SOCIAL BRIDGES: SOCIETY, PSYCHOLOGY AND BEHAVIOR DURING AND POST COVID-19

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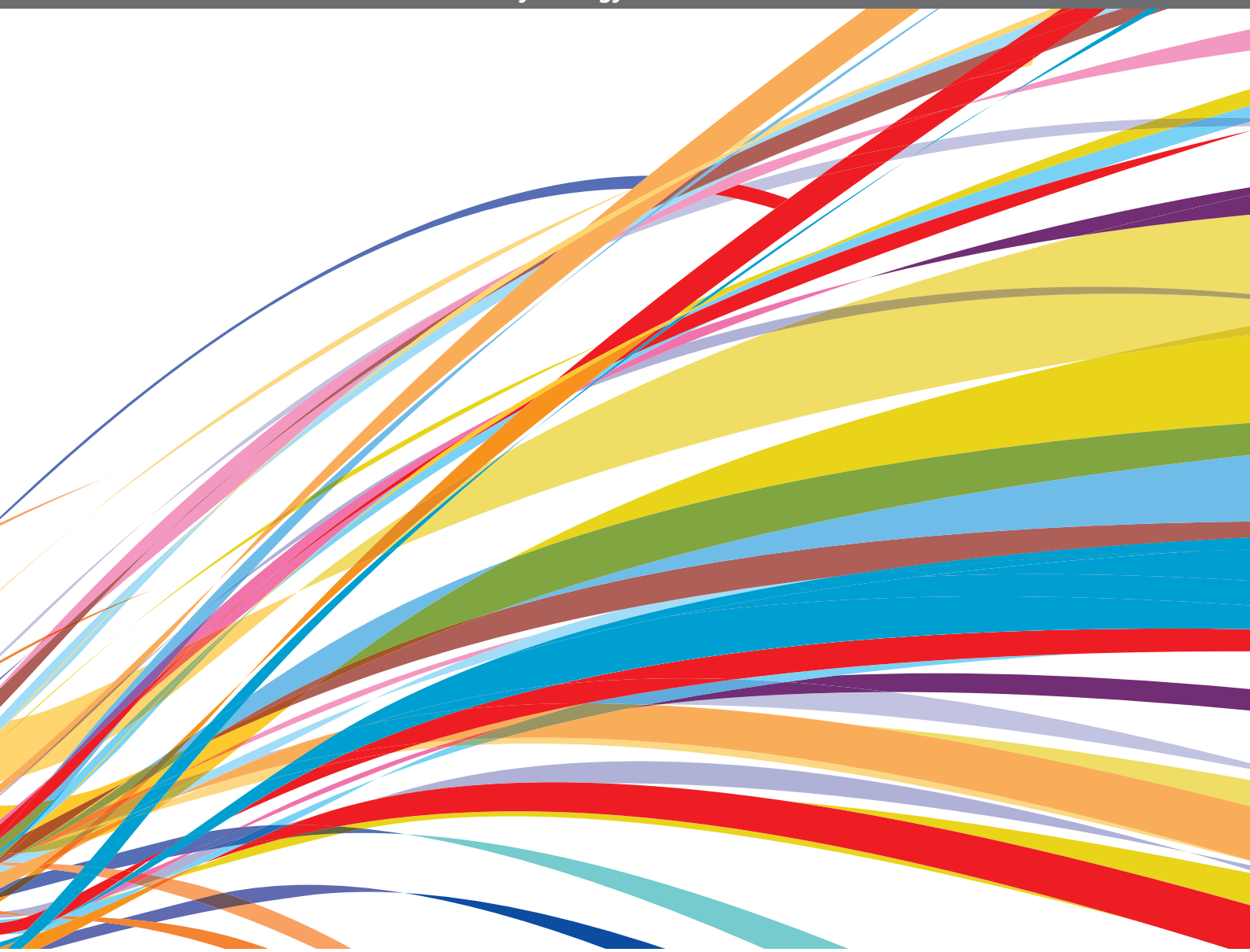

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SOCIAL BRIDGES: SOCIETY, PSYCHOLOGY AND BEHAVIOR DURING AND POST COVID-19

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Stay Mindful and Carry on: Mindfulness Neutralizes COVID-19 Stressors on Work Engagement *via* Sleep Duration

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We examine whether mindfulness can neutralize the negative impact of COVID-19 stressors on employees' sleep duration and work engagement. In Study 1, we conducted a field experiment in Wuhan, China during the lockdown between February 20, 2020, and March 2, 2020, in which we induced state mindfulness by randomly assigning participants to either a daily mindfulness practice or a daily mind-wandering practice. Results showed that the sleep duration of participants in the mindfulness condition, compared with the control condition, was less impacted by COVID-19 stressors (i.e., the increase of infections in the community). In Study 2, in a 10-day daily diary study in the United Kingdom between June 8, 2020, and June 19, 2020, we replicate our results from Study 1 using a subjective measure of COVID-19 stressors and a daily measure of state mindfulness. In addition, we find that mindfulness buffers the negative effect of COVID-19 stressors on work engagement mediated by sleep duration. As the COVID-19 pandemic is ongoing and the number of reported cases continues to rise globally, our findings suggest that mindfulness is an evidence-based practice that can effectively neutralize the negative effect of COVID-19 stressors on sleep and work outcomes. The findings of the present study contribute to the employee stress and well-being literature as well as the emerging organizational research on mindfulness.

Keywords: mindfulness, COVID-19 stressors, employee sleep, work engagement, organizational behavior

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INTRODUCTION

Sleep helps employees recover from work and restore their resources (Hülsheger et al., 2014, 2015; Steed et al., 2019). Short sleep duration is associated with detrimental physical health outcomes such as cardiovascular diseases, coronary heart diseases, and even mortality (see Itani et al., 2017, for a review). Low levels of sleep also have destructive effects on psychological outcomes such as cognitive performance (Lim and Dinges, 2010), neurocognitive functioning (Durmer and Dinges, 2005), and mental health (Benca et al., 1992). Importantly, employees with insufficient sleep feel depleted in the workplace, are less satisfied with their jobs, exhibit less organizational citizenship behaviors, and have poor work performance (Kessler et al., 2011; Barnes et al., 2012, 2013; Lanaj et al., 2014; see Litwiller et al., 2017, for a review).

A prominent downstream effect of short sleep duration in the workplace is impaired work engagement (Lanaj et al., 2014; Litwiller et al., 2017). Work engagement is a powerful predictor of employees' job performance. Extant research has shown that more engaged employees perform better in the workplace (Rich et al., 2010; Christian et al., 2011; Bakker et al., 2012; Van Wingerden et al., 2017). Employees who are highly engaged in their work activities not only devote their physical effort, but are also mentally vigilant and emotionally dedicated to the endeavor, and thereby performing better in their tasks (Kahn, 1990; Ashforth and Humphrey, 1995; Rich et al., 2010).

Given that poor sleep takes a serious toll on employees and organizations, organizational research has identified organizational antecedents that impede employees' sleep (Litwiller et al., 2017). Previous studies have shown that demands such as occupational stressors (DeArmond and Chen, 2004), employees' late night smartphone use for work (Lanaj et al., 2014), long hours worked per week (Blau, 2011), and work-family conflict (Barnes et al., 2012; Berkman et al., 2015) are antecedents of employees' reduced sleep duration. Although it is important to understand organizational factors that keep employees awake at night, sleep as a recovery process may also be influenced by non-work factors. In fact, it has long been recognized that organizational scholars should also consider the potential role of non-organizational factors in studying employees' recovery process (Sonnentag, 2003; see Steed et al., 2019 for a recent review).

Exposure to traumatic events is probably the most powerful non-organizational factor that disturbs employees' sleep (Lavie, 2001; see Sinha, 2016, for a review). The ongoing COVID-19 pandemic is the defining global crisis of our time. The UN has referred to it as the greatest challenge humanity has faced since the II World War (United Nations, 2020). Even as we prepare this manuscript, the situation is evolving with cases rising daily in Africa, the United States, and Europe. Scholars have drawn attention to the impacts it could have on individuals' psychological well-being and functioning, with some scholars referring to it as a "collective trauma" (Silver, 2020; Van Bavel et al., 2020; Kniffin et al., In press). Organizational scholars have termed this type of large-scale traumatic events as *acute-extraorganizational stressors* (Byron and Peterson, 2002; Hochwarter et al., 2008). The defining feature of an acute-extraorganizational stressor is that it is driven by a sudden or extreme force that is external to organizations. Unlike intra-organizational stressors (e.g., organizational restructuring or high work demands), organizations cannot take active steps to prevent stressors induced by COVID-19. Scholars have argued that such extra-organizational stressors can have a more devastating effect on employees than intra-organizational stressors (Byron and Peterson, 2002; Hochwarter et al., 2008). Nevertheless, organizations can take intervening steps to mitigate the negative effects of acute-extraorganizational stressors on their employees. As such, it is important for organizational scholars to examine factors that can protect employees from these negative effects during the crisis. However, to date, research has mainly focused on intra-organizational stressors, and thus, we have limited understanding about extra-organizational stressors (Hochwarter et al., 2008). Given this dearth of research, scholars have called for studies that provide theoretical and practical recommendations for how organizations can help their employees manage acute-extraorganizational stressors (Byron and Peterson, 2002; Hochwarter et al., 2008; James, 2011).

We build on the metacognitive theory of mindfulness (Ong et al., 2012; Jankowski and Holas, 2014) and the recovery literature (Barnes, 2012; Steed et al., 2019) to propose that mindfulness can neutralize the negative effect of COVID-19 stressors on employee sleep and employee work engagement (Schaufeli et al., 2008). Specifically, given that exposure to trauma can stimulate an intense and sustained state of hyperarousal, which, in turn, disrupts individuals' sleep (Lavie, 2001; Germain, 2013; Sinha, 2016), we argue that mindfulness – a state in which individuals become aware of their present moment experience – can reduce this hyperarousal state and thereby mitigate the negative effect on sleep duration. Further, given that sleep duration is a crucial recovery mechanism that leads to more engaged employees at work (Barnes, 2012; Lanaj et al., 2014), we propose that state mindfulness may be able to neutralize the negative effects of the COVID-19 stressors on work engagement through the mediating role of sleep duration.

COVID-19 STRESSORS, SLEEP DURATION, AND WORK ENGAGEMENT

Sleep disruption is a prominent feature of individuals' neurobiological and physiological response to trauma (Sinha, 2016). Trauma generates a stressful response that leads to physiological hyperarousal, which in turn disrupts sleep (Lavie, 2001; Germain, 2013; Sinha, 2016). The hyperarousal state occurs at two levels: primary arousal and secondary arousal (Ong et al., 2012). Primary arousal refers to cognitive activities that directly impair sleep, such as worrying about the impact of COVID-19. Secondary or metacognitive arousal refers to the awareness and judgment of primary arousal (i.e., thinking about thinking), which includes how negatively individuals evaluate their thoughts that occurred at the primary level. For example, people may further ruminate about their stressful thoughts about COVID-19 and amplify a hyperarousal state. They may become more attentive to and obsessed with the thoughts that occur at the primary level, which may result in a vicious cycle of falling and/or staying asleep. Indeed, research has shown that exposure to traumatic events leads to shorter sleep duration (Sinha, 2016; Goodwin et al., 2018). Thus, it is possible that employees will experience sleep disruption in response to COVID-19 stressors.

Returning to work after a good night's sleep is critical to ensure employees have sufficient energy and self-regulatory resources to work (Barnes, 2012) and helps employees achieve psychological detachment and physiological recovery (Steed et al., 2019). Thus, sleep is a crucial recovery mechanism leading to work engagement (Barnes, 2012; Lanaj et al., 2014). Specifically, work engagement is defined as a cognitive-affective state characterized as being vigorous, dedicated, and absorbed

in work (Schaufeli et al., 2002; Schaufeli and Bakker, 2004). Engaged employees have high energy, are intensely involved, and are enthusiastic and immersed in work activities. In line with our theorizing, past research has established that sleep duration is positively associated with work engagement (Lanaj et al., 2014; Litwiller et al., 2017).

Given that employees react to trauma by losing sleep (Lavie, 2001; Germain, 2013; Sinha, 2016) and that sleep duration is a crucial recovery mechanism leading to work engagement (Barnes, 2012; Lanaj et al., 2014; Litwiller et al., 2017), we argue that COVID-19 stressors may damage employees' work engagement *via* impaired sleep duration. However, previous research has suggested that these stressors do not universally impact employees (Hochwarter et al., 2008). For example, Hochwarter et al. (2008) have found that employees' perceived resources interact with the effect of hurricane induced stressors on job satisfaction such that hurricane stress reduces job satisfaction for employees with lower perceived resources while hurricane stress is neutralized for employees with higher perceived resources. Thus, there are boundary conditions that determine whether acute-extraorganizational stressors negatively impact employees. Building on the metacognitive theory of mindfulness which suggests that mindfulness is effective in reducing hyperarousal state and improves sleep (Ong et al., 2012; Jankowski and Holas, 2014), we propose that mindfulness is a boundary condition that buffers the negative effect of COVID-19 stressors on sleep duration and in turn work engagement.

MINDFULNESS NEUTRALIZES THE NEGATIVE EFFECT OF COVID-19 STRESSORS

Mindfulness is defined as a moment-to-moment non-judgmental awareness of one's present experience (Brown and Ryan, 2003). Mindfulness can be viewed as a naturally occurring mental state (measured as a dispositional trait or a transient mental state) or can be trained through meditation practices (Davidson, 2010). Despite these distinct operationalizations, scholars view the mindfulness state as a unitary construct across these measures (Reb and Atkins, 2015; Good et al., 2016). This state of mind has been linked with numerous positive outcomes, such as reduced employee stress (for a meta-analysis see Bartlett et al., 2019), and outcomes more specific to the workplace (for reviews see Reb and Atkins, 2015; Good et al., 2016; Eby et al., 2019). Existing research suggests that many of these benefits are a result of mindfulness, increasing a metacognitive awareness of one's experience (Jankowski and Holas, 2014; Kay and Skarlicki, 2020). Specifically, the metacognitive theory of mindfulness suggests that a non-judgmental awareness of one's present experience facilitates individuals' capacity to observe their experience as something separate from themselves. By generating psychological distance between oneself and one's immediate experience, mindfulness supports individuals' capacity to observe and to accept their thoughts and experiences without judgments (Jankowski and Holas, 2014).

As discussed above, sleep is disrupted because metacognitive arousal amplifies the primary arousal triggered by COVID-19 stressors. Mindfulness can specifically mitigate the metacognitive arousal by shifting the negative metacognitive process to a more adaptive stance, in which individuals simply observe and accept their primary thoughts without judgments (Ong et al., 2012; Jankowski and Holas, 2014). In other words, mindfulness may prevent a primary arousal state from developing into a secondary (metacognitive) arousal state. As a result, mindful employees have less difficulty falling asleep and, thus, experience a longer sleep duration. Indeed, previous studies have established that mindfulness effectively increases sleep quantity (Hülsheger et al., 2015; see Ong and Smith, 2017, for a review). Therefore, building on the metacognitive theory of mindfulness and previous studies, we argue that mindfulness may be effective in buffering the negative effects of COVID-19 stressors on sleep duration. Thus, we propose the following hypothesis,

> *Hypothesis* 1: COVID-19 stressors interacts with mindfulness to predict sleep duration such that COVID-19 stressors negatively affects sleep duration when mindfulness is low while the effect of COVID-19 stressors is buffered when mindfulness is high.

Building on the preceding hypothesis that argues that mindfulness will neutralize the negative effect of COVID-19 stressors on sleep duration and previous evidence that sleep duration is a key recovery resource leading to work engagement (Lanaj et al., 2014; Litwiller et al., 2017), we further propose that the buffering effect of mindfulness on the relationship between COVID-19 stressors and work engagement is mediated by sleep duration (see **Figure 1**).

> *Hypothesis* 2: The interaction effect of COVID-19 stressors and mindfulness on work engagement is mediated by sleep duration.

OVERVIEW OF STUDIES

We tested our hypotheses in two studies. We tested hypothesis 1 in Study 1 which is a 10-day field experiment conducted among employees in Wuhan, China during the lockdown between February 20, 2020, and March 2, 2020. We operationalized COVID-19 stressors as an objective indicator - the increase of infections in the community as this was salient to inhabitants in Wuhan at that time. Participants in this study were randomly assigned to either a daily mindfulness practice or a daily mind-wandering practice. Study 2 is a 10-day longitudinal survey conducted among employees in the United Kingdom between June 8, 2020 and June 19, 2020. This study serves two purposes. First, we increased the ecological validity of our research by replicating the buffering effect of mindfulness in a different country where the COVID-19 pandemic had spread widely within the country. Second, we provided additional robustness to our model by adopting

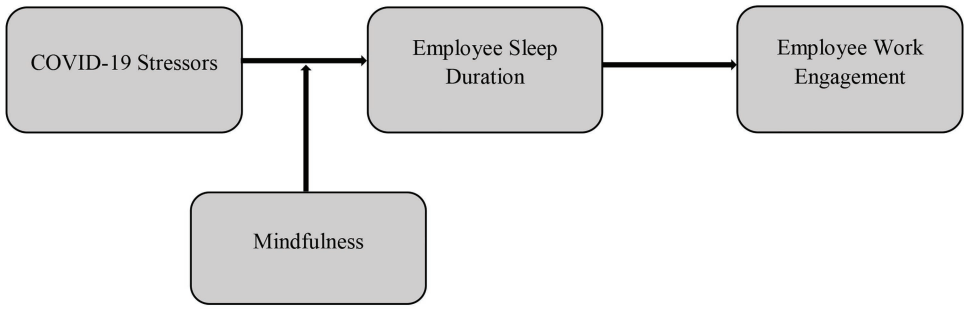

FIGURE 1 | Conceptual model.

alternative operationalizations of our primary independent variables, testing the moderated mediation model by measuring self-reported state mindfulness as a within-subject individual difference variable and COVID-19 stressors as employees' self-reported variable.

STUDY 1

Participants

A snowballing technique was employed to recruit participants through an online advertisement posted through the first author's personal networks in Wuhan between February 18, 2020 and February 20, 2020. The ad stated that a study was recruiting working adults who were experiencing the lockdown in Wuhan to complete a 12-day study with a compensation of 100 RMB (approximately USD 14). All procedures in the study were in accordance with the ethical standards of the institutional review board at the first author's institution and with the Declaration of Helsinki, 1964, and its later amendments or comparable ethical standards. One day before the daily surveys, participants completed a consent form online. Subject IDs were assigned upon submitting the consent form in which a computerized random number was generated at the end of the form. To ensure anonymity, we did not ask participants to indicate their names throughout the study. All participants were blind to the study condition. Throughout the study, the research assistant used the subject ID to identify participants.

To ensure randomization, the research assistant who managed the study was blind to the treatment and the hypothesis. Interested participants scanned a QR on WeChat to enroll in the study. Participants were randomly assigned to one of the two WeChat anonymous groups. Recruitment stopped when the goal of enrolling 110 participants was reached. Experimental conditions were randomly assigned to these two groups by the first author. There are 60 participants in the mindfulness condition and 50 participants in the mind-wandering condition. Three participants in the mindfulness condition and six participants in the mind-wandering condition did not complete the daily surveys. Thus, they were not included in the final analyses. The response rate of initially enrolled participants to daily surveys did not significantly differ between the mindfulness and the mind-wandering groups [95% mindfulness, 88% mind-wandering, χ^2 (1) = 1.78, p = 0.18]. The survey App automatically timestamped the initiation and the completion of the morning survey. This timestamp was used to check if participants adhered to their daily practice. Among participants who completed the 12-day study, one participant in the mindfulness condition and two participants in the mind-wandering condition did not practice the exercise in the morning for at least four consecutive days. In addition, one participant in the mindfulness condition was not located in Wuhan; since our study coded for information about new cases in Wuhan, we dropped this participant from the analysis as well. After excluding participants who did not meet the study criteria, we obtained a final sample of 97 with 55 participants remaining in the mindfulness condition and 42 in the mind-wandering condition. The sample size in the two conditions is comparable with previous mindfulness research (Lindsay et al., 2019; Hafenbrack et al., 2020). The 97 participants (68.04% female) have an average age of 34.49 years (SD = 5.03), 79.4% have a college/Bachelor's degree, and 21.6% have a Masters/PhD degree. Participants in the mindfulness and the mind-wandering conditions did not significantly differ in terms of their sociodemographic features. Specifically, the distribution of gender in the mindfulness condition (58.2% female) did not differ from those in the mind-wandering condition (76.2% female), χ^2 (1) = 2.58, p = 0.064. Participants' age in the mindfulness condition (34.69 years, SD = 5.66) did not differ from those in the mind-wandering condition (34.33 years, SD = 4.03), F(1, 96) = 0.39, p = 0.54. There was no difference between mindfulness condition (27.69 years, SD = 12.42) and mind-wandering condition (28.36 years, SD = 10.85) in terms of years living in Wuhan, F(1, 96) = 0.13, p = 0.73. Participants in both conditions share similar education level (bachelor degree or above 80% vs. 90.5%), χ^2 (1) = 0.71, p = 0.40. In addition, they did not differ in terms of trait mindfulness (4.82, SD = 0.54 vs. 4.83, SD = 0.83), F(1, 96) = 0.05, p = 0.83. These participants in the final sample also did not differ from individuals who initially enrolled in the study but failed to actually participate in the daily surveys (gender: χ^2 (1) = 0.002, p = 0.97.; age: F(1, 105) = 2.36, p = 0.13, years living in Wuhan (F(1, 105) = 0.34, p = 0.56, trait mindfulness F(1, 105) = 0.53, p = 0.47). Although there was a marginally lower percentage of women in the mindfulness condition, this was the result of the snowballing technique

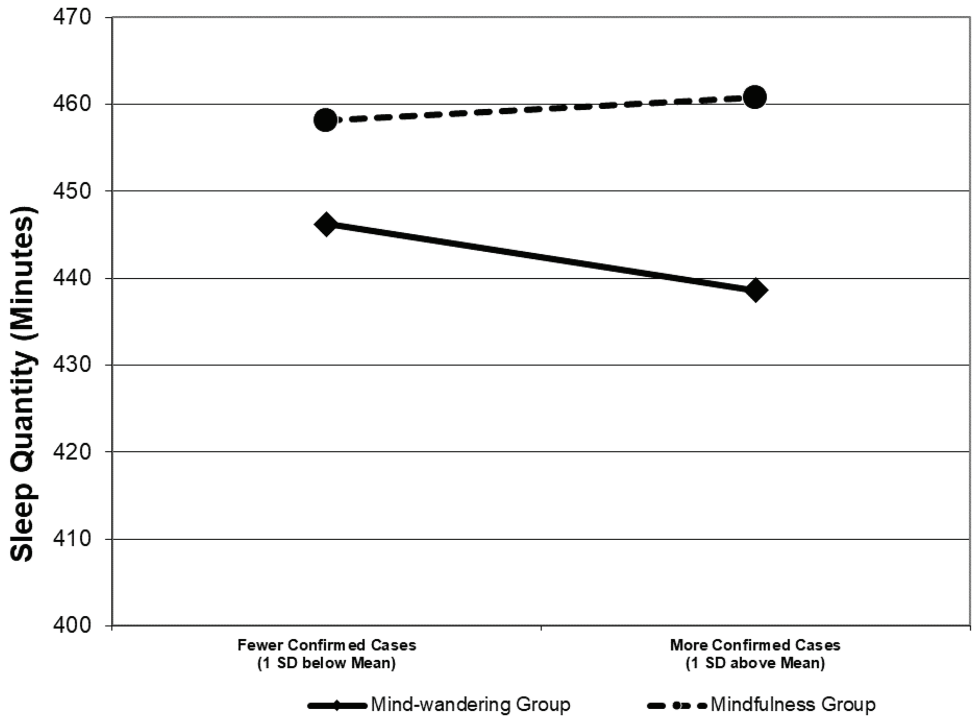

FIGURE 2 | This figure visually depicts how daily mindfulness practice mitigated the relationship between COVID-19 stressors and sleep quantity in Study 1.

rather than the planned assignment. As a robustness check, we controlled for gender in our analyses and found that the buffering effect of mindfulness on the relationship between daily confirmed cases and sleep quantity remained significant (B = 0.06, SE = 0.03, p = 0.02). We found no effect of gender (B = 0.01 SE = 0.03, p = 0.74).

