distress (Cullen et al., 2020), and so on. Both the short-term and long-term effects of the COVID-19 pandemic have influenced how people view and represent current events and future scenarios, including adherence to preventive behavior (Liu, 2021). This research aims to advance our understanding of how social media shapes public perceptions of threat and their involvement in preventive behaviors by analyzing data collected during the COVID-19 outbreak in Pakistan in 2020. According to the results, more than half of the participants used social media to learn about COVID-19. This finding corroborates the findings of previous research looking at how people search for and share information during epidemics (Sharma et al., 2017). People's use of social media to exchange

TABLE 3 | Independent sample *t*-test between gender and study variables.

Variables	Gender	Mean	SD	*t*	*p*-value	95% CI	
						Lower	Upper
Perceived threat related to COVID-19							
Perceived susceptibility	Male	13.39	3.35	−0.24	0.804	−0.785	0.609
	Female	13.48	2.89				
Perceived severity	Male	13.19	2.92	−0.92	0.357	−1.027	0.372
	Female	13.52	3.27				
Preventive behavior							
Handwashing	Male	21.78	3.46	−2.04	0.041	−1.479	−0.029
	Female	22.54	3.02				
Cough etiquette	Male	12.59	2.59	−3.56	<0.001	−1.428	−0.413
	Female	13.51	1.94				
Social distancing	Male	21.08	4.10	−2.00	0.046	−1.673	−0.015
	Female	21.93	3.32				
Social media use							
Medical use	Male	15.89	4.36	0.76	0.445	−0.572	1.299
	Female	15.52	4.00				
General use	Male	14.16	3.14	−2.57	0.010	−1.530	−0.206
	Female	15.03	2.78				
Self-efficacy	Male	14.60	2.54	−1.84	0.068	−1.146	−0.040
	Female	15.15	2.75				

TABLE 4 | Pearson correlation analysis.

Variables	Age	Monthly family income
Perceived threat related to COVID-19		
Perceived susceptibility	−0.013	−0.002
Perceived severity	−0.122*	−0.077
Preventive behavior		
Handwashing	0.062	−0.100
Cough etiquette	−0.015	0.074
Social distancing behavior	−0.056	0.034
Social media use		
Medical use	−0.112*	−0.018
General use	0.041	0.042
Self-efficacy	0.042	−0.027

*$p < 0.05$.

TABLE 5 | Structural equation model fit indices.

Model fit indices	Good fit	Acceptable fit	Model values
Normed Chi square (X^2/d)	$X^2/d < 3$	$3 < X^2/d < 5$	2.23
GFI	$0.95 \leq GFI \leq 1$	$0.90 \leq GFI \leq 0.95$	0.95
AGFI	$0.95 \leq AGFI \leq 1$	$0.90 \leq AGFI \leq 0.95$	0.92
CFI	$0.95 \leq CFI \leq 1$	$0.90 \leq CFI \leq 0.95$	0.92
RMSEA	$0 < RMSEA < 0.05$	$0.05 < RMSEA < 0.08$	0.06

TABLE 6 | Path coefficients of observed variables.

Latent variable	Observed variable	Path coefficients (β)
Perceived threat related to COVID-19	Perceived susceptibility	0.83***
	Perceived severity	0.61***
Preventive behavior	Handwashing	0.61***
	Cough etiquette	0.67***
	Social distancing behavior	0.72***
Social media use	Medical use	0.88***
	General use	0.23***

***$p < 0.001$.

information about their opinions and activities continues to increase in popularity (Vitak et al., 2011). Social media may be well-suited for individuals to share their opinions and views on particular health issues due to the affordances offered by social media platforms. Users of social media may find satisfaction in purposefully expressing themselves on these platforms (Fogg and Iizawa, 2008).

The unexpected and deadly COVID-19 pandemic has prompted an increasing number of studies on its effects, especially on risk perception, with the goal of providing useful information for future health-related communication strategies (Liu, 2021; Oh et al., 2021). The results show that social media use is linked to perceived threat and self-efficacy, both of which are associated with coronavirus preventive behavior. In the situation of infectious disease outbreaks, social media has grown in importance as a risk and crisis coordination tool (Strekalova, 2017; Lwin et al., 2018). Information seeking and sharing through