Procedure

Participants completed a baseline assessment on February 20, 2020, that asked for their demographic information and trait mindfulness a day before the intervention began. Participants in the mindfulness practice condition engaged in a 10-min mindfulness practice each morning and participants in the mind-wandering condition engaged in a 10-min mind-wandering practice for 10 consecutive days from February 21, 2020, (Friday) to March 1, 2020 (Sunday). Each day, participants in both conditions completed a short morning survey that was sent *via* WeChat App in the morning (8 am), including audio instructions for the practice, a mindfulness manipulation check, sleep quantity, sleep quality, and caffeine intake in the previous day. On day 12, participants completed a brief survey in which they reported their previous night's sleep, caffeine intake, and Alipay account. After the completion of the study, all participants were debriefed and were invited to a daily group practice at 10 am for a 10-min mindfulness practice. This was done to ensure that all participants, including those in the mind-wandering condition, could benefit from the practice.

State mindfulness induction. As all our participants were native Chinese speakers, we used audio instructions in Mandarin that were recorded by a professional mindfulness coach. These instructions were developed based on well-established English mindfulness programs (Kiken and Shook, 2011). The audio instructions have been used in previous research and were effective in inducing mindfulness and mind-wandering in Chinese populations (Schuh et al., 2019). These audio instructions are available on request from the first author.

Mindfulness manipulation check. After listening to the audio clip in the morning, participants rated their momentary mindfulness on four items on a seven-point Likert scale (1 = not at all to 7 = Completely) (Long and Christian, 2015). Four items were "I focused on the present," "I thought about anything I wanted (reversed coded)", "I let my mind wander freely (reversed coded)," and "I was mindful of the present moment."

COVID-19 stressors. Given that Wuhan is the city that was seriously affected by the virus before the outbreak in other cities and countries, the information about daily confirmed cases was salient to employees in Wuhan. Thus, as a proxy for the COVID-19 stressors, we recorded the number of increased cases (M = 384.55, SD = 108.28) in Wuhan between 20 February, 2020 and 1 March, 2020, from the official records of the Chinese National Health Commission of the People's Republic of China.[1]

[1]http://www.nhc.gov.cn/wjw/xinx/xinxi.shtml

Sleep quantity. We measured sleep quantity in the survey with the following item taken from the previous studies (Lanaj et al., 2014). "How many hours of *actual sleep* did you get last night?" Recent meta-analytic research has revealed that the correlation between objective measures of sleep quantity, such as Actigraph, and self-reported measures of sleep quantity is high, indicating that self-reported measure is accurate and reliable (Litwiller et al., 2017).

Control variables. As a control variable, we measured participants' trait mindfulness in the baseline survey with a 15-item scale on a 7-point Likert scale ranging from 1(never) to 7(very often) (Brown and Ryan, 2003). Fifteen items are "I could be experiencing some emotion and not be conscious of it until sometime later; " "I break or spill things because of carelessness, not paying attention, or thinking of something else;" "I find it difficult to stay focused on what's happening in the present", "I tend to walk quickly to get to where I'm going without paying attention to what I experience along the way;" "I tend not to notice feelings of physical tension or discomfort until they really grab my attention;" "I forget a person's name almost as soon as I've been told it for the first time;" "It seems I am "running on automatic" without much awareness of what I'm doing;" "I rush through activities without being really attentive to them;" "I get so focused on the goal I want to achieve that I lose touch with what I am doing right now to get there;" "I do jobs or tasks automatically, without being aware of what I'm doing;" "I find myself listening to someone with one ear, doing something else at the same time;" "I drive places on "automatic pilot" and then wonder why I went there;" "I find myself preoccupied with the future or the past;" "I find myself doing things without paying attention", and "I snack without being aware that I'm eating." All items are reverse coded. ($\alpha = 0.79$).

Consistent with sleep research, we also controlled for variables that may influence sleep quantity: sleep quality and daily caffeine intake (Gellis and Lichstein, 2009; Lanaj et al., 2014). Research has shown that poor sleep quality on one night can lead to longer sleep the next night (Banks et al., 2010). Thus, when predicting sleep quantity, we included sleep quantity and sleep quality from the previous night (i.e., lagged in time by 1 day) as control variables. We measured sleep quality with an overall item on a seven-point Likert scale ranging from 1(very bad) to 7(very good): "How do you evaluate your night's sleep?". We measured daily caffeine intake with one item: "Did you have beverage that contains caffeine (such as coke, coffee, etc.)?" We have also recorded daily death cases ($M = 58.36$, $SD = 36.65$) and cumulative cases ($M = 32{,}658$, $SD = 3{,}956.85$) between 20 February, 2020 and 1 March, 2020, from the official records.

Results

Descriptive statistics and bivariate correlations are reported in **Table 1**. As a manipulation check, we tested whether the experimental condition had a significant effect on mindfulness (Long and Christian, 2015). Participants in the mindfulness condition reported higher levels of mindfulness than those in the mind-wandering condition ($B = 0.29$, $SE = 0.12$, $p = 0.02$), indicating that our manipulation was successful.

Given the nested nature of the data (daily observations nested within individuals), we used a multilevel modeling approach to test our hypothesis – whether the mindfulness practice would mitigate the effect of the number of daily confirmed cases on sleep quantity. Specifically, we analyzed the data with random coefficient modeling (RCMs; Raudenbush and Bryk, 2002), in which we specified the within-individual-level relationship between the number of daily confirmed cases and sleep quantity as a random slope and used the between-individual-level mindfulness intervention to predict this slope. As shown in **Table 2**, the mindfulness practice positively predicted the random slope between daily confirmed cases and sleep quantity ($B = 0.05$, $SE = 0.03$, $p = 0.046$). To further probe into the effect of the mindfulness practice, we plotted the simple slopes for the mindfulness treatment group and the mind-wandering treatment group, respectively. As shown in **Figure 2**, among people assigned to the mind-wandering group, the number of confirmed cases on a day was negatively related to their sleep quantity on that day ($B = -0.04$, $SE = 0.01$, $p = 0.003$). On average, they lost 39 min of sleep with every thousand confirmed cases reported in the city. In contrast, among people assigned to the mindfulness practice condition, their sleep quantity was unaffected by the number of confirmed cases ($B = 0.01$, $SE = 0.01$, $p = 0.30$). Hypothesis 1 was thus supported.

To check the robustness of our findings, we included sleep quantity and sleep quality on the previous night (Banks et al., 2010), trait mindfulness (Hülsheger et al., 2014), daily cumulative confirmed cases to that date, with daily cases of death reported as control variables. We found that the positive relationship

TABLE 1 | Means, standard deviations, and correlations (Study 1).

	Mean	*SD*	1	2	3	4	5	6	7	8
1.Age	34.49	5.03	-							
2.Gender	1.67	0.47	0.05	-						
3.Years live in Wuhan	27.68	11.79	0.43**	0.05	-					
4.Experimental condition	0.57	0.50	0.06	−0.22*	−0.04	-				
5.Trait mindfulness	4.81	0.69	0.06	0.03	−0.20*	0.02	-			
6.Sleep quantity	460.60	57.66	0.05	−0.07	0.14	0.15	−0.20	-		
7.Sleep quality	4.67	0.98	0.07	0.05	0.20*	−0.04	0.00	0.31**	-	
8.Caffeine abstinence	0.73	0.36	0.10	−0.07	−0.15	0.08	0.16	0.05	0.01	-

*n = 97 participants. Gender: 1 = male, 2 = female. Caffeine abstinence: 0 = taking caffeine, 1 = no taking caffeine. Experimental condition: 0 = mind-wandering control group, 1 = mindfulness intervention group. *$p < 0.05$; **$p < 0.01$.*

TABLE 2 | Multilevel regression results (Study 1).

Predictors	DV = Daily Sleep quantity (Minutes)		DV = Slope between daily confirmed cases and sleep quantity	
	Estimate	*SE*	Estimate	*SE*
Intercept	324.75**	14.63	–0.01	0.03
Within-individual level				
Self-perceived sleep quality	26.41**	2.23		
Caffeine abstinence	8.64	6.60		
Between-individual level				
Experimental condition	17.00	11.67	0.05*	0.03

*The effects of self-perceived sleep quality and caffeine abstinence on sleep quantity were modeled as fixed slopes. Caffeine abstinence was coded as 0 = taking caffeine, 1 = no taking caffeine. Experimental condition was coded as 0 = mind-wandering control group, 1 = mindfulness intervention group. *$p < 0.05$; **$p < 0.01$.*

TABLE 3 | The robustness check results (Study 1).

Predictors	DV = Daily Sleep quantity (Minutes)		DV = Confirmed cases-sleep quantity slope	
	Estimate	*SE*	Estimate	*SE*
Intercept	225.10	414.61	0.18*	0.08
Within-individual level				
Daily cumulative cases	7.80	38.70		
Daily cases of death	0.013	0.105		
Previous day's sleep quality	–2.79	2.78		
Previous day's sleep quantity	0.061	0.046		
Self-perceived sleep quality	26.68**	2.26		
Caffeine abstinence	9.83	6.49		
Between-individual level				
Trait mindfulness			–0.04*	0.02
Experimental condition			0.05*	0.02

*This table shows that the results of the multilevel regression with trait mindfulness, daily cumulative cases, daily cases of death, and sleep quality and quantity on the previous day as additional control variables. Caffeine abstinence was coded as 0 = taking caffeine, 1 = no taking caffeine. Experimental condition was coded as 0 = mind-wandering control group, 1 = mindfulness intervention group. **$p < 0.01$; **$p < 0.05$.*

between the mindfulness practice and the random slope between daily confirmed cases and sleep quantity was robust ($B = 0.05$, $SE = 0.02$, $p = 0.04$) with all these factors controlled for (see **Table 3**). In addition, mindfulness practice did not moderate the relationship between COVID-19 stressors and sleep quality ($B = 0.001$, $SE = 0.001$, $p = 0.73$).

STUDY 2

Participants

All participants were recruited through the online platform Prolific (Palan and Schitter, 2018). Participants were pre-screened to ensure that they were (a) working full-time throughout the study and (b) working in the United Kingdom. Further, to ensure data quality, all participants had an approval rating of 95% (or above) for past studies completed on Prolific (Keith et al., 2017). Based on this, a total sample of 140 participants (59.3% female) was obtained, with a mean age of 34.1 ($SD = 9.10$), 75.1% have a college/bachelor degree, and 28.3% have a Master/PhD degree.

Procedure

The study took place over a 2-week period with 10 surveys sent out on 10 consecutive workdays between June 8, 2020 and June 19, 2020. To be eligible for this study, participants had to complete a demographic information pre-survey. Each daily survey was emailed to participants in the evening after a typical UK workday had ended (5 pm), and this survey then expired each day at midnight. Participants were paid for each survey (GBP 1 for 5 min) along with a bonus payment for completing nine or more surveys (GBP 3). This resulted in a high completion rate with participants completing 1,302 of the 1,400 daily surveys sent out (93%).

Measures

COVID-19 stressors. Unlike the early outbreak in Wuhan captured in Study 1, daily case numbers were less prominent in the UK during the data collection period since the COVID-19 pandemic has widely spread to many countries. Thus, consistent with previous studies that measure stressors (Wang et al., 2010), we operationalized COVID-19 stressors as a subjective measure that directly captures the extent to which people perceive COVID-19 as a stress that interferes with their work on a daily basis. To measure this construct, a daily measure of family-to-work conflict (see Wang et al., 2010) was adapted by supplanting the terms "home-life" *or* "family" with "COVID-19". Items included "Today at work, how often did COVID-19 interfere with your job or career?", "Today, how often did you think about COVID-19 related problems?", "Today, how often did COVID-19 interfere with your responsibilities at work, such as getting to work on time, accomplishing daily tasks, or working overtime?", "Today, how often did COVID-19 keep you from spending the amount of time you would like to spend on job or career-related activities?", and "Today, how often did you think about things you need to do related to COVID-19?" ($\alpha = 0.93$) In the analyses, this measure was lagged to represent the previous day's COVID-19 stressors.

Daily state mindfulness. Individuals' state mindfulness was measured on a daily level using an abbreviated version of the MAAS (Brown and Ryan, 2003) which had been previously adapted by Liang et al. (2018). Items included, "Today, I rushed through activities without being attentive to them.", "Today, I did things without paying attention.", "Today, I was preoccupied with thoughts of the future or the past.", "Today, I did things automatically, without being aware of what I was doing.", and "Today, I found it difficult to stay focused on what was happening in the present moment." ($\alpha = 0.89$); of note, all items are reverse-coded. In the analyses, this measure was lagged to represent the previous day's mindfulness.

Sleep quantity. As in study 1, we measured sleep quantity with the following item (Lanaj et al., 2014); "How many hours of *actual sleep* did you get last night?"

Work engagement. Daily work engagement was measured using an abbreviated 5-item version of the Utrecht Work Engagement Scale (Schaufeli et al., 2006). Items included, "Today at work, I felt bursting with energy.", "Today at work, I felt strong and vigorous", "Today, I was enthusiastic about my job", "Today, my job inspired me", and "Today, I was immersed in my work" (α = 0.89).

Control Variables. Consistent with the past-sleep research (Gellis and Lichstein, 2009; Lanaj et al., 2014), and Study 1, we measured sleep quality as a control variable. Sleep quality was measured with an overall item on a 7-point Likert scale ranging from 1(very bad) to 7(very good): "How would you rate your sleep quality overall last night?"

Results

Descriptive statistics and bivariate correlations for all study variables are provided in **Table 4**.

As in Study 1, to account for the nested nature of the data, we used multilevel modeling and centered all predictors around each participant's mean score (Hofmann et al., 2000). However, because we focused on daily state mindfulness (vs. an individual-level mindfulness practice) in this study and tested only within-individual (vs. between-individual) effects, we used fixed slope modeling. The relationships of COVID-19 stressors, state mindfulness, and their interaction with sleep quantity were all modeled as fixed slopes. Given that variables such as trait mindfulness, sleep quality, and daily caffeine intake did not influence results in any way in Study 1, we did not control for these variables in our analyses.

Consistent with Hypothesis 1, the interactive effect of daily COVID-19 stressors and mindfulness on sleep quantity was positive and significant (B = 0.11, SE = 0.05, p = 0.04, see **Table 5**). Simple slope analyses further revealed that the relationship between COVID-19 stressors and sleep quantity was negative when state mindfulness was low (B = −0.11, SE = 0.05, p = 0.03) and nonsignificant when state mindfulness was high (B = 0.09, SE = 0.05, p = 0.20); difference in simple slopes = 0.20, SE = 0.10, p = 0.04; **Figure 3**). Mindfulness neutralized the negative effect of COVID-19 stressors on sleep duration; Hypothesis 1 was thus supported. In addition, results indicated that mindfulness did not moderate the relationship between COVID-19 stressors and sleep quality (B = 0.10, SE = 0.06, p = 0.07).

We continued to test a moderated mediation model in which state mindfulness moderated an indirect effect of COVID-19 stressors on work engagement *via* sleep quantity (H2). Analyses revealed that there was a positive relationship between sleep quantity and work engagement (B = 0.14, SE = 0.03, p < 0.01). With a Monte Carlo simulation method (Preacher et al., 2010), we found that the indirect effect of COVID-19 stressors on work engagement *via* sleep quantity was negative and significant when state mindfulness was low [estimate = −0.01, 95% CI = (−0.030, −0.002)] and nonsignificant when state mindfulness was high [estimate = 0.01, 95% CI = (−0.001, 0.027); difference in conditional indirect effects = 0.03, 95% CI = (0.002, 0.059)]. Hypothesis 2 was thus supported.

TABLE 4 | Means, standard deviations, and correlations (Study 2).

	Mean	*SD*	1	2	3	4	5	6
1.Age	34.1	9.10	-					
2.Gender	1.62	0.49	−0.20*	-				
3.COVID-19 stressors	1.95	0.88	−0.01	0.13	-			
4.State mindfulness	4.86	0.98	0.23**	−0.05	−0.33**	-		
5.Sleep quantity	392.12	53.28	−0.21*	0.21*	−0.16	0.17*	-	
6.Work engagement	3.56	1.04	0.06	−0.12	−0.06	0.44**	0.04	-

*n = 140 participants. Gender: 1 = male, 2 = female. *p < 0.05; **p < 0.01.*

TABLE 5 | Multilevel regression results in (Study 2).

Predictors	DV = Sleep quantity	
	Estimate	***SE***
COVID-19 stressors	−0.007	0.084
State mindfulness	−0.046	0.037
COVID-19 stressors × State mindfulness	0.109*	0.052

**p < 0.05; **p < 0.01.*

GENERAL DISCUSSION

We found that induced or measured state mindfulness significantly buffered the negative effect of COVID-19 stressors on sleep duration (Studies 1 and 2) and work engagement (Study 2) such that COVID-19 stressors had negative effects when state mindfulness was low while negative effects were buffered when state mindfulness was high. Findings of the present studies contribute to the employee stress and well-being research as well as the emerging mindfulness research in the organizational literature.

First, our work extends the recovery literature by looking beyond the widely examined organizational factors and introducing a non-organization factor that is probably the most powerful external force that disrupts employees' sleep. Previous studies have shown that organizational factors such as occupational stressors and work-family conflict can harm employees' sleep (DeArmond and Chen, 2004; Blau, 2011; Barnes et al., 2012; Lanaj et al., 2014; Berkman et al., 2015). Understanding these organizational antecedents can help employees and organizations achieve better recovery by specifically alleviating these potential stressors. Unlike organizational factors, traumatic events such as the COVID-19 pandemic are external shocks that are not controllable by organizations and employees. Yet, it has detrimental effects on employees' sleep (Sinha, 2016). Indeed, a recent review suggests that "scholars should consider how recovery, an inherently non-work activity, is impacted by non-work demands and resources in addition to work-specific demands and resources"

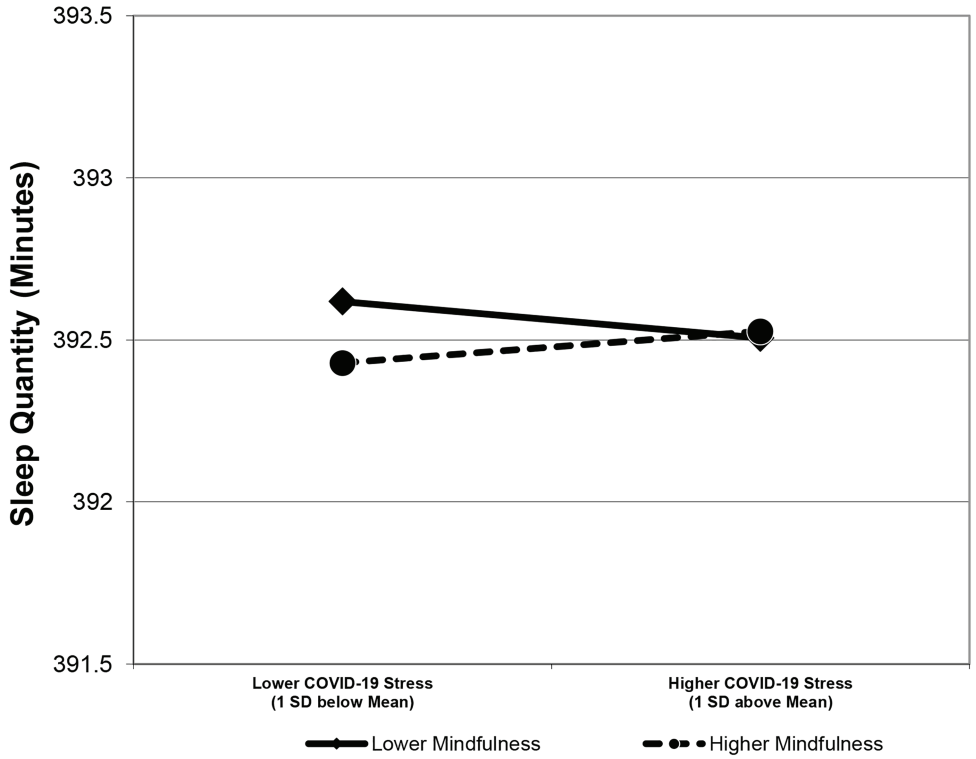

FIGURE 3 | This figure visually depicts how daily state mindfulness mitigated the relationship between COVID-19 stressors and sleep quantity in Study 2.

(Steed et al., 2019; p.24). Our research echoes this view and highlights the importance of considering public traumatic events when examining the employees' recovery process.

Second, organizational research on sleep has generally used one of the two indicators to capture sleep: sleep quality and sleep quantity (Barnes, 2012; Litwiller et al., 2017). Although they are conceptually similar and related, they are different because they tend to be correlated with different variables (Barclay et al., 2010; Hülsheger et al., 2015; Litwiller et al., 2017). Consistent with previous studies, our findings that mindfulness interacts with COVID-19 stressors to influence sleep quantity, but not quality, further confirms that they are two distinct concepts (Litwiller et al., 2017). Specifically, compared to sleep quality, sleep quantity is more closely related to resources available for work, which have downstream effects on work engagement (Lanaj et al., 2014). Indeed, we show that sleep quantity is a crucial mechanism through which mindfulness exerts a buffering effect on work engagement. Thus, our findings have important implications for different roles that sleep quality and quantity may play in work-related outcomes.

Third, our work extends the employee stress and well-being research by looking beyond the widely examined intra-organizational stressors and examining the negative effects of acute-extraorganizational stressors. Research on employee stress and well-being dates back nearly 100 years, during which traumatic events such as World War I, the influenza epidemic of 1918, and the Great Depression have greatly impacted employees (see Bliese et al., 2017 for a recent review). Although the origins of the field were stimulated by these events, the majority of research to date has focused on the effect of intra-organizational stressors. However, growing evidence has mounted, showing that acute-extraorganizational stressors play an equally significant role in impacting employees' outcomes, e.g., increasing absenteeism and decreasing job satisfaction, and leading to higher turnover (Byron and Peterson, 2002; Hochwarter et al., 2008; Dollard et al., 2013; Ragins et al., 2014; Baruch et al., 2016). Nevertheless, research on how to tackle these negative effects has lagged behind (Byron and Peterson, 2002; Hochwarter et al., 2008). Furthermore, the few interventions that have been introduced in the psychology literature were conducted after the crisis occurred and focused on "fixing" *post-traumatic effects* rather than timely intervening negative effects of the crisis as it unfolds (Lavie, 2001; Sinha, 2016). This post-hoc approach is at odds with recent research, suggesting that the early treatment of trauma-induced stress may be more effective in preventing the development of post-traumatic negative experiences such as depression (Sinha, 2016). Therefore, our study is among the first to examine how the negative impacts of extra-organizational stressors can be neutralized *during a crisis*. In doing so, we identified that mindfulness, both as a state and implemented as a randomized-controlled intervention, is effective in mitigating the negative effect of an ongoing crisis on an employee's well-being. Thus, our work has general theoretical implications for managing acute-extraorganizational stressors.

Furthermore, our study contributes to organizational research on mindfulness. Past work has found mindfulness can be an effective intervention in workplace settings providing a myriad of positive effects on work attitudes and outcomes (for reviews see Sutcliffe et al., 2016; Kay et al., 2019). Moving beyond these main effects of mindfulness, this paper identifies mindfulness as an effective crisis intervention. Specially, this paper draws on the metacognitive theory of mindfulness and extends this theory into the context of crisis by showing that mindfulness can neutralize the negative effects of COVID-19 stressors on work engagement *via* the mediating role of sleep duration, a mechanism that is highly vulnerable to the hyperarousal state triggered by trauma. Further, this paper also contributes to growing research on the role of state mindfulness in the workplace (e.g., Tuckey et al., 2018; Hafenbrack et al., 2020), investigating this through a low-dose intervention along with measuring it as a self-reported state. The synergy of these results provides promise for future research interested in examining the daily impacts of mindfulness along with providing a low-cost (or even free) intervention for organizations to implement in the light of acute extra-organizational stressors.

Our research also has practical implications. In uncertain times like the COVID-19 pandemic, how organizations treat their employees will have a lasting impact on employees' loyalty, engagement, and productivity (Carvalho and Areal, 2016). Our findings suggest that mindfulness practice can be introduced as an effective employee care program for organizations. Importantly, our findings provide further evidence that even a "low dose" of on-line mindfulness practice is effective (Hülsheger et al., 2015). Thus, during the COVID-19 outbreak, organizations that offered morning meditations to all company employees (e.g., Google), might have been more effective in managing the negative impacts of the pandemic on employee engagement.

Limitations and Future Research Directions

Despite several contributions to the literature, the present study should be viewed in light of its strengths and weaknesses. First, we argue that mindfulness can activate a metacognitive process of observing thoughts without judgment, thus reducing the secondary arousal related to trauma. While this research argumentation is consistent with the neuroscience literature on mindfulness and metacognition (Jankowski and Holas, 2014), we did not examine the specific psychological mechanisms that underlie this effect. To date, studies have examined mechanisms such as cognitive reappraisal, decentering process, and affective rumination for the effects of mindfulness (Fresco et al., 2007; Liang et al., 2018; Kay and Skarlicki, 2020). In addition, it is also possible that COVID-19 stressors are associated with increased workload, alternative shifts, interpersonal conflict. These are possible mechanisms of mindfulness on improving sleep duration. Thus, we suggest that future research could examine the exact mechanisms in the moderating effects of mindfulness on sleep duration.

Second, our research examines the neutralizing of mindfulness in the relationship between the COVID-19 stressors and employees' sleep duration and work engagement. However, post-traumatic growth theory suggests that it is possible that individuals can benefit and grow from traumatic exposure (Tedeschi and Blevins, 2015). Specifically, this theory suggests that mindfulness may facilitate positive reappraisal of the negative experience. In line with the mindfulness-to-meaning hypothesis (Garland et al., 2017), this reappraisal process can in turn make individuals experience growth in aspects such as personal strength and appreciation of life. Future research should take a growth perspective and examine the effect of mindfulness on individuals' post-traumatic growth.

Third, a strength of this study was the dual operationalization of mindfulness through a randomized-control trial and a daily self-reported measure. Organizational studies typically focus on a sole operationalization, despite scholars often referring to mindfulness state, trait, and trained skill being a unitary construct (Reb et al., 2020). Therefore, the replication of our results using two operationalization provides further evidence for the generalized effect of mindfulness. Nevertheless, the moderation graphs for Study 1 and 2 have slight discrepancies, suggesting that there might be fine grained difference between the operationalization. However, despite the discrepancy, it is noteworthy that both studies support our primary hypothesis that mindfulness will neutralize the negative effect of COVID-19 stressors, demonstrated by simple slope analyses, showing that COVID-19 *only* has a significant negative effect on sleep quantity when mindfulness is low. This helps contribute to the literature linking mindfulness with sleep outcomes (Ong et al., 2012; Ong and Smith, 2017); nevertheless, there are still important questions for the field to address. One key question that arises as a result of the current study is understanding how sleep quantity (and quality) impacts mindfulness. This study, and the majority of past work (for a review see Ong and Smith, 2017), has focused on how mindfulness impacts sleep but given that practicing mindfulness has its own self-regulatory challenges (Mrazek et al., 2020), it is possible that a good night's sleep could increase an individual's capacity to engage in, and thus benefit from, mindfulness practice. Building on the past work, this would suggest a potentially virtuous cycle in which mindfulness improves sleep and then better sleep subsequently improves mindfulness.

Furthermore, consistent with previous studies (Barnes, 2012), our research confirms that sleep quality and sleep quantity are two distinct concepts. Research suggests that sleep quantity is more closely related to resources available for work while sleep quality is more closely related to employees' perceptions or emotions (Litwiller et al., 2017). Indeed, we show that sleep quantity is a crucial mechanism through which mindfulness exerts a buffering effect on work engagement. This is because sleep quantity provides resources for employees to be engaged in the workplace. Future research should take into consideration other work-related outcomes that are related to perceptions, such as job satisfaction and negative affect, and examine the buffering effect of mindfulness on these perceptual outcomes.

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 Study 1 was approved by the Ethics committee at China Europe International Business School (CEIBS). Study 2 was approved by the Ethics committee at the National University of Singapore. The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

MZ and JN designed Study 1. MZ collected the data for Study 1. JN, TM-W, YL, and NT designed Study 2. JN, TM-W, and YL collected the data for Study 2. JY, MZ, and TM-W analyzed the data from both studies. MZ, TM-W, and JN wrote first drafts of the paper. All authors provide comments and inputs. All authors contributed to the article and approved the submitted version.

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Grace Under Pressure: Resilience, Burnout, and Wellbeing in Frontline Workers in the United Kingdom and Republic of Ireland During the SARS-CoV-2 Pandemic

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The coronavirus pandemic has necessitated extraordinary human resilience in order to preserve and prolong life and social order. Risks to health and even life are being confronted by workers in health and social care, as well as those in roles previously never defined as "frontline," such as individuals working in community supply chain sectors. The strategy adopted by the United Kingdom (UK) government in facing the challenges of the pandemic was markedly different from other countries. The present study set out to examine what variables were associated with resilience, burnout, and wellbeing in all sectors of frontline workers, and whether or not these differed between the UK and Republic of Ireland (RoI). Individuals were eligible if they were a frontline worker (in health and social care, community supply chain, or other emergency services) in the UK or RoI during the pandemic. Part of a larger, longitudinal study, the participants completed an online survey to assess various aspects of their daily and working lives, along with their attitudes toward their government's handling of the crisis, and measurement of psychological variables associated with heroism (altruism, meaning in life, and resilient coping). A total of 1,305 participants ($N = 869$, 66.6% from the UK) provided sufficient data for analysis. UK-based workers reported lower wellbeing than the RoI-based participants. In multivariate models, both psychological and pandemic-related variables were associated with levels of resilience, burnout, and wellbeing in these workers, but which pandemic-related variables were associated with outcomes differed depending on the country. The judgment of lower timeliness in their government's response to the pandemic appeared to be a key driver of each outcome for the UK-based frontline workers. These findings provide initial evidence that the different strategies adopted by each country may be associated with the overall wellbeing of frontline workers, with higher detriment observed in the UK. The judgment of the relatively slow response of the UK government to instigate their pandemic measures appears to be associated with lower resilience, higher burnout, and lower wellbeing in frontline workers in the UK.

Keywords: coronavirus, Covid-19, CV19 heroes, heroism, keyworkers, government strategy, meaning in life

INTRODUCTION

Keeping economies and societies afloat during crisis is a delicate balance between urging caution and responsibility, and deterring panic. In 2019, the first case of the Covid-19 disease (caused by the virus SARS-CoV-2) was diagnosed, and by 11th March 2020 the World Health Organisation (WHO) declared a global pandemic. Since then, most countries of the world have faced an unprecedented public health care crisis, where human behavior plays a critical role not only in the spread of disease, but also, in response to the crisis.

After the WHO declared Covid-19 to be a pandemic on 11th March 2020, the leaders of many European governments addressed their countries to announce their strategies to take on the challenges of the pandemic. The leader of the United Kingdom (UK) government (Prime Minister Boris Johnson) advised that anyone with a new or persistent cough or fever should self-isolate; on this day, the approximate number of infections was 590, with a recorded eight deaths. The advice at this time was not to minimize gatherings of people, nor to close schools or businesses. On the same day, the leader (Taoiseach) of the Republic of Ireland (RoI) government, Dr. Leo Varadkar, announced the immediate closure of schools, colleges, and universities, and the limiting of public gatherings to those under 100 attendees in the case of indoor events, and under 500 in the case of outdoor events. At this point in RoI, the approximate number of infections was 70, with one recorded death. The UK government did not limit gatherings of any kind until an announcement on the evening of the 23rd March 2020, after which many large-scale sporting events were canceled by organizers, but others went ahead (such as The Cheltenham Festival, a 4-day horseracing event attended by approximately 251,684 individuals). The so-called "lockdown" measures — limiting individuals to working from home where possible, introducing furlough support to business, and limiting opportunities to leave the house for anything other than work or provisions to one outing for exercise only — were described by Prime Minister Johnson, to be a core component of the "delay" phase of the pandemic. These restrictions were placed in the UK on the evening of the 23rd March 2020, where the approximate number of infections were 6,650, with an approximate number of hospital fatalities at 335 (0.49/100,000). In contrast, similar measures were put in place in RoI on the 27th March 2020, when the approximate number of infections was 2,121 and the approximate number of fatalities was 22 (0.44/100,000). To provide a point of equal comparison, by the 22nd April 2020, the approximate morbidity rate in the UK was 133,495 to RoI's 16,671, and the approximate mortality rate in the UK was 18,738 (27.61/100,000) to RoI's 769 (15.57/100,000). See **Figure 1** for an overview of the cumulative morbidity and mortality rate in the UK and RoI from the 12th March 2020 to 15th May 2020 derived from published government data. It is worth noting that on 5th May 2020, the death toll in the UK (29,427; 43.34/100,000) became the highest in Europe, and the second highest in the world at that point in time in the pandemic. Both countries have adopted markedly different public health strategies in relation to managing the outbreak of the disease, with the UK adopting an approach many have likened to a "herd immunity" strategy (Jetten et al., 2020), whereas the RoI adopted a more conservative approach more in line with WHO guidance. For our purpose, these strategic differences provide interesting comparative contexts for examining the psychological impact of working in a frontline capacity during the Covid-19 crisis.

During Covid-19, and other health crises, the term frontline workers (or frontline heroes) has been applied to workers that provide an essential service during the pandemic and lockdown periods across the world (Hsin and Macer, 2004; Smith et al., 2020). Frontline workers, health care workers in particular, have been likened in the media to combat veterans: minimizing their own distress in order to care for others, and hailed as heroes. The frontline workers in this global pandemic, predominantly in health and care settings, emergency services and community supply chain, have faced increased risks of contracting the virus themselves and spreading it to their significant others (Liu et al., 2020). They have also needed to navigate a range of exceptional challenges ranging from increased exposure to death in health and care home settings, increased hours and pressures at work, dealing with challenging situations brought on from contact with members of the public, and social isolation from colleagues and loved ones (Lai et al., 2020; Liu et al., 2020; Stuijfzand et al., 2020; The Lancet, 2020). The physical and psychological impact of working during the Covid-19 pandemic have been significant: globally, thousands of frontline workers have died from contracting SARS-CoV-2, and some have committed suicide (World Health Organization, 2020; Zaka et al., 2020). We know from previous research that there are significant mental health consequences associated with disasters (see Goldmann and Galea, 2014 for review), and for healthcare crises, the mental health fallout for healthcare professionals is likely to last beyond the physical threat of the virus itself (Maunder et al., 2006).

Existing research with frontline workers during health crises has been conducted almost exclusively with healthcare professionals. Experience with previous epidemics show that dealing with infected patients can cause considerable mental stress, high anxiety, and posttraumatic stress disorder (PTSD) for healthcare workers, especially nurses (Chersich et al., 2020; Tsamakis et al., 2020). Work carried out during the HIV/AIDS outbreak showed that anxiety, depression, and various personality factors associated with emotional processing and management of interpersonal relationships were some of the significant risk factors of highly "burned out" healthcare workers (Bellani et al., 1996). Many healthcare workers reported feelings of extreme vulnerability, uncertainty, psychological distress, and symptoms of anxiety during the outbreak of severe acute respiratory syndrome (SARS) (Tam et al., 2004). Most recently, research conducted during Covid-19 to-date indicates that those frontline healthcare workers are experiencing high rates of depression, distress, anxiety and insomnia (Lai et al., 2020). Longitudinal data from previous health crises indicate that the psychological impact of frontline healthcare workers is long-lasting, and that they are at increased risk of burnout, depression, anxiety, substance misuse, and PTSD over the longer term across

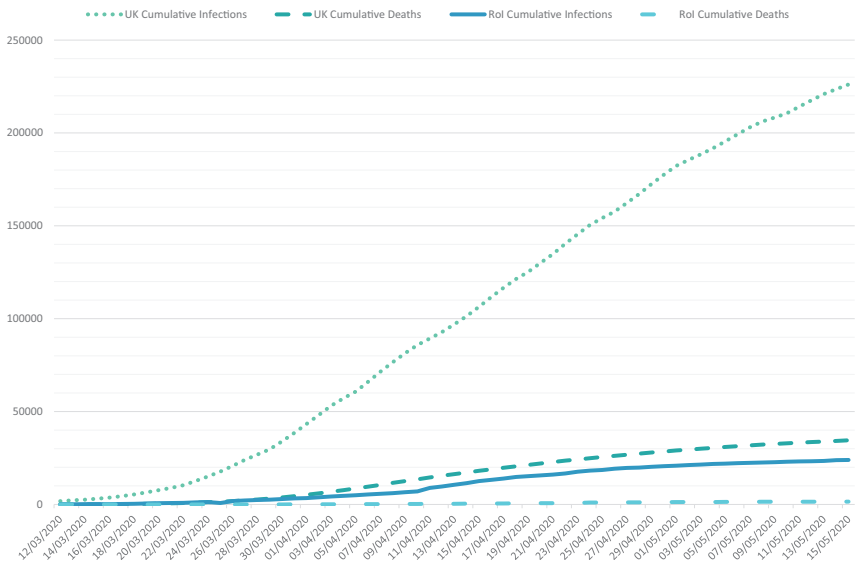

FIGURE 1 | Cumulative number of infections and deaths in the United Kingdom (UK) (Data obtained from the United Kingdom Government Coronavirus surveillance data, available at: http://coronavirus.data.gov.uk/) and Republic of Ireland (RoI) (Data obtained from the Republic of Ireland Government Coronavirus surveillance data hub, available at: http://covid19ireland-geohive.hub.arcgis.com/) from COVID-19. Data obtained from NHS and HSE pandemic statistical reports.

epidemic surges and several years beyond (e.g., Ho et al., 2005; Wu et al., 2008).

It is perhaps not too surprising that negative psychological outcomes are common in frontline HCWs during both acute and post-acute phases of health crises. However, not all workers experience equal levels of distress, and some patterns of influencing factors have been identified. For example, the extent that healthcare workers perceive sufficiency of information during an influenza outbreak has been shown to relate to psychological distress (Goulia et al., 2010). In addition, workers' appraisal of their own working conditions as high-risk relates to decreased levels of psychological resilience (Son et al., 2019). Some protective factors have been noted. For example, higher levels of social support have been associated with greater resilience and positive mental health in healthcare workers (Hou et al., 2020). Having an empathetic relationship with patients has been shown to reduce risk of burnout (Visintini et al., 1996). On the other hand, external coping style (e.g., religiosity, denial) has been shown to significantly predict levels of burnout beyond known factors such as age, perceived workload, and locus of control in caregivers (Gueritault-Chalvin et al., 2000). However, gaps in our understanding remain, such as the extent to which government policy may be associated with these outcomes. Also, it is not known whether others working on the frontline (beyond healthcare workers) are also vulnerable to these negative psychological outcomes, and what factors may be associated with their general welfare as they undertake this work. As a result, our knowledge of how best to support frontline workers across a range of essential service sectors is limited.

The Covid-19 pandemic is of an international scale not seen in other health crises in living memory, and the numbers of people working in frontline positions both in health and non-healthcare positions has been of a scale never witnessed before. As a result, there are likely to be additional factors that influence the mental health and wellbeing of frontline workers that have not been considered in previous research, such as their appraisal of their government's response to the outbreak, and their uncertainty about whether they were infected with this extremely contagious (and sometimes asymptomatic) virus. The limited existing literature concerns the coping and wellbeing of healthcare workers during previous health crises but cannot account for the experiences of the additional sectors of frontline workers that the Covid-19 pandemic has brought about. Indeed, stressful working conditions have not been limited to healthcare settings — all types of frontline workers faced risks with regard to their health and the prospect of potentially infecting their loved ones. The consumer panic, for instance, at the prospect of needing to self-quarantine for several weeks put an enormous strain on workers in community supply chains (such as supermarket workers, delivery drivers, and postal workers). As well as better understanding how personal factors may be associated with the psychological response of workers across all frontline sectors, there is a pressing need to understand how wider contextual factors (such as government public health policies) play a part in these outcomes.

To address this gap, in the present research we aimed to understand how both personal factors and pandemic variables are associated with resilience, burnout and wellbeing in frontline workers in the UK and RoI. Specifically, given the difference in government strategy in tackling the pandemic between the two countries, we assessed participants' perceptions of their government strategies (with respect to appropriateness, timeliness, and effectiveness) to further understand whether they may be related to the welfare of frontline workers. Further, given

that uncertainty has been previously associated with resilience and burnout (Kimo Takayesu et al., 2014; Simpkin et al., 2018), and the fact that the beginning stages of the pandemic were characterized by a lack of available, accurate testing for SARS-CoV-2 infection, we were interested to see whether the uncertainty of having had the infection (which, at the time, was thought to be possible only once) may be associated with the stress of working on the frontline.

The personal variables of interest for the present study — meaning in life, altruism and resilient coping style — were selected in order to gain as much insight as possible into those factors that are associated with extremely stressful work, particularly work associated with heroic action. Meaning in life is the feeling that people have that their lives and experiences make sense and matter (Steger, 2009), which plays a role in human well-being (e.g., Zika and Chamberlain, 1992). Individuals differ in relation to how hard they search for meaning in their lives (Steger et al., 2006), and also, situational factors can trigger a search for meaning process (e.g., Van Tilburg and Igou, 2012; Maher et al., 2018). Search for meaning is associated with negative psychological states (Steger et al., 2006; Steger, 2009), unless presence of meaning is already high (Park et al., 2010). Behaving heroically may sometimes imbue life with meaning due to an increased sense of purpose and coherence, and at other times, decrease sense of meaning in life due to social ostracism and isolation from others (Kinsella et al., 2019). Interestingly, greater search for meaning is associated with greater motivation to behave heroically (Igou et al., 2018). Overall, the relationship between heroism and meaning in life is likely to be complicated: in the present study, meaning in life was included as a variable to further explore these relationships. Altruism was also included here in an exploratory capacity to see whether it may be associated with these outcomes, particularly burnout, as people who were more altruistic may be more likely to show higher levels of burnout due to going above and beyond the call of duty (e.g., working extra shifts, helping neighbors). The relationship between altruism and burnout appears to be quite complicated in the literature surrounding frontline work, with some citing it as protective and others as harmful (Altun, 2002; Burks and Kobus, 2012), so its incorporation in the present study came with no anticipations of directional relationship. Coping and resilience, whilst very much related, are distinct concepts. Coping is described to be an active and dynamic process of adjustment to challenge, whereas the concept of resilience has been defined as being the result of successful handling of challenge: encompassing recovery, recuperation, and regeneration following traumatic experiences (Earvolino-Ramirez, 2007; Hoge et al., 2007; Rice and Liu, 2016). Therefore, two distinct measures were included: a resilient coping measure was included to account for the use of coping strategies associated with delivering a status of resilience and a measure of resilience itself to incorporate a concept of invulnerability to these experiences of stress.

In addition to resilience, the other outcomes of interest were burnout and wellbeing. Burnout is associated with subjective wellbeing of those carrying out this vital work as well as work quality and workforce attrition (Maslach et al., 2001), so it is an important variable to consider within the context of the global pandemic – particularly when considering the associations with government strategy. When work demands surpass capacity, such as in the case of Covid-19, the conditions are ripe for burnout to occur. Wellbeing is a central aspect of the WHO definition of health, and is a core element of the WHO global strategy on occupational health for all (World Health Organization, 1995) and the World Health Assembly Worker's Health strategy 2008–2017 (World Health Organization, 2007). The present study utilized wellbeing as a key outcome as assessing the wellbeing of frontline workers has been cited as an ethical duty both during and in the aftermath of Covid-19 (Gavin et al., 2020).

The present study was conducted during the earlier stages of the pandemic in Northern Europe (31st March to 15th May 2020) to understand the impact of working during the Covid-19 crisis on frontline workers. Here, we present the cross-sectional findings from the first registered study examining the mental health effects of working on the 'frontline' (including healthcare and non-healthcare workers) during the Covid-19 pandemic in the UK and RoI – two countries with markedly different public health strategies in response to the outbreak of Covid-19. In doing so, we respond to an urgent call for researchers to assess the psychological effects of Covid-19 on frontline workers (Holmes et al., 2020). This study is particularly novel in the sense that a broad spectrum of frontline workers were sampled, not limited to healthcare settings. Another novel aspect of this study is provided through a comparison of UK and RoI workers as we assessed how individuals rated their respective governmental strategies in dealing with the pandemic and their own certainty around Covid-19 diagnoses are associated with resilience, burnout and wellbeing in these workers.