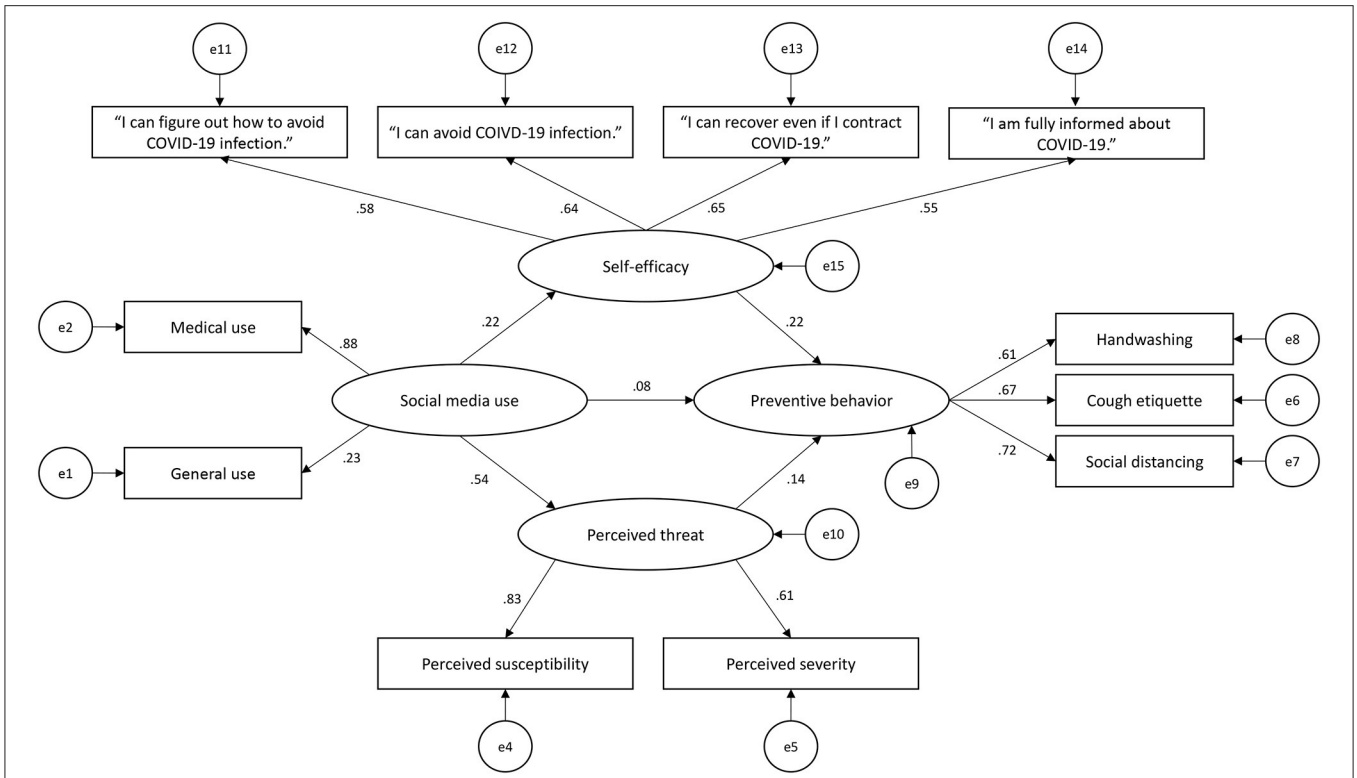

FIGURE 2 | Structural equation model of social media use, self-efficacy, perceived threat related to COVID-19, and preventive behavior.

social media can complicate disease communication, as emotions can influence both public perceptions and behavior related to infectious diseases (Apuke and Omar, 2021; Dadaczynski et al., 2021; Soroya et al., 2021). In the literature, the dynamics between social media use, affective responses, risk perception, and behavioral outcomes have been discussed (Karasneh et al., 2021). The findings revealed that people's perceptions of the COVID-19 threat were high, and that most people took self-preventive measures and believed they were helpful. This study explains the emotional and cognitive mechanisms that affect people's threat perceptions and preventive behaviors as a result of information available on social media. The researchers (Liu, 2021) also found that social media plays a role in fostering preventive behaviors by inducing fear, which influences people's risk perceptions. In China, it is reported that people were exposed to COVID-19-related information through a variety of social media platforms, which had a positive impact on preventive behaviors (Liu et al., 2021). In another study, it is concluded that the large amount of COVID-19 information made available via social media was linked to the public's understanding of their susceptibility to and the severity of COVID-19 infections, as well as their subsequent involvement in COVID-19 prevention behaviors (Lin et al., 2020).

The use of social media as a communication tool during an infectious disease epidemic is a novel form of observation, but it offers a possible source of reliable and timely assessments of disease development within populations (Nazir et al., 2020). Developing countries, such as Pakistan, usually lack the resources to sustain and monitor the surveillance system in a timely manner during an outbreak of an infectious disease (Eke, 2011). Therefore, most developing countries use social media networks as health networking mechanisms to prevent and monitor the spread of infectious disease in their communities due to a lack of funding. Social media can provide a quick method of surveillance that predicts the real-time burden of infectious disease and, as a result, can direct outbreak prevention strategies (Bhatia et al., 2021). Based on the findings of this research, the authors suggest that the government, health sector, and other stakeholders, such as media experts, collaborate to design a program for using social media platforms as health communication tools to prevent and track the spread of infectious disease in Pakistan.

LIMITATIONS

This study has some limitations. The authors utilized social media to recruit participants only from Pakistan. Thus, while the findings may not be easily generalized to other developing countries, they are useful for governments, politicians, policymakers, health administrators, and social scientists, especially those in similar situations to Pakistan. The authors were also unable to assess other variables underlying the category of social sciences and their role in dealing with COVID-19. Future researchers could investigate other factors related to social media use, such as psychological stress, family

relationships, social isolation, and loneliness. However, one of this study's strengths is that it sought to develop a local scale to assess social media usage and its relationship to perceived threat, self-efficacy, and preventive behavior, which could be used in future health communication and infectious disease management studies. To our knowledge, this is the first study of its kind conducted in Pakistan that empirically identifies the relationship between social media use, preventive behavior, self-efficacy, and perceived threat.

CONCLUSION

In conclusion, social media has become an increasingly popular source of awareness and information for health communication, especially during an outbreak of disease. In an emergency, social media enhances health-risk communication by disseminating relevant information and encouraging people to engage in preventive behaviors. The current study contributes to health risk communication scholarship by using an expanded parallel process model (EPPM). This study adds to the growing body of knowledge revealing that using social media to disseminate COVID-19 information can influence audiences' perceptions of perceived threat and self-efficacy, as well as their preventive behavior. This means that social media can be used as part of public health communication during outbreaks. Official social media pages for experts and health agencies could share timely and important information with the public, potentially counteracting the negative impacts of other types of media sharing.

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 ethical committee from the International Islamic University Islamabad. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

QM, SJ, and SM conceptualized the study. QM and SM contributed to data collection. SJ and FF supervised the work and supported in data analysis. QM drafted the draft. 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.2021.562042/full#supplementary-material

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