MATERIALS AND METHODS

Participants

Data collection commenced on 31st March 2020, 20 days after the WHO declared pandemic status for Covid-19, and 8 days after "lockdown" status was announced in the UK, and 4 days after a similar status was announced in RoI. Recruitment to the study concluded on 15th May 2020. Inclusion criteria were that participants were over 18 years old, working in a frontline role in the UK or RoI. Participants were advised of the nature of the study, that it would contain questions related to the pandemic, and were advised not to participate if they felt that they would be distressed as a result. The survey was presented online[1].

Measures

Participant Demographics

Demographic details were requested from participants in the form of age, gender, country of residence (UK or RoI), level of education, marital status, caring status (for children, relatives, or other adults), and employment sector (health and social care; supply chain; other emergency services; or other). For the purposes of defining these groups, examples of these groups were provided on the survey. For the Health and Social Care category

[1] onlinesurveys.ac.uk

these were: nurse, doctor, paramedic, care worker, pharmacist, allied health professional. For the supply chain group, the provided examples were: supermarket worker, food/grocery delivery driver, postal worker, convenience store workers, other food/grocery provision worker. The "other emergency services" group examples were: police, fire and rescue; and the final category of "other frontline key worker" invited participants to specify their role (this category included public transport operators, teachers, and veterinaries).

Pandemic-Related Variables

Information specific to the Covid-19 pandemic context was gathered. Participants were asked to rate on a scale of 1 (not at all) to 10 (very much so) whether they thought decisions made by their government and organization were: appropriate, timely, and effective. To understand whether social support might be associated with outcomes, participants were asked about their partnership status. To capture personal experience of Covid-19 infection, participants were asked if they, a family member, a friend, or a colleague had a Covid-19 infection (no; I'm not sure; yes – not tested but certain of diagnosis; yes – formally tested and diagnosed). Due to the lack of widespread testing for Covid-19, these measures were later collapsed to assess certainty (i.e., those indicating either "no" or one of the "yes" answers as certain, or "I'm not sure" being categorized as uncertain). As infection with SARS-CoV-2 may take some time before becoming symptomatic, if at all, it was important to assess this level of certainty around infection, as this would potentially have an impact on worry surrounding contracting or spreading the infection to others. It is also important to consider that certainty around infection can be addressed with sufficient availability of accurate testing, and so as a factor that may contribute to the outcomes of interest, it is also something that can provide learning from these early stages of the pandemic, and an important factor to consider if and when another similar emergency arises in the future. It is also possible that significant stress may be experienced just from having or not having had SARS-CoV-2, and so supplementary analyses were conducted treating this variable in an alternative means to understand incidence of infection (i.e., yes, no, I don't know). These findings are presented in **Supplementary Tables 1, 2**.

Psychological Variables

To assess concepts associated with heroic and altruistic behaviors, the Meaning in Life Questionnaire (MLQ: Steger et al., 2006) and Adapted Self-Report Altruism Scale (ASRAS: Witt and Boleman, 2009) were used. The MLQ is a 10-item scale separated into two components: "presence," an index of whether or not an individual feels they have found meaning in life; and "search," whether the individual is still seeking meaning in life. The score ranges for each subdimension of the questionnaire are five to 35. Examples of items on the scale are: "My life has a clear sense of purpose" (presence) and "I am looking for something that makes my life feel meaningful" (search). Both subscales for the MLQ provided good internal consistency ($\alpha = 0.87$; $\alpha = 0.90$, respectively).

The ASRAS is a self-report measure of altruism, which although is different to heroism (Franco et al., 2011), examines the extent that have an 'other-orientation' and behave in ways that benefit others which is consistent with heroism. The ASRAS is a 14-item scale, with a score range of zero to 56, that asks participants to record the frequency of certain behaviors, for example: "I would donate clothes or goods to a charity," and "I would help an acquaintance move houses." This particular scale provided good internal consistency here ($\alpha = 0.88$).

To assess coping styles associated with resilience the Brief Resilient Coping Scale (BRCS: Sinclair and Wallston, 2004) was used. The BRCS is a four-item scale (with observable range from four to 20) designed to assess individual tendencies to cope with stress in a highly adaptive manner, with items such as "I look for creative ways to alter difficult situation" and "I actively look for ways to replace the losses I encounter in life." The originators (Sinclair and Wallston, 2004) suggest that levels of resilient coping can be conceptualized with reference to score ranges, in terms of those who are "low" (scoring between four and 13), "medium" (scoring between 14 and 16), and "high" (scoring from 17 to 20, inclusive). The scale captures specific patterns of stress adaptation that are more likely to result in increased resilience even in the face of highly stressful situations (Sinclair and Wallston, 2004). Here we use this scale as an indicator of individual differences in coping style that are associated with positive adjustment to life challenges. It was included as a separate variable due to its ability to be learned as a coping style (Polk, 1997) – this was important action as it provided a potentially useful avenue to explore and inform the development of future, evidence-based interventions to support frontline workers.

To assess the presence of resilience in participants, the Brief Resilience Scale (BRS: Smith et al., 2008) was included. Resilience, as measured by the BRS, is the present ability to recover from stress (Smith et al., 2008). Specifically, the BRS is designed to measure resilience — an individual's ability to bounce back or recover from stress (Smith et al., 2008). The BRS is a six-item scale that asks respondents to indicate their agreement with statements such as: "It does not take me long to recover from a stressful event," and "I usually come through difficult times with little trouble." The BRS has a scale range of six to 30, but the final score is meaned as per author recommendations (Smith et al., 2008). Here, we use the BRS as both a predictor and outcome variable informed by research that shows that repeated engagement with stressors reinforce resilient traits and makes future resilience more likely (Woodgate, 1999). The BRCS and BRS scales were chosen due to their brevity in order to minimize participant burden and provided excellent reliability ($\alpha = 0.72$; $\alpha = 0.86$, respectively).

The main outcomes of interest for the present study were wellbeing and burnout, however, resilience (ability to bounce back or recover from stress; measured by the BRS: Smith et al., 2008) was also considered as an outcome. Wellbeing was measured by the Short Warwick Edinburgh Mental Wellbeing Scale (SWEMWBS: Tennant et al., 2007), and was chosen for its measurement of mental wellbeing that relates to both feelings and functioning, its brevity over the full version, and

excellent internal consistency ($\alpha = 0.86$). The SWEMWBS is a seven-item scale that asks participants to indicate their agreement to statements with regard to their experience in the preceding 2 weeks, with items such as "I've been feeling useful," and "I've been dealing with problems well." The scale has an observable range of seven to 35.

Burnout was measured by the Bergen Burnout Inventory (BBI: Salmela-Aro et al., 2011), chosen for its brevity but also for its sub-domains of exhaustion, cynicism, and feelings of inadequacy. The BBI is a nine-item scale, asking participants to indicate their agreement with statements in line with their experience in the last month, with items such as: "I feel dispirited at work and I think of leaving my job" (in the cynicism dimension), "I often sleep poorly because of the circumstances at work" (in the exhaustion dimension), and "My expectations to my job and to my performance have reduced" (in the inadequacy dimension). Total and mean scores were calculated for each of the subscales: exhaustion, cynicism, and feelings of inadequacy. Mean scores are presented for demographic overview for comparison to other samples, but total scores were used in multivariate analyses. Reliability analyses for these provided good metrics for the total scale ($\alpha = 0.86$) as well as the subscales (exhaustion: $\alpha = 0.65$; cynicism: $\alpha = 0.79$; feelings of inadequacy: $\alpha = 0.72$).

Procedure

The present sample recruited frontline workers from the UK and RoI by opportunity and snowballing sampling through social and news media as part of a larger longitudinal study (the CV19 Heroes project[2]). For the purposes of the study, "frontline workers" were defined as "frontline health and social care workers; frontline workers in community supply chains: supermarket staff, delivery drivers, and stock management; and any other frontline workers during the pandemic such as police officers/Gardaí." Participants were guided toward the online survey through Facebook, Twitter, Reddit, and news media advertising. The survey included a full participant information sheet, consent form, and debrief including adequate signposting for participants of both countries to access accurate information with regard to Covid-19 and psychosocial support in the case of any distress caused. The questionnaire itself was expected to take around 15 min for participants to complete. Any responses of potential participants that did not complete the survey in full were not recorded to allow participant withdrawal. The study was reviewed and ethically approved by the University of Gloucestershire School of Natural and Social Sciences Research Ethics Panel (NSS/2003/003), and protocol was registered on the Open Science Framework[3] on March 23rd, 2020. To assist in reduction of potential study duplication, the study was also registered on a variety of Covid-19 research trackers.

Analysis

All data were analyzed using SPSS version 23. Summary data regarding participant demographics, and tests of difference for comparison between the country of residence (UK or RoI) were carried out using one-way ANOVA or χ^2 depending on the type of data in question.

To assess what psychological aspects may contribute to resilience, burnout, and wellbeing; regression models were fit including partnership status (as a proxy for social support), caring responsibilities (as a means of understanding additional stressors beyond working), meaning in life (presence and search), altruism, and resilient coping. In a nested approach, resilience was used as an additional predictor for burnout, and both resilience and burnout were added as predictors for wellbeing. To assess whether or not specific pandemic factors contributed to these outcomes, the pandemic associated factors (attitude toward government response measures, certainty of knowledge in self/family/friends/workers having been infected with SARS-CoV-2) were included in models to predict resilience, burnout, and wellbeing. To answer the research question concerning whether differential pandemic response strategy may contribute to these outcomes, models were then fit to include all predictors (person-specific and pandemic-specific) by country in a stratified approach.

RESULTS

The Sample

A total of 1,318 individuals completed the online survey. During data cleaning, eight were removed that had not listed either the UK or RoI as their country of residence, and five participants were removed for not being classed as a frontline worker during the pandemic. A total of 1,305 participants remained within the dataset for analysis.

The majority of respondents were from the UK ($N = 869$, 66.6%), identified as female ($N = 1109$, 86.7%), identified as white ($N = 1244$, 95.3%), and reported being a frontline worker in the area of health and social care ($N = 1039$, 79.9%). The majority indicated that they had caring responsibilities alongside work ($N = 789$, 60.6%), the largest group within these were those with children ($N = 439$, 33.7%). The majority indicated that they had a partner either in marriage, civil partnership, or cohabitation ($N = 861$, 66.1%). Across the whole sample, and ranging from a score between 1 and 10, the participants rated their government's response to the pandemic at 5.7 ± 3.33 for "appropriate," 4.3 ± 3.16 for "timely," and 5.1 ± 3.15 for "effective." Participants were asked whether they, anyone in their family, their friends, or their colleagues had a Covid-19 infection, with the option of answering one of the following: "No," "I'm not sure," "Yes – not tested, but certain of diagnosis," and "Yes – formally tested and diagnosed." Due to the lack of availability of effective testing at the time of data collection, these categories were collapsed to operationalise certainty around diagnosis; with those indicating "no," and either of the "yes" (i.e., "Yes – not tested, but certain of diagnosis," and "Yes – formally tested and diagnosed") options into a category of "certain," and those selecting "I'm not sure" into a category of "uncertain." For each category, certainty was the most populous, but this varied according to which individual was in question: self $N = 908$ (69.6%), family $N = 1024$

[2] www.cv19heroes.com

[3] https://osf.io/hcr6x

TABLE 1 | Demographic, psychological, and pandemic-factor overview of the sample, including United Kingdom (UK) and Republic of Ireland (RoI) subsamples and tests of difference between the subsamples.

		Whole Sample (*N* = 1305)				**UK (*N* = 869, 66.6%)**				**RoI (*N* = 436, 33.4%)**				
		N	**%**	***M***	***SD***	***N***	**%**	***M***	***SD***	***N***	**%**	***M***	***SD***	**Test of difference**
Age				43.4	10.89			43.8	11.16			42.6	10.30	$F_{(1,1286)} = 3.36$, $p = 0.067$
Gender	Female	1109	86.7			733	86.2			376	87.6			$\chi^2(5) = 2.37$, $p = 0.796$
	Male	162	12.7			110	13.0			52	12.1			
	Trans woman	1	0.1			1	0.1							
	Trans man	1	0.1			1	0.1							
	Non-binary/Gender queer	2	0.2			2	0.2							
	Prefer not to say	4	0.3			3	0.4			1	0.2			
Employment division	Health and Social Care	1039	79.9			685	78.9			354	81.9			**$\chi^2(3) = 10.67$, $p = 0.014$**
	Supply chain	112	8.6			88	10.1			24	5.6			
	Other emergency services	59	4.5			33	3.8			26	6.0			
	Other frontline key worker	90	6.9			62	7.1			28	6.5			
Highest level of education	Primary	121	9.3			110	12.7			11	2.5			**$\chi^2(5) = 75.18$, $p < 0.001$**
	Secondary	284	21.9			219	25.3			65	14.9			
	Foundation degree/higher diploma	264	20.3			175	20.3			89	20.5			
	Undergraduate degree	386	29.7			230	26.6			156	35.9			
	Postgraduate degree	232	17.9			122	14.1			110	25.3			
	Doctoral degree	12	0.9			8	0.9			4	0.9			
Partnership status	Partnered	861	66.1			584	67.4			277	63.5			$\chi^2(1) = 1.97$, $p = 0.172$
	Unpartnered	441	33.9			282	32.6			159	36.5			
Caring responsibilities	Yes – children, parents, or other adults	789	60.6			499	57.6			290	66.7			**$\chi^2(1) = 9.93$, $p = 0.001$**
	No caring responsibilities	512	39.4			367	42.4			145	33.3			
Government response rating	Appropriate			5.7	3.33			5.2	3.19			6.8	3.35	**$F_{(1,1303)} = 70.23$, $p < 0.001$**
	Timely			4.3	3.16			3.6	2.76			5.7	3.44	**$F_{(1,1303)} = 141.74$, $p < 0.001$**
	Effective			5.1	3.15			4.6	2.98			6.0	3.25	**$F_{(1,1303)} = 66.38$, $p < 0.001$**
Have you had CV19?	No	770	59.0			458	52.7			312	71.7			**$\chi^2(3) = 50.93$, $p < 0.001$**
	I'm not sure	396	30.4			307	35.3			89	20.5			
	Yes – not tested but certain	75	5.8			64	7.4			11	2.5			
	Yes – tested and diagnosed	63	4.8			40	4.6			23	5.3			
	Certain	908	69.6			562	64.7			346	79.5			**$\chi^2(1) = 30.31$, $p < 0.001$**
	Uncertain	396	30.4			307	35.3			89	20.5			
Has anyone in your family had CV19?	No	852	65.4			500	57.6			352	81.1			**$\chi^2(3) = 75.51$, $p < 0.001$**
	I'm not sure	278	21.4			228	26.3			50	11.5			
	Yes – not tested but certain	115	8.8			100	11.5			15	3.5			
	Yes – tested and diagnosed	57	4.4			40	4.6			17	3.9			
	Certain	1024	78.6			640	73.7			384	88.5			**$\chi^2(1) = 37.47$, $p < 0.001$**
	Uncertain	278	21.4			228	26.3			50	11.5			

(Continued)

TABLE 1 | Continued

		Whole Sample (*N* = 1305)				UK (*N* = 869, 66.6%)				RoI (*N* = 436, 33.4%)				
		N	**%**	***M***	***SD***	***N***	**%**	***M***	***SD***	***N***	**%**	***M***	***SD***	**Test of difference**
Have any of your friends had CV19?	No	508	39.0			299	34.4			209	48.2			**$\chi^2(3) = 58.05$, $p < 0.001$**
	I'm not sure	309	23.7			237	27.3			72	16.6			
	Yes – not tested but certain	160	12.3			136	15.7			24	5.5			
	Yes – tested and diagnosed	325	25.0			196	22.6			129	29.7			
	Certain	993	76.3			631	72.7			362	83.4			**$\chi^2(1) = 18.35$, $p < 0.001$**
	Uncertain	309	23.7			237	27.3			72	16.6			
Have any of your colleagues had CV19?	No	314	24.1			168	19.3			146	33.6			**$\chi^2(3) = 104.71$, $p < 0.001$**
	I'm not sure	332	25.5			242	27.8			90	20.7			
	Yes – not tested but certain	194	14.9			182	20.9			12	2.8			
	Yes – tested and diagnosed	464	35.6			277	31.9			187	43.0			
	Certain	972	74.5			627	72.2			345	79.3			**$\chi^2(1) = 7.83$, $p = 0.006$**
	Uncertain	332	25.5			242	27.8			90	20.7			
Meaning in Life	Presence			26.4	6.40			26.0	6.52			27.3	6.05	**$F_{(1,1272)} = 11.79$, $p = 0.001$**
	Search			19.5	8.21			19.7	7.98			19.3	8.66	$F_{(1,1303)} = 0.56$, $p = 0.454$
Altruism				40.4	9.27			40.2	9.69			41.0	8.33	$F_{(1,1254)} = 2.01$, $p = 0.156$
Resilient Coping	Total			14.6	3.03			14.6	3.00			14.7	3.09	$F_{(1,1303)} = 0.79$, $p = 0.373$
	Low resilient coper	400	30.8			275	31.7			125	28.9			$\chi^2(2) = 1.26$, $p = 0.532$
	Medium resilient coper	569	43.8			377	43.5			192	44.3			
	High resilient coper	331	25.5			215	24.8			116	26.8			
Resilience				3.3	0.82			3.2	0.82			3.3	0.81	$F_{(1,1282)} = 1.97$, $p = 0.161$
Burnout	Total (mean)			3.1	1.10			3.2	1.06			3.1	1.18	$F_{(1,1303)} = 1.94$, $p = 0.164$
	Exhaustion			3.4	1.22			3.5	1.19			3.4	1.26	$F_{(1,1303)} = 2.02$, $p = 0.156$
	Cynicism			2.9	1.35			2.9	1.33			2.8	1.39	$F_{(1,1303)} = 3.12$, $p = 0.078$
	Feelings of inadequacy			3.1	1.27			3.1	1.24			3.1	1.34	$F_{(1,1303)} = 0.15$, $p = 0.698$
Wellbeing	SWEMWBS* Total			22.7	4.91			22.3	4.94			23.8	4.69	**$F_{(1,1293)} = 26.92$, $p < 0.001$**
	SWEMWBS metric score			21.0	3.89			20.6	3.91			21.8	3.74	**$F_{(1,1293)} = 24.93$, $p < 0.001$**

Tests of difference marked in bold denote a significant difference ($p < 0.05$).
**SWEMWBS, Short Warwick Edinburgh Mental Wellbeing Scale.*

(78.6%), friends $N = 993$ (76.3%), and colleagues $N = 972$ (74.5%). **Table 1** provides an overview of the sample. As previously noted, this concept of testing certainty may not be the only way to conceptualize stress in these frontline workers, and so multivariate analyses have been carried out using an operationalization that captures occurrence of Covid-19 infection and are presented in **Supplementary Tables 1, 2**.

To examine basic associations with outcomes, a series of two-tailed zero-order correlations were implemented (see **Table 2**). Here, the personal factors of presence of and search for meaning in life, altruism, and resilient coping were associated with resilience and wellbeing to varying degrees from small to large effects (Cohen, 1988). The pandemic factors were associated with all outcomes, aside from the judgment of the appropriateness of their government's response and resilience. The remaining relationships were significant, but with small effect sizes. For burnout, the only two personal factors that were significantly related were the two aspects of meaning in life, with *presence of*

TABLE 2 | Zero-order correlations of personal factors and resilience, burnout, and wellbeing in the whole frontline worker sample.

		Resilience (BRS)	Burnout (BBI, Total)	Wellbeing (SWEMWBS)
Presence of meaning in life (MLQ P)		0.348***	−0.291***	0.465***
Search for meaning in life (MLQ S)		−0.203***	0.264***	−0.195***
Altruism (ASRAS)		0.094**	−0.025	0.144***
Resilient coping (BRCS)		0.409***	−0.011	0.339***
Government response rating	Appropriate	0.044	−0.086**	0.152***
	Timely	0.060*	−0.114***	0.197***
	Effective	0.066*	−0.093**	0.182***

*Significant at $p < 0.05$

**Significant at $p < 0.01$

***Significant at $p < 0.001$

MLQ, Meaning in Life Questionnaire;ASRAS, Adapted Self-Report Altruism Scale; BBI, Bergen Burnout Inventory; BRCS, Brief Resilient Coping Scale; BRS, Brief Resilience Scale; P, presence; S, search; SWEMWBS, Short Warwick Edinburgh Mental Wellbeing Scale.

meaning being negatively related and *search for meaning* being positively related.

Comparisons Between the UK and the Republic of Ireland

In terms of the sample, there were significance differences in employment division [$\chi^2(3) = 10.67$, $p = 0.014$], with slightly more healthcare workers proportionately in the frontline sample of workers from RoI, and comparatively fewer from other groups. Education also differed between the two groups of participants [$\chi^2(5) = 75.18$, $p < 0.001$] with lower levels of education more frequently reported in the UK-based sample. Caring responsibilities between the two countries differed [$\chi^2(1) = 9.93$, $p = 0.001$], with notably higher levels of UK-based respondents indicating that they currently did not have caring responsibilities.

Differences were reported in each of the measures concerning the respondents' rating of their government's response to the Covid-19 crisis. Here, UK-based participants reported their government's response to be significantly less appropriate [$F_{(1,1303)} = 70.23$, $p < 0.001$], timely [$F_{(1,1303)} = 141.74$, $p < 0.001$], and effective [$F_{(1,1303)} = 66.38$, $p < 0.001$] than did the RoI-based frontline worker sample. There were differences across the board between the countries for whether or not participants had either themselves [$\chi^2(3) = 50.93$, $p < 0.001$], their family members [$\chi^2(3) = 75.51$, $p < 0.001$], friends [$\chi^2(3) = 58.05$, $p < 0.001$], or colleagues [$\chi^2(3) = 104.71$, $p < 0.001$] contracted Covid-19. For each person considered, the certainty in whether or not they had experienced an infection was significantly greater in the RoI-based sample {self: [$\chi^2(1) = 30.31$, $p < 0.001$]; family: [$\chi^2(1) = 37.47$, $p < 0.001$]; friends [$\chi^2(1) = 18.35$, $p < 0.001$]; colleagues [$\chi^2(1) = 7.83$, $p = 0.006$]}.

For the psychological variables, only presence of meaning in life and wellbeing showed significant differences, with respondents from the UK reporting lower levels of presence of meaning in life [$F_{(1,1272)} = 11.793$, $p = 0.001$], and wellbeing in both raw SWEMWBS scores [$F_{(1,1293)} = 26.92$, $p < 0.001$] and their metric equivalents [$F_{(1,1293)} = 24.93$, $p < 0.001$]. Compared to population norm values (reported as 23.6 ± 3.90: Craig et al., 2011), the whole sample scored lower, but the RoI-based subsample scored comparatively close. Compared to other population samples of burnout using the BBI, the present sample scored higher on the total mean score (cited as 2.56 in workers from "social affairs and health") and the mean scores for each of the burnout subscales (Exhaustion: 2.79, Cynicism: 2.26, Inadequacy: 2.66; Maarit et al., 2013), although this did not differ by country. Similarly, resilience was lower amongst the present sample than in other population norms (cited as 3.35: Kunzler et al., 2018), although this did not vary significantly between the two subgroups.

Factors Associated With Resilience, Burnout, and Wellbeing

Resilience

For resilience, the model was significant [$F_{(13,1207)} = 33.31$, $p < 0.001$, $R^2 = 0.26$, $R^2_{adjusted} = 0.26$], with both presence of meaning in life ($\beta = 0.02$, $t = 6.68$, $p < 0.001$) and resilient coping ($\beta = 0.11$, $t = 13.97$, $p < 0.001$) positively associated with resilience. Search for meaning in life ($\beta = -0.02$, $t = -6.69$, $p < 0.001$) and SARS-CoV-2 infection certainty for self ($\beta = -0.11$, $t = -2.07$, $p = 0.039$) were negatively associated with resilience. In supplementary analyses, where the SARS-CoV-2 infection was treated with an operationalization that captured presence of virus rather than certainty (i.e., "Yes – not tested, but certain of diagnosis," and "Yes – formally tested and diagnosed" were collapsed into a "yes" category, and both "no" and "I don't know" remained, with "no" forming the reference group), the model for resilience showed the same variables as being associated with the outcome, in the same direction and to similar effect. Here, whether or not they themselves had had SARS-CoV-2 infection was also negatively associated with resilience ($\beta = -0.08$, $t = -2.29$, $p = 0.022$). Supplementary analyses for the whole sample are presented in **Supplementary Table 1**.

Burnout

Burnout was significantly predicted by the personal and pandemic-related factors [$F_{(14,1206)} = 19.33$, $p < 0.001$,

R^2 = 0.18, $R^2_{adjusted}$ = 0.17], with being partnered (β = 1.63, t = 2.89, p = 0.004), having higher levels of search for meaning in life (β = 0.15, t = 4.32, p < 0.001), and SARS-CoV-2 infection certainty for self (β = 2.04, t = 3.13, p = 0.002) being associated with higher total burnout. Having both higher presence of meaning in life (β = −0.30, t = −6.57, p < 0.001), resilience (β = −2.73, t = −7.58, p < 0.001), and perception of the timeliness of government actions (β = −0.40, t = −2.82, p = 0.002) were negatively associated with burnout. In supplementary analyses, the picture for burnout appears to change somewhat with regard to the variables that capture SARS-CoV-2 infection. Here, we also see that having had SARS-CoV-2 themselves (β = 1.15, t = 2.68, p = 0.008), or their friends (β = 0.75, t = 2.39, p = 0.017), or colleagues (β = 0.80, t = 2.34, p = 0.019) having had the infection also appeared to be associated with burnout.

Wellbeing

Personal and pandemic-related factors significantly predicted outcome wellbeing in the total sample of this study [$F_{(15,1205)}$ = 85.28, p < 0.001, R^2 = 0.52, $R^2_{adjusted}$ = 0.51]. Here, presence of meaning in life (β = 0.15, t = 8.01, p < 0.001), resilient coping (β = 0.27, t = 6.43, p < 0.001), resilience (β = 1.56, t = 10.95, p < 0.001), and perception of the timeliness of government actions (β = 0.16, t = 2.84, p = 0.005) were positively associated. Level of burnout (β = −0.19, t = −16.67, p < 0.001) was the only variable negatively associated with wellbeing.

Table 3 details the regression models for resilience (1), burnout (2), and wellbeing (3).

Comparing Profiles of Association With Resilience, Burnout, and Wellbeing Between Those in the UK and Those in RoI

Resilience

Both models for resilience in the UK-based [$F_{(13,809)}$ = 23.35, p < 0.001, R^2 = 0.27, $R^2_{adjusted}$ = 0.26] and RoI-based [$F_{(13,384)}$ = 11.26, p < 0.001, R^2 = 0.28, $R^2_{adjusted}$ = 0.25] frontline workers were significant. For the UK workers, resilience was positively associated with presence of meaning in life (β = 0.02, t = 5.06, p < 0.001), higher levels of resilient coping (β = 0.11, t = 12.01, p < 0.001), and judgments of the government's response as being more timely (β = 0.03, t = 1.99, p = 0.047). Search for meaning in life was negatively associated with resilience (β = −0.02, t = −6.11, p < 0.001) in this group. For the RoI-based frontline workers, the personal factors of presence of meaning in life (β = 0.03, t = 4.01, p < 0.001) and resilient coping (β = 0.11, t = 6.89, p < 0.001) were positively associated with resilience. In this subgroup, the pandemic-related factors of certainty over the experience of SARS-CoV-2 infection in self and family were differentially associated with resilience. Here, uncertainty of infection for self was negatively associated (β = −0.29, t = −2.90, p = 0.004), but uncertainty of infection in a family member was positively associated (β = 0.34, t = 2.61, p = 0.009) with wellbeing.

Burnout

Burnout was significantly predicted by the combined models for both UK-based [$F_{(14,808)}$ = 11.70, p < 0.001, R^2 = 0.17, $R^2_{adjusted}$ = 0.15] and RoI-based [$F_{(14,383)}$ = 9.19, p < 0.001, R^2 = 0.25, $R^2_{adjusted}$ = 0.22] frontline workers. For both groups of frontline workers, the pattern of significant personal factors predicting burnout was largely the same, with burnout being higher in those who were partnered (UK: β = 1.53, t = 2.27, p = 0.023; RoI: β = 2.09, t = 2.00, p = 0.046) and those whose search for meaning in life was higher (UK: β = 0.17, t = 4.02, p < 0.001; RoI: β = 0.13, t = 2.01, p = 0.046); and lower in those scoring more highly on presence of meaning in life (UK: β = −0.27, t = −5.05, p < 0.001; RoI: β = −0.37, t = −4.09, p < 0.001) and on resilience (UK: β = −2.35, t = −5.43, p < 0.001; RoI: β = −3.32, t = −5.08, p < 0.001). In a slight difference between the two groups, resilient coping styles were associated with higher levels of burnout in UK-based participants only (β = 0.25, t = 2.01, p = 0.045). For the pandemic associated factors, the UK-based participants reported higher levels of burnout if they judged the timeliness of their government's response to the pandemic to be lower (β = −0.55, t = −2.86, p = 0.004), and if there was more uncertainty over whether they had themselves experienced Covid-19 (β = 1.49, t = 1.98, p = 0.048). For the frontline workers based in RoI, the only pandemic-related factor that predicted their levels of burnout in the model was uncertainty over whether they had themselves been infected with SARS-CoV-2 (β = 3.52, t = 2.68, p = 0.008).

Wellbeing

Both the UK-based [$F_{(15,807)}$ = 55.32, p < 0.001, R^2 = 0.51, $R^2_{adjusted}$ = 0.50] and RoI-based [$F_{(15,382)}$ = 28.27, p < 0.001, R^2 = 0.53, $R^2_{adjusted}$ = 0.51] frontline workers' wellbeing was significantly predicted by the composite models of personal and pandemic factors. For both samples of frontline workers, presence of meaning in life (UK: β = 0.16, t = 7.30, p < 0.001; RoI: β = 0.10, t = 2.90, p = 0.004), resilient coping (UK: β = 0.24, t = 4.87, p < 0.001; RoI: β = 0.32, t = 4.17, p < 0.001), and resilience (UK: β = 1.64, t = 9.34, p < 0.001; RoI: β = 1.36, t = 5.47, p < 0.001) were positively associated, and burnout (UK: β = −0.19, t = −13.19, p < 0.001; RoI: β = −0.20, t = −10.57, p < 0.001) was negatively associated with wellbeing. For the UK-based sample, the perception of timeliness of the government's response to the pandemic was positively associated with wellbeing (β = 0.16, t = 2.03, p = 0.043). There were no pandemic-associated factors associated with wellbeing in the model for the RoI-based frontline workers.

Table 4 details the regression models for resilience (4), burnout (5), and wellbeing (6), stratified by country (a: UK; b: RoI). Supplementary analyses for the stratified models can be found in **Supplementary Table 2**.

TABLE 3 | Regression models examining separate contributions of personal and pandemic factors for resilience, burnout, and wellbeing in the whole frontline worker sample.

		Model 1					**Model 2**					**Model 3**				
		Resilience					**Burnout**†					**Wellbeing**				
		$F_{(13,1207)} = 33.31$, $p < 0.001$, $R^2 = 0.26$, $R^2_{adj} = 0.26$					$F_{(14,1206)} = 19.33$, $p < 0.001$, $R^2 = 0.18$, $R^2_{adj} = 0.17$					$F_{(15,1205)} = 85.28$, $p < 0.001$, $R^2 = 0.52$, $R^2_{adj} = 0.51$				
		β	*t*	*p*	95% CI		β	*t*	*p*	95% CI		β	*t*	*p*	95% CI	
					Lower	Upper				Lower	Upper				Lower	Upper
	Partnership status	0.003	0.057	0.955	−0.086	0.091	1.634	2.890	**0.004**	0.525	2.742	0.195	0.887	0.375	−0.237	0.627
	Caring status	−0.011	−0.265	0.791	−0.097	0.074	0.840	1.551	0.121	−0.222	1.903	−0.160	−0.761	0.447	−0.573	0.253
	MLQ presence	0.024	6.676	**<0.001**	0.017	0.031	−0.303	−6.570	**<0.001**	−0.393	−0.212	0.146	8.012	**<0.001**	0.110	0.181
	MLQ search	−0.019	−6.686	**<0.001**	−0.024	−0.013	0.153	4.318	**<0.001**	0.084	0.223	−0.008	−0.606	0.545	−0.036	0.019
	Altruism	−0.003	−1.234	0.218	−0.007	0.002	0.006	0.193	0.847	−0.051	0.063	0.020	1.735	0.083	−0.003	0.042
	Resilient coping	0.111	13.973	**<0.001**	0.095	0.127	0.145	1.351	0.177	−0.065	0.354	0.267	6.431	**<0.001**	0.186	0.349
	Resilience*						−2.725	−7.575	**<0.001**	−3.431	−2.020	1.564	10.947	**<0.001**	1.284	1.844
	Burnout**											−0.186	−16.658	**<0.001**	−0.208	−0.164
Government response rating	Appropriate	−0.009	−0.782	0.435	−0.031	0.013	0.017	0.123	0.902	−0.0260	0.294	−0.036	−0.658	0.510	−0.143	0.071
	Timely	0.014	1.234	0.217	−0.008	0.037	−0.403	−2.816	**0.005**	−0.683	−0.122	0.158	2.835	**0.005**	0.049	0.267
	Effective	0.007	0.551	0.582	−0.018	0.032	0.069	0.436	0.663	0.243	0.382	0.045	0.731	0.465	−0.076	0.166
CV19 Infection certainty	Self	−0.107	−2.067	**0.039**	−0.209	−0.005	2.036	3.134	**0.002**	0.762	3.311	0.417	1.648	0.100	−0.079	0.914
	Family	0.013	0.227	0.820	−0.101	0.127	−0.201	−0.276	0.782	−1.626	1.224	−0.314	−1.114	0.266	−0.867	0.290
	Friends	0.005	0.098	0.922	−0.097	0.107	−0.718	−1.102	0.271	−1.996	0.560	−0.399	−1.579	0.115	−0.896	0.097
	Co-Workers	0.026	0.528	0.598	−0.071	0.123	−0.133	−0.216	0.829	−1.343	1.076	−0.194	−0.812	0.417	−0.664	0.275

*Models 2 and 3 only

**Model 3 only

Significant differences are highlighted in bold.

†*Burnout models were fit using the total (unmeaned) Bergen Burnout Inventory score.*

MLQ, Meaning in Life Questionnaire.

Resilient coping refers to specific adaptational styles associated with coping that are supportive of resilience. Resilience refers to the status of having successfully handled stressful situations.

TABLE 4 | Stratified regression models to examine the combined associations of personal and pandemic factors for the United Kingdom (UK)-based **(A)** and Republic of Ireland (RoI)-based **(B)** subsamples for resilience (4), burnout (5), and wellbeing (6).

		Resilience					**Burnout**†					**Wellbeing**				
		Model 4a – UK					**Model 5a – UK**					**Model 6a – UK**				
		$F_{(13,809)} = 23.35, p < 0.001,$ $R^2 = 0.27, R^2_{adj} = 0.26$					$F_{(14,808)} = 11.70, p < 0.001,$ $R^2 = 0.17, R^2_{adj} = 0.15$					$F_{(15,807)} = 55.32, p < 0.001,$ $R^2 = 0.51, R^2_{adj} = 0.50$				
		β	*t*	*p*	95% CI		β	*t*	*p*	95% CI		β	*t*	*p*	95% CI	
					Lower	Upper				Lower	Upper				Lower	Upper
	Partnership status	−0.005	−0.093	0.926	−0.113	0.102	1.534	2.273	**0.023**	0.210	2.859	0.075	0.279	0.781	−0.454	0.605
	Caring binary	0.025	0.486	0.627	−0.077	0.128	0.699	1.087	0.278	−0.563	1.960	−0.229	−0.895	0.371	−0.733	0.274
	MLQ presence	0.022	5.064	**<0.001**	0.013	0.030	−0.273	−5.053	**<0.001**	−0.378	−0.167	0.159	7.299	**<0.001**	0.116	0.202
	MLQ search	−0.021	−6.108	**<0.001**	−0.027	−0.014	0.172	4.019	**<0.001**	0.088	0.256	−0.011	−0.612	0.541	−0.044	0.023
	Altruism	−0.004	−1.505	0.133	−0.009	0.001	−0.020	−0.589	0.556	−0.086	0.046	0.020	1.520	0.129	−0.006	0.047
	Resilient Coping	0.112	12.011	**<0.001**	0.094	0.131	0.251	2.010	**0.045**	0.006	0.497	0.243	4.866	**<0.001**	0.145	0.341
	Resilience*						−2.353	−5.430	**<0.001**	−3.203	−1.502	1.641	9.337	**<0.001**	1.296	1.986
	Burnout**											−0.185	−13.194	**<0.001**	−0.212	−0.157
Government response rating	Appropriate	−0.017	−1.156	0.248	−0.046	0.012	0.108	0.600	0.548	−0.245	0.462	−0.053	−0.742	0.458	−0.194	0.088
	Timely	0.031	1.991	**0.047**	0.000	0.061	−0.545	−2.858	**0.004**	−0.919	−0.171	0.155	2.031	**0.043**	0.005	0.305
	Effective	0.010	0.608	0.543	−0.022	0.041	−0.004	−0.022	0.982	−0.393	0.384	0.062	0.787	0.431	−0.093	0.217
CV19 Infection certainty	Self	−0.049	−0.804	0.421	−0.169	0.071	1.494	1.982	**0.048**	0.014	2.973	0.419	1.392	0.164	−0.172	1.010
	Family	−0.075	−1.141	0.254	−0.204	0.054	0.315	0.697	0.697	−1.274	1.904	−0.183	−0.569	0.570	−0.817	0.450
	Friends	−0.018	−0.301	0.764	−0.137	0.101	−0.668	−0.893	0.372	−2.136	0.800	−0.576	−1.933	0.054	−1.161	0.009
	Co-Workers	0.026	0.441	0.659	−0.089	0.141	0.393	0.544	0.587	−1.026	1.813	0.055	0.190	0.849	−0.511	0.621

(Continued)

TABLE 4 | Continued

		Resilience					Burnout†					Wellbeing				
		Model 4b – RoI					Model 4b – RoI					Model 6b – RoI				
		$F_{(13,384)} = 11.26, p < 0.001,$ $R^2 = 0.28, R^2_{adj} = 0.25$					$F_{(14,383)} = 9.19, p < 0.001,$ $R^2 = 0.25, R^2_{adj} = 0.22$					$F_{(15,382)} = 28.27, p < 0.001,$ $R^2 = 0.53, R^2_{adj} = 0.51$				
		β	*t*	*p*	95% CI		β	*t*	*p*	95% CI		β	*t*	*p*	95% CI	
					Lower	Upper				Lower	Upper				Lower	Upper
	Partnership status	0.004	0.049	0.961	−0.156	0.164	2.088	2.002	**0.046**	0.037	4.139	0.645	1.672	0.095	−0.114	1.404
	Caring binary	−0.119	−1.491	0.137	−0.275	0.038	0.869	0.850	0.396	−1.142	2.881	−0.291	−0.772	0.441	−1.032	0.450
	MLQ presence	0.027	4.009	**<0.001**	0.014	0.041	−0.366	−4.090	**<0.001**	−0.542	−0.190	0.097	2.895	**0.004**	0.031	0.164
	MLQ search	−0.015	−3.093	0.002	−0.025	−0.006	0.130	2.006	**0.046**	0.003	0.257	−0.006	−0.200	0.795	−0.053	0.041
	Altruism	0.002	0.534	0.594	−0.006	0.011	0.072	1.262	0.208	−0.040	0.185	0.018	0.865	0.387	−0.023	0.060
	Resilient Coping	0.105	6.885	**<0.001**	0.075	0.135	−0.198	−0.957	0.339	−0.604	0.209	0.318	4.171	**<0.001**	0.168	0.468
	Resilience*						−3.324	−5.078	**<0.001**	−4.611	−2.037	1.361	5.467	**<0.001**	0.871	1.850
	Burnout**											−0.199	−10.572	**<0.001**	−0.236	−0.162
Government response rating	Appropriate	0.002	0.099	0.921	−0.034	0.037	−0.162	−0.695	0.487	−0.619	0.296	−0.051	−0.589	0.556	−0.219	0.118
	Timely	−0.006	−0.324	0.746	−0.043	0.047	−0.408	−1.710	0.088	−0.877	0.061	0.086	0.971	0.332	−0.088	0.259
	Effective	0.005	0.237	0.813	−0.037	0.047	0.227	0.838	0.403	−0.306	0.761	0.049	0.492	0.623	−0.147	−0.246
CV19 Infection certainty	Self	−0.293	−2.902	**0.004**	−0.492	−0.095	3.516	2.683	**0.008**	0.940	6.093	0.494	1.014	0.311	−0.463	1.451
	Family	0.341	2.612	**0.009**	0.084	0.597	−0.163	−0.097	0.923	−3.482	3.155	−0.246	−0.396	0.692	−1.467	0.976
	Friends	0.043	0.421	0.674	−0.159	0.245	−0.716	−0.543	0.588	−3.310	1.878	0.203	0.418	0.676	−0.752	1.158
	Co-Workers	−0.002	−0.024	0.981	−0.182	0.178	−1.144	−0.973	0.331	−3.457	1.168	−0.812	−1.874	0.062	−1.664	0.040

*Models 5 and 6 only

**Model 6 only

Significant differences are highlighted in bold.

†*Burnout models were fit using the total (unmeaned) Bergen Burnout Inventory score.*

MLQ, Meaning in Life Questionnaire.

Resilient coping refers to specific adaptational styles associated with coping that are supportive of resilience. Resilience refers to the status of having successfully handled stressful situations.

DISCUSSION

From the onset of the Covid-19 global pandemic, frontline workers have been asked to work in conditions that put them at risk both physically and psychologically (see Kröger, 2020). As part of a larger project, the present study sought to understand those factors that were associated with resilience, burnout, and wellbeing in frontline workers in the UK and RoI, and whether they varied by country.

Overall, both samples of frontline workers had comparable levels of resilience and burnout, but the UK-based workers appeared to have significantly lower wellbeing. RoI-based workers were more likely to also be in an informal caring role, although this did not appear to be associated with any of the outcomes in the models, which is inconsistent with previous related findings (May et al., 2004). In terms of factors associated with the pandemic, UK-based workers reported lower levels of appropriateness, timeliness, and effectiveness of their government's response to the pandemic than did those in RoI. UK-based workers were also more likely to be uncertain as to whether they, their family members, friends, or colleagues had experienced Covid-19. There were few differences in the regression models between the countries with reference to personal factors. The judgment of lower timeliness in their government's response appeared to be an important factor for UK-based frontline workers. It was a significant predictor of resilience, burnout, and wellbeing in cumulative models, appearing to drive the overall association with wellbeing both independently, and as a function of its contribution to lower resilience and higher burnout. The RoI-based subsample were largely normative in their overall wellbeing, and this appeared to be borne out in cumulative models as there were no pandemic-associated factors (the only other bivariate differences between the countries) that were significant in the final model. The uncertainty of whether or not they themselves had experienced Covid-19 appeared to be a key driver for resilience, and for its cumulative contribution to burnout, but its associated with wellbeing was eradicated in the last model, where personal factors appeared to carry the total associative weight. For the workers in RoI, certainty over family members having had Covid-19 was positively associated with resilience, suggesting that the availability of reliable testing (for self or family members) may be an important aspect of resilience beyond personal factors.

The present findings both support and extend similar work in the field. We have observed lower resilience, higher burnout, and lower wellbeing in this sample of frontline workers in the UK and RoI during the Covid-19 pandemic. This aligns with prior work observing similar outcomes in healthcare workers (Tam et al., 2004; Chan et al., 2005; Maunder et al., 2006; Lung et al., 2009; Chersich et al., 2020) and extends this to broader sectors of frontline workers in this new global infectious disease pandemic[4]. The integration of personal factors along with pandemic-related factors provides the present work with findings that are meaningful for policy and practice. The examination of differences between samples from two countries whose strategies to delay, but work toward herd immunity (UK) or delay and eliminate (RoI) the virus have provided a unique opportunity to explore whether these differences are manifest in the psychological profiles of frontline workers. Both countries are, arguably, culturally and economically similar, providing a relatively stable basis for comparison.

The present examination of participant's assessment of the government response to the pandemic provides the literature with a first glimpse at how government strategy might impact the health and wellbeing of those staffing its frontline; from the healthcare workers that tend to the infected, to the supermarket workers confronted with panic-buying and hoarding, to the workers who have stepped forward to provide auxiliary services in a time of need. Here, we observe differential patterns of variable association with each outcome by country, most particularly with regard to the pandemic factors, which may reflect some of the differences in the way that the pandemic has progressed in each country. In the RoI-based subsample, pandemic factors associated with judgment of the government strategy were not ultimately implicated in the outcomes in each model, however, uncertainty regarding experience of SARS-CoV-2 infection were significantly associated with both resilience and wellbeing. This could be explained by related literature that has explored the impact of fearing passing the infection on to others (Tam et al., 2004; Maunder et al., 2006), and could also explain why being partnered appears to be positively associated with burnout in the whole sample and in each country-based subsample.

Compared to related literature examining the factors associated with heroic action, the present findings appear to both complement and refute previously observed trends. The lack of relative importance for altruism as a factor in determining variance in resilience and wellbeing in these workers appears to contravene previous studies. In related work, Vaulerin et al. (2016) determined that burnout was not sufficiently predicted by the personality facet of agreeableness, of which altruism is one component. Whilst altruism has been shown to be protective of health and wellbeing, its salutogenic impact may well be over-ridden when the task at hand (particularly one of helping or assistance) proves to be overwhelming (Post, 2005). In this context, it would seem with our present population that altruism in the face of the significant adversity faced may not be protective, particularly over the longer term. With regard to meaning in life, the present findings echo others in the field. Presence of meaning in life has been suggested to be protective against burnout in palliative care nurses (Gama et al., 2014) and firefighters (Krok, 2016). Meaning in life is a relatively dynamic concept within the sphere of work. Engaging in activities perceived to be meaningful has been noted to have longitudinal correlates of presence of meaning (Eakman, 2014), and for some employment sectors such as healthcare, the opportunity to engage in a work that answers a "calling" not only provides meaning, but may also protect from burnout (Vinje and Mittelmark, 2007). However, encountering particularly challenging circumstances can damage meaning, and result in losing a feeling of having meaning in

[4]Comparisons across sectors are due to be conducted in future analyses of these data as part of the larger project.

life, and therefore necessitate an increase in search for meaning (Hicks and King, 2009). For our present sample, it is likely that engaging in meaningful and valuable work for the current context may have increased presence of meaning in life for some, but also that challenges associated with the pandemic (such as the witnessing of death, the experience of customer hoarding, or experiencing the use of coughing or spitting as a means of social protest) may also impair meaning. Here, we find that both search for and presence of meaning in life are differentially associated with all outcomes in the whole sample, and when stratified by sample location. In other words, those experiencing high levels of search for meaning in life appear to have poorer resilience, burnout, and wellbeing, and those higher in presence the inverse.

Our use of cumulative models of wellbeing (where resilience contributes to burnout, and both resilience and burnout contribute to wellbeing) provide a new perspective for understanding the mental health of frontline workers, as well as providing greater clarity about the relationships between these psychological constructs more broadly. Here, we are able to determine the cumulative contribution of personal factors and pandemic-related factors on wellbeing. The examination of resilient coping style as distinct from the concept of resilience provides new knowledge to the field, in terms of being able to provide intervention avenues for those working on the frontline. The personal factors that are associated with each of the outcomes (presence of and search for meaning in life, and resilient coping style) are associated with each outcome in each country-based subsample. The addition of pandemic-associated factors to the stratified cumulative models indicates the over-riding importance for the judgment of timeliness in government response for the UK-based sample both independently for each outcome and cumulatively. The uncertainty around whether or not participants or their family members had experienced SARS-CoV-2 infection similarly had a relationship to resilience and burnout (in this case, just the self) for the RoI-based subsample. This likely reflects differences in the way that the pandemic has evolved in each of these countries, and the subsequent impact this may have on frontline workers.

The present study provides a timely and important addition to the literature on the experiences of frontline workers during times of crisis. The study is set at a critical time during the pandemic in the UK and RoI, commencing data collection at pre-peak and continuing to post-peak during the first surge of a global pandemic. The sample size of the present study is also a strength, providing a robustness to the findings overall and by country subsample. The present study builds on existing literature to add to the overall picture of factors associated with heroic acts, providing personal and contextual understanding to various aspects of psychological health and wellbeing in a broad and atypical (for the literature) sample of frontline workers. To our knowledge, this is the first study to attempt to compare the experiences of frontline workers across countries, where there have been meaningful differences in pandemic strategy. Moreover, this is the first study to report on resilience, burnout, and wellbeing during a global pandemic in a broad and comprehensive conceptualization of frontline worker. Prior research into the SARS and H1N1 pandemics, which were comparatively less internationally devastating in both reach and depth of health and economic damage, have focused purely on healthcare workers, mostly those in hospital settings. Here, we not only incorporate healthcare workers in community and social care settings (such as care homes, and community healthcare hubs such as general practitioners), we also include other sectors of workers who have found themselves on the frontline: supermarket workers, teachers who have been supporting the children of keyworkers (in the UK), social workers, police officers, and testing station workers. The inclusion of these other workers into the consideration of their vulnerability to stress-related harm in their work is an important acknowledgment of the sacrifices they have made, and of their importance in supporting the population during such times.

There is a clear remit for resilient coping within the context of the welfare of frontline workers, thus a key recommendation from this work would be to focus on interventions that introduce or otherwise increase the utilization of such coping styles. The present findings give insight into the consequences of political strategy during such times and find that the lack of timeliness in the UK's government response is also associated in the psychological welfare of its frontline workers. Whilst unpacking the direct and indirect influence of policy on behavior and health is difficult, these findings are consistent with research that shows relationships between policy decisions and health in other areas (Msetfi et al., 2018). The present work provides a theoretical contribution to the field also, by providing a greater understanding of the interplay between individual-level variables and contextual factors in relation to mental health. There are significant contributions to policy to be made from the present research. One clear indication is the need for governments to act in a timely way in response to such crises. The finding herein that the perception of timeliness of government response appears to be associated with poorer outcomes, specifically for those in the UK, provides a stark warning to UK-based organizations in frontline sectors that support is needed to protect these workers from burning out. The relatively slower response of the UK government to introducing effective measures to combat the spread of SARS-CoV-2 has had an apparent impact on infection rate, death toll, and now on the welfare of its most precious asset in such times: its frontline workers (Scally et al., 2020).

Limitations and Future Research

The present study is limited by its cross-sectional perspective, and as such cannot determine causality with regard to the variables analyzed. As this present study is part of a longitudinal project, further work examining the long-term impact of the pandemic and these baseline factors will be determinable in future studies. Whilst the variables of interest were chosen in order to understand how they contribute to these mental wellbeing outcomes, any differences between the countries pre-pandemic in these variables cannot be accounted for this, however, will be addressed through through future longitudinal analyses to some extent. There are many other variables of importance and interest in the current pandemic in these workers — including levels of stress, locus of control, and

more detailed assessments of attitudes toward government pandemic strategy — that were beyond the scope of the present study. Further, and more detailed, understanding of social support and the quality of frontline workers' relationships with significant others will be of particular interest. The present research was conducted at a time when frontline workers were increasing their weekly working hours, and working in conditions that were increasingly demanding. It was, therefore, of ethical importance to ensure that we, the researchers, were able to derive meaningful answers in a time-effective manner.

There is also the issue of sample bias. The present sample, whilst sufficiently large and robust, is not demographically representative of the UK nor RoI, with respect to frontline worker profile or population. Moreover, the two subsamples are not even in size, providing a relative dominance of the UK-based sample in full-sample models. This has been partially addressed by assessing outcomes in country-based models but is nonetheless a limitation that has an impact on the interpretation of the findings. Further work with more diverse samples is warranted in any potential future crises. As part of a larger project, further analyses will be carried out on these and subsequent longitudinal data to explore sectoral and organizational level variables, as well as longer-term consequences of working on the frontline.

CONCLUSION

The present study set out to understand what factors may be associated with the psychological welfare (as determined by resilience, burnout, and wellbeing) in a broad profile of frontline workers, beyond those in healthcare, during the Covid-19 pandemic. Further, we sought to understand whether government policy in dealing with the pandemic may have been associated with these outcomes by comparing frontline workers from the UK and RoI. To this end, we have found that the personal factors of presence of meaning in life, and resilient coping styles are associated with more positive welfare outcomes (i.e., higher resilience, lower burnout, and higher wellbeing), and search for meaning in life inversely associated. We also find that the perception of the timeliness of the government's response to the pandemic appears to be an important factor in these outcomes in the UK-based sample. In stark contrast to the role that governments should be providing, in safeguarding and encouraging the resilience of all its citizens (Jetten et al., 2020), it appears that this has not been the case in the UK, but may well be in the RoI, if at least during the period of time assessed through the present study. Situated in the context of the proportionally higher morbidity and mortality rate that the UK has experienced during the pandemic, the present findings suggest that the welfare, and lower overall wellbeing, of UK frontline workers may also be part of this fallout. These findings offer insights into the correlates of wellbeing, burnout and resilience of frontline workers during the Covid-19 pandemic during the acute phase. This information can be used to plan for future waves of Covid-19 and inevitable future societal disasters where we will again rely on heroic efforts of workers to keep our societies afloat.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are not readily available because the data will be hosted online at OSF after the completion of all publications from the project. Requests to access the datasets should be directed to RS, rsumner@glos.ac.uk.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Natural & Social Sciences Research Ethics Panel at the University of Gloucestershire. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

RS and EK were responsible for the development and implementation of the study protocol, the analysis, and final writing of this report. Both authors contributed to the article and approved the submitted version.

DEDICATION

The COVID-19 pandemic has taken many lives, and will continue to do so. Among those are the lives of frontline workers – named and unnamed – who, for a variety of reasons, unfortunately felt that they had no choice but to take their own lives. This work is dedicated to their memory, to the incredible sacrifices and efforts made by all frontline workers worldwide, and to all those lives lost in the pandemic.

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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.2020.576229/full#supplementary-material

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Self-Perceived Mental Health Status, Digital Activity, and Physical Distancing in the Context of Lockdown Versus Not-in-Lockdown Measures in Italy and Croatia: Cross-Sectional Study in the Early Ascending Phase of the COVID-19 Pandemic in March 2020

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The novelty of the coronavirus disease 2019 (COVID-19) pandemic is that it is occurring in a globalized society enhanced by digital capabilities. Our aim was to analyze the psychological and emotional states of participants in different pandemic-related contexts, with a focus on their digital and physical distancing behaviors. The online survey was applied during the ascending phase of the pandemic in March 2020 in two neighboring EU countries: Italy and Croatia. The study subjects involved four groups, two directly affected by epidemiological measures and two serving as controls—(1) participants from Italy who were in lockdown (Italy group), (2) participants from Croatia who were not in lockdown but who were in direct contact with an infected person and underwent epidemiological measures (CRO-contact group), (3) participants from Croatia who were in an analogous situation but not near the same infected person (CRO-no contact group), and (4) participants from Croatia who were not aware of any infected person (CRO-unrelated group). The survey consisted of validated scales of psychological and emotional states, and custom-made questionnaires on the digital (online) and physical (off-line) behavior of the participants. The Italy group in lockdown had higher self-perceived scores for depression, stress, post-traumatic intrusion, and avoidance, as well as the highest digital activity and physical distancing than the not-in-lockdown Croatian groups. The insight into the extent of online activities and off-line isolation allowed for the introduction of Digital Activity and Physical Distancing Scores. Self-perceived post-traumatic avoidance was higher in both the Italy and CRO-contact groups than the control CRO-no contact and CRO-unrelated groups,

and higher avoidance correlated with higher Digital Activity and Physical Distancing Scores. Being in direct contact with the infected person, the CRO-contact group had no other alterations than unexpectedly lower post-traumatic hyperarousal when compared with the Italy group. The Italy group in lockdown demonstrated higher self-perceived psychological toll together with higher digital activity and physical distancing than Croatian groups not in lockdown, even when compared with the affected CRO-contact group. The study outcomes suggest that the general emergency measures influenced citizens in lockdown more than exposure to the virus through direct contact with an infected person.

Keywords: pandemic (COVID-19), avoidance, intrusion, stress, depression, digital society

INTRODUCTION

Wars, natural disasters, financial crises, terror, or similar damaging situations involving whole countries, regions, or communities affect mental and physical health and leave long-lasting personal and societal consequences. For example, wars in Afghanistan (Scholte et al., 2004) and Iraq (Taylor et al., 2014); earthquakes in Northridge, United States (McMillen et al., 2000) and L'Aquila, Italy (Ciocca et al., 2015); the 9/11 and Paris terrorist attacks (Updegraff et al., 2008; Vandentorren et al., 2018); the financial crisis during 2008 (McInerney et al., 2013); and the Ebola and swine flu pandemics (Jones and Salathé, 2009; Jalloh et al., 2018) all have one thing in common: considerable negative impact on affected communities. These unfortunate events also had notable psychological consequences, related to depression, anxiety, stress, and post-traumatic stress disorder (PTSD) (Beaglehole et al., 2018). According to the stress and coping theory, the extent of the psychological consequences depends on an energized and interchangeable relationship between individuals and their contextual environment (Lazarus and Folkman, 1984).

It is to be assumed that the coronavirus disease 2019 (COVID-19) pandemic would inflict analogous consequences on the psychological and emotional states of affected populations. However, the temporal dynamic of the pandemic, the truly global engagement, and its spread to almost every human community represent a new situation not previously encountered and therefore in need to be analyzed. The first empirical reports on psychological status of the general population due to the COVID-19 pandemic confirmed that levels of anxiety and depression were higher than those reported before the pandemic and that they increase over time (e.g., Gao et al., 2020; Wang et al., 2020). In the United States, the rate of psychological distress during the pandemic has tripled relative to the years before (McGinty et al., 2020). In another study, 35% of 52,000 participants reported psychological distress caused by the emergence of COVID-19 (Qiu et al., 2020). These findings were also demonstrated in the case of past pandemics (Hawryluck et al., 2004; Mihashi et al., 2009; Liu et al., 2012).

The additional important novelty of the current situation is that the citizens' general habits and lifestyle have recently evolved to embrace and apply digital capabilities. By interacting and sharing the variety of contents in the digital environment, the society becomes globally connected and digitally enhanced (Svalastog et al., 2017; Kopilaš and Gajović, 2020). While feeling in danger in the off-line world, citizens currently have the alternative to operate in the online realm. Nevertheless, the digital environment is not free from risks related to mental health. A study conducted in 28 countries by Mertens et al. (2020) showed that frequent social media use and media exposure were associated with higher levels of fear that can then lead to anxiety. Misinformation is quickly distributed throughout the online realm and can cause fear, panic, and anxiety (Garfin et al., 2020). The decreased exposure to the media reports on COVID-19-related information is suggested as a protective factor against development of some psychological symptoms (Moreira and Pinto da Costa, 2020).

In this study, we were interested in the contexts surrounding individuals during the COVID-19 pandemic, and we wanted to contribute to the theoretical debate of how these contexts influenced the pandemic's psychological consequences. As argued above, the contexts of the COVID-19 pandemic are indeed novel as they combine the global pandemic, the imposed society-wide epidemiological measures, and the globally interconnected digital society. Therefore, our aim was to examine the relation of these novel contextual aspects of the COVID-19 pandemic with psychological and emotional status of affected individuals. To reflect this aim, a cross-sectional study during the ascending phase of the pandemic in March 2020 was designed in two neighboring European countries, Croatia and Italy, to get insight into three different contextual aspects of the pandemic—being directly affected by pandemic events, following epidemiological measures, and being digitally active. The first contextual aspect relates to findings from previous pandemics (e.g., SARS) suggest that factors such as level of exposure to infection, direct contact with an infected person, and isolation have negative effects on psychological outcomes (Matsuishi et al., 2012; Lee et al., 2018). Subsequently, we examined exposure to infection by direct contact with an infected person and the general epidemiological measures of the lockdown. Moreover, we separated these two factors into two study groups, one being in direct contact with an infected person but not in lockdown, and another in lockdown but unaware of having any contact with an infected person. These two study groups were compared with the control groups who

were not in lockdown or aware of contact with an infected person. Another analyzed contextual aspect was individual physical isolation and adherence to general epidemiological protective measures, and the third contextual aspect was respondents' digital activity.

Our hypothesis was that the affected groups (individuals in direct contact with an infected person and individuals in lockdown) would report higher levels of psychological and emotional consequences compared with the control groups who were not in direct contact with an infected person or in lockdown. What was a surprising outcome was that the lockdown group reported the highest psychological disturbances, highlighting society-wide epidemiological measures as contextual contributors to the psychological consequences of the pandemic.

MATERIALS AND METHODS

Participants and Procedure

The initiation of the study during the early ascending phase of the pandemic in March 2020 was dependent on the serendipity of having access to a unique group of Croatian Ph.D. students, who attended class (3 hours long) with an infected person identified as the third COVID-19-positive individual in Croatia. The students were notified as first-line contacts by official epidemiologists from the Croatian Institute of Public Health and were asked to avoid social gatherings for 2 weeks, to measure their temperature every day, and in case of symptoms (i.e., cough, sore throat, and fever) to stay home and call their epidemiologist. This Croatian group was henceforth referred in the study as CRO-contact group (n = 27). To provide adequate controls, the CRO-contact group was matched by a group of Ph.D. students at the same institution who were not in contact with the same infected person but were involved at the same time in a similar academic program (hence referred as CRO-no contact group, n = 21). Moreover, as an additional control, an unrelated group of students from a different institution was included, which had no knowledge of the possible COVID-19-infected students (CRO-unrelated group, n = 43). Finally, the study included an additional affected group, referred as Italy group (n = 72), which consisted of participants from Italy. Italy, at that moment in March 2020, had just entered a lockdown phase due to the ascending pandemic as the first European country that reported COVID-19 in its territory. The Italy group was recruited using convenient sampling from Trento and Bologna regions in North Italy affected by the pandemic outbreak, however, less than the Lombardy province, which was the most affected. As the whole study used email to contact the respondents, the Italy group was composed of contacts of one of the authors (LM), who were assumed to have similar education levels as the Croatian groups and being proficient in the use of the English language. Although the Croatian groups were recruited from student population (Ph.D.), these programs involve very heterogeneous attendees in regard to their age and status. Nevertheless, none of the groups were considered to be representative of the whole populations (Italians or Croatians).

A cross-sectional online study was implemented between March 4 and March 24, 2020. The online questionnaire was administered in English through the Qualtrics online survey software system (Qualtrics, Provo, United States). All participants received an invitation to participate with a link to the questionnaire sent to their email address. Participants had access to the questionnaires after they confirmed they had read the informed consent and agreed to participate in the study. In addition, all participants confirmed that they are 18 years or older and that they speak English. Participation in this study was completely voluntary, and participants did not receive any monetary compensation. The study was approved by the University of Zagreb School of Medicine Ethics Committee.

All participants, except the CRO-contact group, reported that they had not undergone testing for COVID-19, nor were they, to their knowledge, in contact with any COVID-19-infected person. A total of 231 persons were invited to participate in the online survey, and 164 individuals responded (**Table 1**). On the day when the participants entered the study, Italy had 31,506 infected persons and 2,503 deaths due to COVID-19, while Croatia had 10 infected persons and no deaths (Worldometers, 2020). During the period when the study groups were examined, the Italy participants were already in lockdown, whereas the Croatia participants were not. The lockdown in Croatia and the other stressful event, the March series of earthquakes (up to 5.5 M_L) (Croatian Seismological Service, 2020), both occurred after the study was completed.

Measures

The differences between the four analyzed groups (CRO-contact, CRO-no contact, CRO-unrelated, and Italy) were assessed by an online questionnaire that included the following subsections: demographic information (gender, age, and education), validated measures of psychological and emotional states, two sets of questions developed by the authors to assess digital and physical activities, and an open response question for additional comments.

The included validated measures covered a depth of psychological and emotional states of interest (depression, anxiety, stress, PTSD, positive and negative affect, and loneliness) and have been used in previous studies to examine people's psychological and emotional states after stressful and potentially traumatic situations (Wang et al., 2020). The other part of the questionnaire was aimed to assess participants' digital (online) and physical (off-line) activities during the preceding week.

Measures of Psychological and Emotional States

We used the English version of validated scales and questionnaires to measure psychological and emotional states. These online and self-reported tools included the following: the Depression Anxiety Stress Scale-21 (DASS-21; Lovibond and Lovibond, 1995), Impact of Event Scale-Revised (IES-R; Weiss and Marmar, 1997), the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988), and the UCLA Loneliness Scale (ULS; Russell et al., 1978).

The Cronbach's alpha was calculated to be representative of our samples. DASS-21 is a 21-item measure of self-reported symptoms of depression, anxiety, and stress over the past week. The seven-item depression scale (α = 0.92–0.96) covers

TABLE 1 | Participant response rate and questionnaire answering.

	Italy	CRO-contact	CRO-no contact	CRO-unrelated	Total
Contacted	100	41	35	55	231
Responded	72	28	21	43	164
Response rate (Responded/contacted*100%)	72.00%	68.29%	60.00%	78.18%	71.00%
Fully completed (% of responded)	58 (81%)	18 (64%)	16 (76%)	32 (74%)	124 (76%)
Partially completed (% of responded)	14 (19%)	9 (32%)	5 (24%)	11 (26%)	39 (24%)
No-consent (% of responded)	0 (0%)	1 (4%)	0 (0%)	0 (0%)	1 (0.06%)
Outliers (% of responded)	7 (10%)	2 (7%)	2 (10%)	3 (7%)	14 (9%)

hopelessness (e.g., "I felt that I had nothing to look forward to"), dysphoria (e.g., "I felt down-hearted and blue"), and anhedonia (e.g., "I couldn't seem to experience any positive feeling at all"). The seven-item anxiety scale (α = 0.87–0.88) addresses situational anxiety (e.g., "I was worried about situations in which I might panic and make a fool of myself") and autonomic arousal (e.g., "I experienced breathing difficulty"). The seven-item stress scale (α = 0.90–0.94) covers nervous arousal (e.g., "I felt scared without any good reason") and difficulty relaxing (e.g., "I found it difficult to relax"). DASS-21 is rated using a 5-point scale (0 = very slightly or not at all to 4 = extremely). IES-R includes 22 items assessing subjective responses to a specific traumatic event during the past week. IES-R has three subscales: eight-item intrusion (α = 0.78–0.84) (e.g., "I had dreams about it"), eight-item avoidance (α = 0.78–0.91) (e.g., "I tried not to think about it"), and six-item hyperarousal (α = 0.71–0.90) (e.g., "I felt watchful and on-guard"). IES-R items were rated on a 0 (not at all) to 4 (extremely) scale (Weiss, 2004). PANAS is a 20-item questionnaire where 10 items measure positive affect (α = 0.87–0.92) (e.g., "Proud" "Inspired") and 10 items measure negative affect (α = 0.82–0.93) (e.g., "Distressed" "Afraid") over the preceding week. Participants rated the PANAS on a 1 (very slightly or not at all) to 5 (extremely) scale. ULS (α = 0.90–0.94) is a 20-item self-report measure of subjective loneliness (e.g., "I lack companionship") and social isolation (e.g., "I am no longer close to anyone") rated on a 4-point scale (0 = I never feel this way to 3 = I often feel this way).

Measures of Digital Activities

Our research team prepared 10 questions focusing on daily digital activities of participants (**Supplementary Table 1**). Participants rated the frequency of their daily digital activities on a 1 (very slightly or not at all) to 5 (extremely) scale. To describe the overall digital activity of the respondents by a single number, we have introduced here a novel Digital Activity Score by summing the responses on all 10 items, with higher scores indicating greater digital activity use. The Digital Activity Score demonstrated good internal consistency for this sample (α = 0.85).

Measures of Physical Activities

Similar to digital activities, 10 questions were prepared to explore the frequency of participants' daily physical activities (**Supplementary Table 2**). Participants rated the frequency of their daily physical activities on a 1 (never) to 4 (every day) scale. Four of the 10 questions referred to activities related to individual health that may have otherwise been uncommon practices before the COVID-19 pandemic, such as "call your epidemiologist" and "measure your temperature." Six of the 10 items referred to the extent to which individuals engaged in physical interactions with other people (e.g., go to work and spend more than 15 min in direct contact with someone). To describe the overall physical distancing of the respondents by a single number, we introduced a novel Physical Distancing Score, which was calculated by summing the six physical interaction items (**Supplementary Table 2**, items *a–f*). All items were reverse coded, with the exception of one ["Isolate yourself from others (not being in direct contact with someone)"]. A higher Physical Distancing Score indicated greater physical isolation. The six items selected for the Physical Distancing Score demonstrated adequate internal consistency for this sample (α = 0.73), whereas all 10 items of physical activities were less reliable (α = 0.44).

Participants' Feelings and Experiences Related to Coronavirus Disease 2019

At the end of the questionnaire, there was an open-ended question on feelings and experiences related to the COVID-19 pandemic: "We would greatly appreciate if you would share some of your feelings and experiences related to finding out about the COVID-19 pandemic."

Statistical Analysis

Data were screened for outliers prior to data analysis. Data from 14 participants (CRO-contact = 2; CRO-no contact = 2; CRO-unrelated = 3; and Italy = 7) were removed because their values were three or more standard deviations from the mean on validated measures of psychological and emotional states. All data were analyzed using IBM SPSS Statistics for Macintosh (Version 23). All multiple comparisons were corrected using the Benjamini–Hochberg procedure to control for false discovery rate (Benjamini and Hochberg, 1995). Significance was set at $p < 0.05$ for all analyses.

Assumption testing was first conducted in order to use multivariate analysis of covariance (MANCOVA) to test our hypothesis of examining group differences on measures of depression, anxiety, stress, PTSD, negative and positive affect, and loneliness, controlling for age and gender. Mahalanobis distance of the nine dependent variables (DASS-21 Depression, DASS-21 Anxiety, DASS-21 Stress, IES-R Intrusion, IES-R Hyperarousal, IES-R Avoidance, PANAS Positive, PANAS Negative, and ULS) was 26.93. Therefore, multivariate normality was assumed

since this was less than the critical value of the chi-square (27.88). Univariate normality assumption was violated; therefore, Pillai's Trace test was used to interpret the MANCOVA results. Homogeneity of regression assumption was met, as all interactions between the independent variables and covariates were not significant (all p's > 0.05). Pearson's r correlation was used to test the assumption of no multicollinearity, and the dependent variables were moderately correlated. One-way MANCOVA was conducted with group as the independent variable, the nine scales of psychological and emotional states as the dependent variables, and age and gender as covariates. Planned contrasts were conducted to examine differences between affected (CRO-contact and Italy) and unaffected (CRO-no contact and CRO-unrelated) groups, Italy (with lockdown measures in place) and Croatia (with no lockdown measures in place), and exposed (CRO-contact) and not exposed (all other groups without contact with an infected person).

To test group differences on the frequency of digital and physical activities, we used the Kruskal–Wallis test. *Post hoc* analyses of pairwise comparisons were done by Mann–Whitney tests. One-way analysis of covariance (ANCOVA) was conducted to examine group differences on Digital Activity Scores and Physical Distancing Scores, controlling for age and gender. Pearson's r correlation analyses were used to examine correlations among psychological measures, digital activities, and physical distancing.

To analyze the open-ended question, we used ATLAS.ti (ATLAS.ti Scientific Software Development GmbH, Berlin, Germany) for qualitative data analysis. The participants' comments were coded into positive, negative, and neutral categories. ATLAS.ti keyword search feature was used to find the frequencies of the most commonly used words.

RESULTS

Response Rate and Demographic Characteristics

Seventy-one percent (164/231) of participants who were contacted via email responded to the survey, of whom 75.6% (124/164) fully completed the survey (**Table 1**). Participants were mostly females (69.3%), and the mean age was 37.27 years (SD = 13.60) (**Supplementary Table 3**). Age differed significantly among the groups ($p < 0.001$). The median completion time for the study was 11.26 minutes [interquartile range (IQR) = 12.87].

Psychological and Emotional States

In order to test if there were group differences on measures of psychological and emotional states, which included depression, anxiety, stress, PTSD, positive and negative affect, and loneliness, a one-way MANCOVA was conducted for each set of measures comparing all four groups, controlling for age and gender. The results of MANCOVA indicated that age was significantly associated with measures of psychological and emotional states [Pillai's Trace = 0.21, $F(9,98) = 2.82$, $p = 0.005$, partial $\eta^2 = 0.21$], but gender was not [Pillai's Trace = 0.08, $F(9,98) = 0.97$, $p = 0.469$, partial $\eta^2 = 0.08$]. In addition, measures of psychological and emotional states differed significantly based on group, after controlling for age and gender, Pillai's Trace = 0.61, $F(27,300) = 2.84$, $p < 0.001$, partial $\eta^2 = 0.20$.

Univariate analyses revealed that younger age was associated with greater depression ($p = 0.023$) and hyperarousal ($p = 0.003$). DASS-21 Depression ($p < 0.001$), DASS-21 Stress ($p < 0.001$), IES-R Intrusion ($p < 0.001$), IES-R Hyperarousal ($p = 0.002$), and IES-R Avoidance ($p = 0.016$) were significantly different among groups (**Table 2**). No group differences were found on measures of anxiety, positive affect, negative affect, and loneliness. Pairwise comparisons showed that compared with the Croatian groups, the Italy group had higher DASS-21 Depression (all p's ≤ 0.002) and Stress (all p's ≤ 0.006) scores (**Figure 1**). Although the statistically significant differences among the groups were demonstrated, none of the groups' mean scores reached levels indicative of psychopathology, all of them being well within the normal range. When impact of event was measured, the Italy group had significantly higher IES-R Intrusion than the Croatian groups (all p's = 0.002), significantly higher IES-R Avoidance than the CRO-no contact and CRO-unrelated groups (both p's = 0.012), and significantly higher IES-R Hyperarousal scores than CRO-contact ($p < 0.001$) (**Supplementary Table 4**).

Affected Versus Unaffected

The univariate analysis was complemented by planned contrasts for three comparisons—affected versus unaffected groups (i.e., Italy and CRO-contact vs. CRO-no contact and CRO-unrelated), lockdown versus not-in-lockdown (i.e., Italy group vs. three Croatian groups), and exposed versus not exposed (i.e., CRO-contact vs. Italy, CRO-no contact, and CRO-unrelated) (**Table 3**). Interestingly, while univariate analyses revealed significant group differences in the IES-R Intrusion, Hyperarousal, and Avoidance subscales, comparisons of affected groups (CRO-contact and Italy) compared with unaffected groups (CRO-no contact and CRO-unrelated) showed only a difference in IES-R Avoidance ($p = 0.009$), with the affected groups scoring higher than the unaffected groups. All other psychological measures were not significantly different between affected and unaffected groups.

Lockdown Versus Not-in-Lockdown

The lockdown (Italy group) and not-in-lockdown (Croatian groups) contrast revealed that the Italy group had significantly higher scores in DASS-21 Depression ($p < 0.001$), DASS-21 Stress ($p < 0.001$), IES-R Avoidance ($p = 0.014$), and IES-R Intrusion ($p < 0.001$) than the three Croatian groups taken together.

Exposed Versus Not Exposed

The groups exposed (CRO-contact) and not exposed (Italy, CRO-no contact, and CRO-unrelated) to the virus by a direct contact with the infected person contrast showed that the CRO-contact group had significantly lower scores in IES-R Hyperarousal ($p < 0.001$) than the not exposed groups.

Digital Activities

Frequency analyses revealed that the majority of the respondents used digital means of communication more during the week before taking the survey than compared with their previous

TABLE 2 | One-way MANCOVA univariate effects for group on measures of psychological and emotional states, controlling for gender and age.

Dependent variable	*F*	Partial η^2	Group	M (SD)	95% confidence interval	
					Lower bound	Upper bound
DASS-21 Depression	9.19***	0.21	Italy	2.53 (2.41)	2.24	3.46
			CRO-contact	0.56 (1.55)	−0.29	1.66
			CRO-no contact	0.29 (0.73)	−0.95	1.51
			CRO-unrelated	1.31 (1.71)	−0.14	1.62
DASS-21 Anxiety	2.31	0.06	Italy	0.89 (1.28)	0.59	1.37
			CRO-contact	0.75 (1.06)	0.11	1.35
			CRO-no contact	0.14 (0.36)	−0.57	0.77
			CRO-unrelated	1.24 (1.57)	0.55	1.70
DASS-21 Stress	7.44***	0.17	Italy	3.21 (2.54)	2.89	4.30
			CRO-contact	1.44 (2.37)	0.36	2.62
			CRO-no contact	0.79 (1.58)	−0.63	1.80
			CRO-unrelated	2.14 (2.05)	0.48	2.51
IES-R Intrusion	7.16***	0.17	Italy	0.81 (0.51)	0.73	1.01
			CRO-contact	0.39 (0.35)	0.17	0.62
			CRO-no contact	0.41 (0.31)	0.14	0.62
			CRO-unrelated	0.46 (0.45)	0.16	0.57
IES-R Hyperarousal	6.12**	0.15	Italy	0.85 (0.56)	0.84	1.17
			CRO-contact	0.31 (0.35)	0.07	0.61
			CRO-no contact	0.73 (0.71)	0.36	0.94
			CRO-unrelated	1.02 (0.63)	0.51	1.00
IES-R Avoidance	4.02**	0.10	Italy	0.70 (0.56)	0.59	0.91
			CRO-contact	0.55 (0.64)	0.28	0.79
			CRO-no contact	0.29 (0.28)	−0.01	0.54
			CRO-unrelated	0.36 (0.43)	0.05	0.51
PANAS Positive	0.91	0.03	Italy	27.25 (7.50)	24.83	29.52
			CRO-contact	23.94 (7.14)	20.12	27.61
			CRO-no contact	27.07 (8.16)	23.10	31.15
			CRO-unrelated	27.24 (7.11)	24.01	30.78
PANAS Negative	2.65	0.07	Italy	17.98 (5.50)	17.31	21.07
			CRO-contact	20.75 (8.68)	18.01	24.02
			CRO-no contact	16.57 (6.27)	12.70	19.15
			CRO-unrelated	17.86 (5.57)	13.11	18.53
ULS	2.73	0.07	Italy	13.42 (8.94)	11.83	17.30
			CRO-contact	11.19 (8.98)	7.17	15.91
			CRO-no contact	8.57 (10.02)	3.25	12.64
			CRO-unrelated	17.10 (7.76)	11.83	19.07

M, mean; SD, standard deviation; DASS-21, Depression Anxiety Stress Scale-21; IES-R, Impact of Event Scale-Revised; PANAS, Positive Affect Negative Affect Schedule; ULS, UCLA Loneliness Scale; MANCOVA, multivariate analysis of covariance.
$^{**}p \leq 0.01$; $^{***}p \leq 0.001$.

behavior (**Supplementary Table 5**). This included the use of cell phones (90% used them at least moderately more than usual), computers (84%), and web browsing (86%). A quarter of the respondents declared that they used digital tools "extremely" (25% in terms of phone and computer usage and 23% for web browsing).

In relation to social media activity, 74% of respondents accessed them at least "a little," with almost a half of them being active as producers and network creators (48% of total participants made their own posts or commented on others' posts, and 42% added new friends). The CRO-unrelated group, being the youngest of all the groups, was a leader in passive access to the content (31% extremely scrolled through social media). Yet this was not reflected by their active content production, where they were similar to other groups (**Supplementary Table 5**).

The Italy group was the most pronounced in digital activities (38% extremely used computer and 31% extremely browsed the web), followed by the CRO-contact group (e.g., 22% extremely browsed the web). Furthermore, more than a fifth of the Italy group reported "extremely" in the case of actively seeking out more information on the Internet (22%) and communicating through email (21%).

Among Croatian groups, when asked specifically about browsing news websites, 22% of the CRO-contact group reported

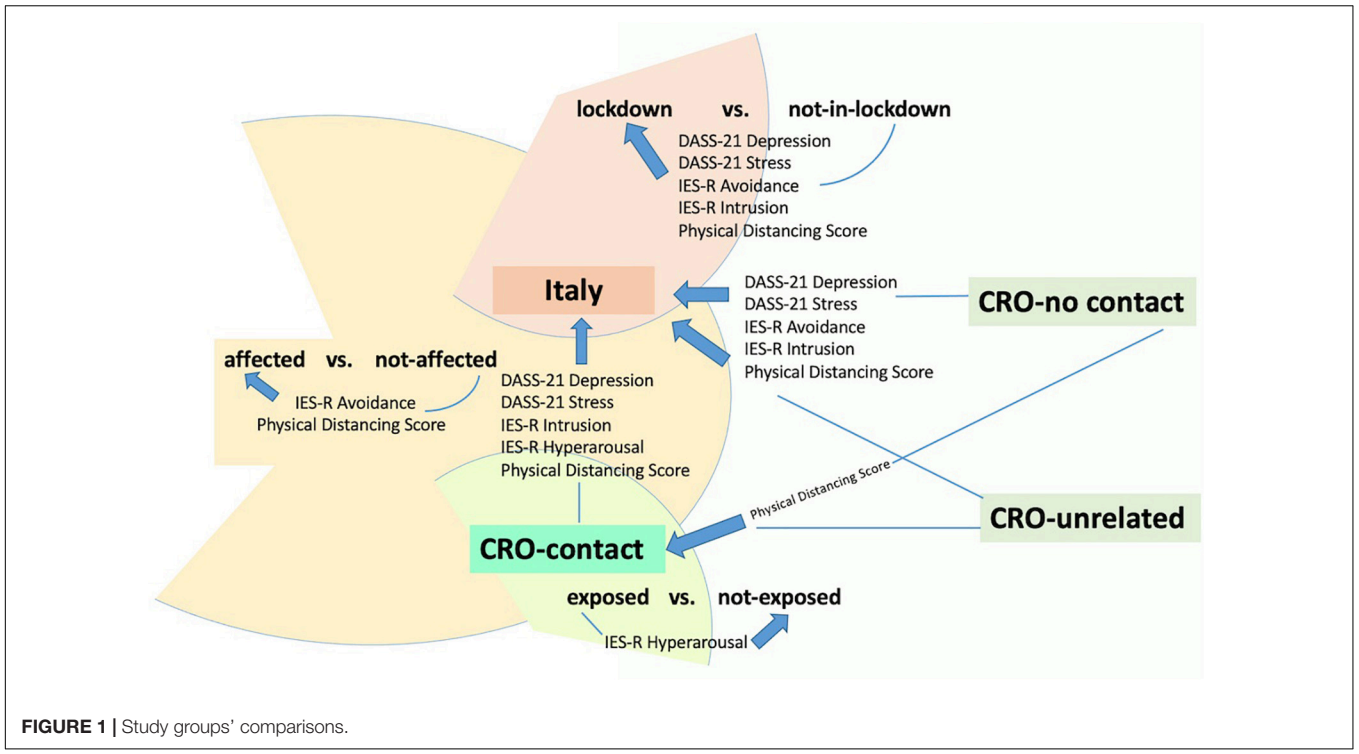

FIGURE 1 | Study groups' comparisons.

TABLE 3 | Planned contrast results for affected versus unaffected, lockdown versus not-in-lockdown, and exposed versus not exposed on measures of psychological and emotional states.

	Affected vs. unaffected			Lockdown vs. not in lockdown			Exposed vs. not exposed		
	Italy CRO-contact	CRO-no contact CRO-unrelated		Italy	CRO-contact CRO-no contact CRO-unrelated		CRO-contact	Italy CRO-no contact CRO-unrelated	
	M (SD)	*M* (SD)	*p*-value	*M* (SD)	*M* (SD)	*p*-value	*M* (SD)	*M* (SD)	*p*-value
DASS-21 Depression	2.07 (2.38)	0.98 (1.54)	0.060	**2.53 (2.41)**	**0.86 (1.54)**	**<0.001**	0.56 (1.55)	1.83 (2.19)	0.268
DASS-21 Anxiety	0.86 (1.20)	0.88 (1.40)	0.641	0.89 (1.25)	0.85 (1.31)	0.607	0.75 (1.06)	0.88 (1.31)	0.981
DASS-21 Stress	2.80 (1.70)	1.70 (1.99)	0.106	**3.21 (2.54)**	**1.63 (2.08)**	**<0.001**	1.44 (2.37)	2.53 (2.42)	0.449
IES-R Intrusion	0.71 (0.51)	0.44 (0.41)	0.060	**0.81 (0.51)**	**0.43 (0.39)**	**<0.001**	0.41 (0.35)	0.64 (0.50)	0.268
IES-R Hyper-arousal	0.74 (0.56)	0.95 (0.86)	0.083	0.86 (0.56)	0.79 (0.66)	0.277	**0.37 (0.39)**	**0.90 (0.62)**	**<0.001**
IES-R Avoidance	**0.68 (0.58)**	**0.34 (0.38)**	**0.009**	**0.70 (0.56)**	**0.42 (0.48)**	**0.014**	0.63 (0.65)	0.53 (0.51)	0.386
PANAS Positive	26.48 (7.50)	27.19 (7.37)	0.444	27.25 (7.50)	26.31 (7.39)	0.607	23.94 (7.14)	27.22 (7.41)	0.268
PANAS Negative	18.62 (6.42)	17.44 (5.76)	0.246	17.98 (5.50)	18.34 (6.76)	0.739	20.75 (8.68)	17.74 (5.60)	0.302
ULS	12.89 (8.80)	14.88 (9.76)	0.743	13.26 (8.80)	13.99 (9.58)	0.739	11.68 (8.94)	13.98 (9.23)	0.596

Significant values bolded. M, mean; SD, standard deviation; DASS-21, Depression Anxiety Stress Scale-21; IES-R, Impact of Event Scale-Revised; PANAS, positive affect negative affect schedule; ULS, UCLA Loneliness Scale.

it as "extremely," while just the opposite 25% of the CRO-unrelated group did it "very slightly or not at all." The CRO-unrelated group in the same way "very slightly or not at all" actively sought out more information on the Internet (28%) and communicated through email (25%).

We tested if there would be group differences on frequency of digital activities. There was a statistically significant difference among groups in relation to computer use [$H(3) = 18.52$, $p < 0.001$], actively seeking out more information via the Internet [$H(3) = 9.91$, $p = 0.019$], and communication through email [$H(3) = 17.13$, $p = 0.001$]. Cell phone use [$H(3) = 0.50$, $p = 0.92$], browsing the web [$H(3) = 7.78$, $p = 0.051$], browsing news websites [$H(3) = 6.21$, $p = 0.102$], scrolling through social media [$H(3) = 4.76$, $p = 0.191$], adding new friends [$H(3) = 7.82$, $p = 0.05$], making own social media posts [$H(3) = 2.06$, $p = 0.56$], and commenting on other people's posts [$H(3) = 2.09$, $p = 0.553$] did not significantly differ by group.

Post hoc pairwise comparisons revealed that there were no group differences between all Croatian groups (CRO-contact, CRO-no contact, and CRO-unrelated; all p's > 0.05). The Italy

group used their computers more than the CRO-unrelated ($p < 0.001$) and CRO-no contact ($p = 0.027$) groups, as well as actively sought more information via the Internet ($p = 0.03$) and communicated through email more frequently ($p < 0.001$) than the CRO-unrelated group (**Supplementary Table 5**).

Digital Activity Score

We tested if there were differences among the groups in Digital Activity Score, controlling for gender and age. A one-way ANCOVA indicated that there were no significant differences between gender [$F(1,105) = 0.25$, $p = 0.616$, partial $\eta^2 = 0.002$], age [$F(1,105) = 0.07$, $p = 0.790$, partial $\eta^2 = 0.001$], and groups [$F(3,105) = 1.29$, $p = 0.282$, partial $\eta^2 = 0.04$] on Digital Activity Scores (**Table 4**). Moreover, planned contrasts showed no differences between affected (CRO-contact and Italy) and unaffected (CRO-no contact and CRO-unrelated) groups ($p = 0.106$), and lockdown Italy group and not-in-lockdown Croatian groups ($p = 0.100$), as well as between CRO-contact (exposed to COVID-19) and not exposed groups ($p = 0.599$) (**Table 5**).

Physical Interactions

To get insight in everyday activities and compliance to epidemiological measures due to the pandemic, the custom-made questionnaire was created and analyzed (**Supplementary Tables 2, 6**). The two study groups were under epidemiological measures, the Italy group was in lockdown during the duration of this study, and the CRO-contact group was advised by official epidemiologists to assume self-isolation measures. Despite receiving instructions from epidemiologists, 61% of the CRO-contact respondents declared they went to work every day, and almost everybody (94%) went to the grocery store at least once (**Supplementary Table 6**). However, in terms of how they perceived isolation, one fifth of them (22%) declared that they actively isolated themselves, more than half of whom (67%) were still in contact with their family members.

The Italy group, which was involved in the lockdown measures, was more watchful than all Croatian groups, leading in almost all aspects of physical distancing. Quite the opposite to CRO-contact, where 61% went to work every day, 62% of the Italy group did not go to work at all. Interestingly, the Italy group exercised more than the other groups (72% exercised at least once), even though they were the oldest among the groups.

The CRO-contact group measured their temperature more frequently than others, as a recommended precaution to check if infected. The majority of participants from all groups did not consult medical professionals; however, 14 (12%) respondents did contact their physician, and four (22%) respondents from CRO-contact group contacted the epidemiologist (most likely the one who prescribed them the isolation measures).

There was a statistically significant difference between groups in going to the grocery store [$H(3) = 24.09$, $p < 0.001$], going to work [$H(3) = 36.87$, $p < 0.001$], measuring temperature [$H(3) = 22.38$, $p < 0.001$], calling epidemiologist [$H(3) = 24.14$, $p < 0.001$], visiting social gatherings [$H(3) = 51.32$, $p < 0.001$], spending more than 15 min in direct contact with someone [$H(3) = 19.05$, $p < 0.001$], and isolating self from others [$H(3) = 21.06$, $p < 0.001$].

Mann–Whitney *post hoc* analyses of pairwise comparisons indicated the differences between groups. The Italy group led in applying the isolation measures: they went to the grocery store fewer times, spent less time at work, and spent less time in social gatherings than each Croatian group (all p's ≤ 0.008). The Italy group spent less than 15 minutes in direct contact with others more frequently than CRO-unrelated ($p < 0.001$) and isolated themselves more than CRO-no contact and CRO-unrelated ($p < 0.001$, $p = 0.003$, respectively). Interestingly, the Italy group exercised more than CRO-contact ($p = 0.042$).

Although CRO-contact group did not fully comply with the epidemiological recommendations, its members measured their temperatures more than the other three groups (all p's ≤ 0.002), called their epidemiologists more than CRO-unrelated and Italy ($p = 0.018$, $p < 0.001$, respectively), and isolated themselves more than the other Croatian groups, CRO-no contact ($p = 0.01$) and CRO-unrelated ($p = 0.037$). CRO-contact spent less time in social gatherings ($p = 0.008$) and less time in direct contact with someone for 15 min or greater ($p < 0.001$) than CRO-unrelated. As expected, no group differences were found between CRO-no contact and CRO-unrelated on frequencies of physical activities (**Supplementary Table 6**).

Physical Distancing Score

When testing differences in Physical Distancing Score, the one-way ANCOVA revealed significant group differences [$F(3,105) = 15.11$, $p < 0.001$, partial $\eta^2 = 0.30$] (**Table 4**). The covariates of gender [$F(1,105) = 0.65$, $p = 0.423$, partial $\eta^2 = 0.01$] and age [$F(1,105) = 0.17$, $p = 0.680$, partial $\eta^2 = 0.002$] were not significantly associated with Physical Distancing Score. Pairwise comparisons revealed that CRO-contact had higher Physical Distancing Score than CRO-no contact ($p = 0.004$) and CRO-unrelated ($p = 0.013$). Similarly, Italy had significantly higher Physical Distancing Score than CRO-no contact and CRO-unrelated (both p's < 0.001), as well as CRO-contact ($p = 0.013$). When these two affected groups were combined in a planned contrast versus unaffected (CRO-no contact and CRO-unrelated) groups, the affected groups had a significantly higher score ($p < 0.001$). Moreover, when the Italy group in lockdown was compared with not-in-lockdown Croatian groups, they had a significantly higher score than all Croatian groups together ($p < 0.001$). No significant difference was found between the exposed (CRO-contact) and not exposed (all other) groups ($p = 0.280$) (**Table 5**).

Correlation Analyses

In order to test if there was a correlation between individual behavior (digital/online and physical/off-line) and psychological and emotional states, we performed Pearson's r correlation test with these parameters. To measure for digital and physical activities, we used the Digital Activity and Physical Distancing Scores introduced by this study as they were shown to have appropriate internal consistency by their α-values.

There was a significant positive correlation between the two newly introduced scores, Digital Activity and Physical Distancing

TABLE 4 | One-way ANCOVA univariate effects for group on digital activity and physical distancing scores, controlling for gender and age.

Dependent variable	*F*	Partial η^2	Group	*M* (SD)	95% confidence interval	
					Lower bound	Upper bound
Digital Activity Score	1.77	0.05	Italy	30.50 (7.36)	27.25	30.37
			CRO-contact	29.62 (7.47)		
			CRO-no contact	28.43 (5.89)		
			CRO-unrelated	26.69 (8.41)		
Physical Distancing Score	27.92***	0.44	Italy	14.73 (2.67)	10.17	11.43
			CRO-contact	11.81 (4.72)		
			CRO-no contact	8.29 (1.64)		
			CRO-unrelated	8.90 (2.58)		

M, mean; SD, standard deviation; ANCOVA, analysis of covariance.
****$p \leq 0.001$.*

TABLE 5 | Planned contrast results for affected versus unaffected, lockdown versus not-in-lockdown, and exposed versus not exposed on digital activity score and physical distancing score.

	Affected vs. unaffected			Lockdown vs. not in lockdown			Exposed vs. not exposed		
	Italy CRO-contact	CRO-no contact CRO-unrelated		Italy	CRO-contact CRO-no contact CRO-unrelated		CRO-contact	Italy CRO-no contact CRO-unrelated	
	M (SD)	*M* (SD)	*p*-value	*M* (SD)	*M* (SD)	*p*-value	*M* (SD)	*M* (SD)	*p*-value
Digital Activity Score	30.29 (6.97)	27.26 (7.66)	0.106	30.50 (6.87)	27.90 (7.62)	0.100	29.63 (7.47)	29.03 (7.38)	0.599
Physical Distancing Score	**13.65 (3.38)**	**8.70 (2.31)**	**<0.001**	**14.21 (2.67)**	**9.54 (3.41)**	**<0.001**	11.81 (4.72)	11.72 (3.72)	0.280

Significant values bolded. M, mean; SD, standard deviation.

Scores [$r(122) = 0.32$, $p < 0.001$], indicating that individuals who implemented more physical distancing measures increased their digital activity as well. Among the nine sets of psychological measures tested, if they correlate with Digital Activity and Physical Distancing Scores, IES-R Intrusion and Avoidance were correlated with both scores (**Table 6**). Higher scores on the PANAS Positive scale were positively correlated with higher engagement in digital activities (**Table 6**).

Participants' Feelings and Experiences Related to the Coronavirus Disease 2019

Fifty-four participants provided a response to the open-ended question: "We would greatly appreciate if you would share some of your feelings and experiences related to finding out about the COVID-19 pandemic." Frequency analyses showed that the majority of the comments were coded as negative ($n = 30$), 16 comments were coded as positive, and eight were neutral (**Supplementary Table 7**). The unaffected groups (CRO-no contact and CRO-unrelated) were more willing to provide responses describing their pandemic-related thoughts (60%; 29/48), of which were predominantly negative (60%, 18/30), than were the affected groups (33%; 25/76). There were no particular differences among groups apart from the unexpected outcome of the Italy group, which although showing the highest psychological scores, had the closest positive (8) to negative (9) comment ratio out of all groups.

Comment classification of negative, positive, or neutral was determined in relation to the current pandemic situation. Some respondents expressed concern and fears regarding the COVID-19 pandemic and its danger to our health. However, others expressed frustration about the COVID-19 "hysteria."

Typical negative comments included features as in the following example: " I am frustrated about the panic it causes

TABLE 6 | Correlation between Digital Activity Score, Physical Distancing Score, and psychological and emotional states.

	Digital activity score	Physical distancing score
	r	*r*
DASS-21 Depression	0.09	0.23
DASS-21 Anxiety	0.20	0.15
DASS-21 Stress	0.20	0.21
IES-R Intrusion	0.32**	0.31**
IES-R Hyperarousal	0.17	0.06
IES-R Avoidance	0.30**	0.33**
PANAS Positive	0.25*	0.03
PANAS Negative	0.17	0.07
ULS	−0.16	−0.02
Digital Activity Score	–	0.30***

r, correlation; DASS-21, Depression Anxiety Stress Scale-21; IES-R, Impact of Event Scale-Revised; PANAS, Positive Affect Negative Affect Schedule; ULS, UCLA Loneliness Scale.
**$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.*

and about the fact everywhere I go—someone is talking about it. I am frustrated because I feel like there are many more disasters and harmful things that are being ignored at this point, making out this virus to be the worst thing that ever happened to humanity—which is not . . .” (CRO-unrelated group).

An example of positive comment is: “We are a large family and have a garden. I think things are incredibly important to me now. I feel very lucky for this and I am aware that others are suffering much more than me and us. Beyond the tragedy we are experiencing, I often make considerations: slowing down was a good experience. We live in a privileged part of the world. We need to invest more in building communities. We have to learn to adapt to what is not predictable, we are not good at this, we take too many things for granted. If at the end of it all we would not have learned some important lessons, then it will not have been worth it” (Italy group).

The most common features of typical neutral comments were covered in the following example: “Every day I am getting more information about it (for instance at my work) so I am not sure what to think about COVID situation anymore” (CRO-unrelated group).

With the use of the keyword search feature, the most frequently used words used here were “people,” “panic,” “media,” “COVID,” and “worried.”

DISCUSSION

The uniqueness of this cross-sectional study is based on the presence of the specific groups allowing to compare tested groups with their controls and in this way introducing the elements of case–control design. The study used a very defined time window when the lockdown measures were introduced in Italy, but just before lockdown measures were subsequently introduced in Croatia. It compared the lockdown versus not-in-lockdown situation of two neighboring countries, both members of the European Union, both during the period of early rise in the numbers of infected persons. Moreover, in the affected group, CRO-contact participants were not in the lockdown (as a population-wide emergency measure); however, they were exposed as first contacts to the infected person at the same university lecture for 3 hours long and subsequently instructed with self-isolation measures by official epidemiologists. The two situations, lockdown-but-no-direct-contact and direct-contact-but-no-lockdown, were compared with the two control groups (CRO-no contact and CRO-unrelated), matched as much as the practical circumstances allowed (**Figure 1**).

The controls were not yet affected by the general emergency measures implemented by the state, nor by the specific measures aimed for the identified contacts of the infected persons. They served as a reference point to analyze the affected groups (CRO-contact and Italy), as they did not differ between each other in any analyzed aspects of the applied online questionnaire and showed “low profile” in the measured scores. Therefore, they were suitable to bring to light the specific changes of the affected groups. However, the control groups were not completely naïve to the pandemic. This was particularly visible in the open-ended survey question about pandemic, where the control groups were more willing to provide responses describing their thoughts, and their responses were predominantly negative.

When affected groups together were compared with the unaffected (control) groups by the set of nine psychological and emotional measures, only one feature—avoidance measured by the IES-R scale—was shown to be significantly higher in the affected groups. Avoidance of the trauma can be singled out as a key psychological consequence for the affected study groups. Due to the above-explained study design including the appropriate controls, the causality can be claimed in this relationship. Subsequently, the context of “being affected” had the consequence of psychological avoidance of the trauma.

Another unique feature of this study was the specific attention given to the digital activities being a novel online feature of the current pandemic, combined by the self-reporting of the individual physical (off-line) activity. These two contextual aspects we could report only as associations to the psychological and emotional measures, without making any conclusion about causal relationships. Interestingly, both contextual aspects were associated with each other. By measuring the digital activity (i.e., the activity in the online environment), we could demonstrate that it correlated with levels of isolation in the off-line environment. Precisely, the newly introduced Digital Activity Score and Physical Distancing Score correlated significantly with each other.

In regard to psychological and emotional states, both scores correlated with IES-R Avoidance. Subsequently, the avoidance as part of traumatic response had been identified again, but from a completely different angle as a psychological feature of the pandemic, using the digital activity and physical isolation as reference points. Moreover, we would like to suggest the triad—isolation, digital activity, and avoidance—which represents a general paradigm for dealing with the traumatic pandemic in the three spheres: off-line, online, and psychological. The avoidance measured by IES-R is shown in multiple studies to be present in traumatic situations (Peng et al., 2020; Wang et al., 2020). According to the *Diagnostic and Statistical Manual of Mental Disorders* (Fifth Edition) (DSM-5), one of the core PTSD symptoms is persistent avoidance of stimuli related to the experienced trauma (American Psychiatric Association (APA), 2013).

An important aspect of the epidemiological measures and recommendations is that citizens have no active tools against the virus, but they are offered passive isolation as a key measure of protection, avoiding the virus in a similar way as it is avoidance as a psychological feature. Presuming that both isolation and avoidance could be qualified as anti-corona measures (in both somatic and psychological sense), the increase of digital activity has allowed for compensation providing socialization while physical distancing. The study outcomes hint that dealing with the pandemic in this way can have a positive effect as the digital activities were associated with positive affect as shown by correlation to the PANAS Positive scale. In addition to IES-R Avoidance, both Digital Activity and Physical Distancing Scores significantly correlated with IES-R Intrusion as well, confirming that online digital activity and off-line isolation were

associated with the traumatic consequences of the COVID-19 pandemic.

Our hypothesis that the affected groups would have higher psychological consequences than the unaffected groups was only partially confirmed, as it surprisingly turned that the two affected groups differed as well between each other. If we would discuss in general the level of likelihood to be infected, the CRO-contact group being in a direct contact with the infected person for considerable time (3 hours long), and at this moment not applying any measures of care like physical distancing or face mask wearing, could be considered to be more exposed to the virus than the Italy group, where the general emergency measures were declared by the state. However, in regard to the analyzed psychological and emotional states, the CRO-contact group did not score higher than the other groups on any of the measures surveyed. Just the opposite, the CRO-contact group surprisingly scored significantly lower on hyperarousal, as an element of traumatic response, than all other groups together. It could be concluded that the CRO-contact group did not show signs of psychological consequences due to direct contact with an infected person. More so, they were paradoxically more relaxed or less aroused regarding the traumatic influences. Suppression coping with the trauma is commonly reported when it comes to traumatic experiences (Thompson and Waltz, 2010; Mary et al., 2020). Some research even suggests that by suppressing unwanted memories, we can reduce their unconscious influence (Gagnepain et al., 2014; Wang et al., 2019).

Opposite to that, the Italy group being in lockdown, but not in direct danger of knowingly being exposed to the virus, scored higher than all other groups on four psychological scales: depression, stress, and trauma-related intrusion and avoidance. Moreover, the Italy group scored the highest in regard to digital activities and physical distancing, the latter statistically significant versus the other groups. Even when compared directly with the CRO-contact group being exposed to the virus, the Italy group scored significantly higher on measures of depression, stress, intrusion, and hyperarousal. It seems that the general emergency measures influencing the complete environment of the Italy group had a way stronger psychological effect than the individual and rather realistic danger of being in contact with the infected person (Lee and You, 2020; Xin et al., 2020). It indicated that we perceive the societal threat in a more traumatic way than the individual dangers, pointing to the importance of socialization to humans (Prime et al., 2020; Wolf et al., 2020). Another factor that could influence our findings was that at this particular moment the number of infected and deceased people was appreciably higher in Italy than in Croatia (Worldometers, 2020).

It should be noted that some measures of psychological and emotional states did not differ among the groups, UCLA scale related to loneliness, PANAS scale for both positive and negative affect, and DASS-21 Anxiety scale. Only psychological differences, but no emotional differences, were shown to differ among the study groups. This, in particular, includes no differences in loneliness, which was indicated by the previous studies to be related to depression, anxiety, and stress (Segrin and Domschke, 2011; Beutel et al., 2017; González-Sanguino et al., 2020). Isolation caused by physical distancing can lead to feelings of loneliness that can negatively impact our mental and physical health over time (Banerjee and Rai, 2020; Groarke et al., 2020). In regard to the absence of significant differences related to loneliness in our study, it could be speculated that the epidemiological isolation was compensated by digital activity.

This study reveals some practical applications worth considering in future research. The digital environment is a novelty that appears as an important contextual aspect in discussing mental health. The digital contents could be helpful in tailoring appropriate interventions, therapies, and prevention strategies in relation to the current pandemic and post-pandemic period. Future research should focus on exploration of sustainability of symptoms over time, and whether phenomena reported in our study are specific for this particular period of early pandemic or they would persist further. Adding to the contextual aspects to be elucidated, since our study was conducted in two neighboring countries, future studies could try to get insight on cross-cultural comparisons, and how cultural differences may play a role on COVID-19 effects.

Limitations of the Study

The current study had several limitations. Although we achieved relatively high response rates, all the answers were self-reported qualifications. Due to the study design and situation specificity, the groups were rather small convenient samples, differed by age, and consisted of more females. The group differences, gender and age, were controlled in the applied statistical analyses, allowing the identification of statistically significant findings. Another limitation was the selection of English measures in non-English-speaking countries, since some of the selected measures have not been translated nor validated in Croatian and/or Italian. Although all participants confirmed proficiency in English prior to the start of the study, and the Cronbach's alpha scores were calculated for our sample, still there may have been differences if the study was conducted in the native languages. All groups could be considered as using the English language frequently in their professional and private lives. Moreover, this allowed to administer exactly the same questionnaire to all participants, and the administration was executed to groups assumed to have appropriate knowledge of English as "lingua franca" of the current society.

Finally, the scores of all four groups were within the normal range of the validated scales. None of the groups met clinical cutoffs for certain psychological diagnoses, but they differed on the severity of normal scores. Similar to that, Wang et al. (2020) reported moderate to severe levels on psychological profiles (DASS-21 and IES-R) of their participants in the early stage of the COVID-19 pandemic.

Conclusion

In conclusion, by using two complementary approaches (applying case–control study design and correlations of the nine dimensions of the psychological and emotional states to digital activity and physical distancing as measured by our newly introduced Digital Activity and Physical Distancing Scores), avoidance could be singled out as the major psychological

consequence of the COVID-19 pandemic on the individual citizens. The observed correlations indicated that avoidance combined with increased digital activity and physical isolation would be part of the behavioral patterns during the pandemic. Moreover, the observed differences between the two affected groups indicated that the psychological response to direct, but individualized threat of infection was considerably lower than the response to collective threat represented by population-wide emergency measures. The study results could be used not only to understand the extent of the psychological toll of the pandemic on the population but as well to inform public health policies necessary to cope with the pandemic and post-pandemic challenges.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the University of Zagreb School of Medicine Ethics Committee. The participants provided their electronic informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

VK, AH, and SG: concept and design, acquisition and interpretation of the data, and drafting the manuscript. VK, AH, LM, GI, LB, and SG: critical revision of the manuscript. AH: statistical analysis. SG: supervision. All authors have read and approved the final 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.2021.621633/full#supplementary-material

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Coping With COVID-19: The Benefits of Anticipating Future Positive Events and Maintaining Optimism

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In early 2020, the COVID-19 pandemic forced a large portion of the world into quarantine, leading to an extensive period of stress making it necessary to explore regulatory techniques that are effective at stimulating long-lasting positive emotion. Previous research has demonstrated that anticipating positive events produces increases in positive emotion during discrete stressors. We hypothesized that state and trait positive anticipation during the COVID-19 pandemic would be associated with increased positive emotions. We assessed how often participants thought about a future positive/negative/neutral event, activity, or goal through a daily reconstruction method that represented a "day in the life" of people in the United States during the early stages of the COVID-19 pandemic. The results of multi-level modeling and mediational analyses demonstrated that higher optimism, one form of trait positive anticipation, was related to higher state positive anticipation, which was in turn related to higher positive emotions during the current episode, which persisted to the next episode. In addition, both optimism and state positive anticipation were related to adaptive responses to the pandemic. These findings suggest that anticipation of future emotional experiences and hopefulness for the future can be a powerful predictor of positive emotions during global pandemics and perhaps other similar chronic stressors.

Keywords: coping, anticipation, optimism, positive emotion, stress, pandemic

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INTRODUCTION

By the beginning of the year 2020, a large portion of the world was forced into quarantine by the spread of the novel COVID-19 virus, which was caused by the Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV2) (Andersen et al., 2020). Long periods of isolation and loneliness have been associated with increased negative emotions (Weiss, 1973), along with higher risk for health issues (Seeman, 2000; Caspi et al., 2006; Thurston and Kubzansky, 2009), hospitalization (Hastings et al., 2008), mortality (Olsen et al., 1991; Eaker et al., 1992; Sugisawa et al., 1994; Penninx et al., 1997; Shiovitz-Ezra and Ayalon, 2010), and decreased cognitive function (Cacioppo and Hawkley, 2009). With the severity of the negative effects of this extensive period of stress, it is vital to explore adaptive regulatory techniques that are effective at stimulating long-lasting positive emotions.

The COVID-19 pandemic was a chronic stressor, one that caused major disruption with no foreseeable end (Elliott and Eisdorfer, 1982). It was unique because it affected almost everyone in the world with a combination of increased minor stressors in daily life and major stressors such as sickness, financial hardship, quarantining, uncertainty, and even death (CDC, 2020). Additionally,

it was a novel social stressor for most of the country, as very few people in the United States had previously experienced this type of social disconnection. This paper explores the benefits of anticipating future positive events and maintaining optimism for individuals coping with the COVID-19 pandemic in the United States during the early stages of the pandemic. State and trait positive anticipation are the focus of this paper because they are hypothesized to be effective strategies during this type of chronic stressor. In addition, although there is ample research on the role of trait positive anticipation/optimism in coping with chronic stress, there is a relative lack of research on the role of state positive anticipation for coping with chronic stress.

Experiences of positive emotion have been associated with increased well-being and improved psychological resources needed for adaptive coping (Fredrickson, 2001). Indeed, resilient responses during a stressor are characterized, in part, by the use of positive emotions (Folkman and Moskowitz, 2000). Additionally, positive emotions have been shown to be adaptive for both everyday stressors (Viney, 1986; Ong et al., 2006) and major life stressors (Fredrickson et al., 2003). Coping strategies that increase positive emotions have been found to be adaptive in treating problems such as anxiety, depression, aggression, and stress related health problems, which can be chronic in nature (Fredrickson, 2000). Daily experiences of positive emotion have been found to predict increased well-being in the months following conjugal loss (Ong et al., 2004). Taken together, it is clear that cultivating positive emotions would be an effective strategy for coping with the major and minor stressors related to the COVID-19 pandemic.

One avenue through which people experience positive emotions is through the anticipation of positive events (Van Boven and Ashworth, 2007). Anticipation involves cognitively simulating a possible future event and has been shown to accurately induce the amount of emotion that would be experienced during the event itself (Waugh et al., 2008), possibly to an even greater extent since it is novel and unanalyzed during the anticipation period (Wilson and Gilbert, 2003). Previous research on discrete stressors have demonstrated that anticipating positive events can produce increases in positive emotion both before the stressor and when recovering from the stressor (Monfort et al., 2015). The authors posited that because the positive events people are reacting to are in the future, they are able to cultivate the positive emotion associated with that anticipation, even during stressful times. This research on state positive anticipation has only focused on discrete stressors so far. However, there is reason to believe that positive anticipation could also aid the regulation of chronic stressors like the COVID-19 pandemic. The COVID-19 pandemic is a chronic stressor characterized by high levels of uncertainty throughout the population, through a variety of ways including: how it will spread, who it will affect, and when it will end (Koffman et al., 2020). Uncertainty has been found to cause increased stress responses experimentally (Miller, 1981), and naturally (Brosschot et al., 2016). When faced with uncertainty, people are naturally motivated to decrease uncertainty by gathering information (Berlyne, 1960) – a problem-focused coping strategy, but when that information is hard to come by or unreliable, they turn to other emotion-focused coping strategies (Miller, 1981). We suggest that positive anticipation is such an emotion-focused strategy that could provide boosts of positive emotion during extended times of uncertainty because it is about simulating possible future experiences and does not necessarily need to be anchored in current uncertain circumstances, such as is the case with the COVID-19 pandemic.

Additional evidence that positive anticipation may be an effective regulatory technique during a chronic stressor stems from the research on trait levels of positive anticipation as reflected by optimism. Individuals high in optimism expect good things to happen to them in the future. Previous research has found that optimism is associated with resilience (Carver et al., 2010) and predicts successful coping with significant life stressors (Scheier et al., 1986; Fredrickson et al., 2003). Optimism is adaptive when coping with uncontrollable events (Nes, 2016) and long-term stressors (Scheier and Carver, 1985). Additionally, previous research has found that individuals high in optimism are more apt to adaptively match coping strategy to the demands of the situation (Nes and Segerstrom, 2006). These individuals also experience decreased illness anxiety (Hirsch et al., 2012), decreased levels of diurnal cortisol (Jobin et al., 2014), and adaptive immune system changes as response to stress (Segerstrom and Sephton, 2010). For chronic stress, optimism has been found to be positively related to acceptance (King et al., 1998), which allows for growth in other domains (Scheier and Carver, 1992). As a form of trait positive anticipation, optimism is hypothesized to be a powerful predictor of positive emotions during the COVID-19 global pandemic.

We also sought to assess whether positive anticipation/emotions impacted some beneficial COVID-related responses. When facing high levels of uncertainty, it's important to maintain motivation to solve issues that may potentially arise. Preserving a positive and optimistic orientation to the stressor can lead to future efforts at effective problem solving (Nezu, 2004). Previous research has shown that effective problem solving reduces the negative effects of stress (Brack et al., 1992; Miner and Dowd, 1996; Cheng, 2001), therefore, we also hypothesize that positive anticipation/emotions will be positively related to people's motivation to deal with COVID-related issues. On the other hand, spending too much time thinking about a stressor with high levels of uncertainty can be problematic as the stressor itself cannot be changed. Repetitive thoughts have been found to predict increased levels of psychological distress (Smith and Alloy, 2009). It has been suggested that positive anticipation promotes successful recovery from stress in part because it replaces negative thoughts about the stressor with positive thoughts about the upcoming event (Tanner et al., 2013; Monfort et al., 2015), therefore we hypothesize that positive anticipation/emotions will be negatively related to thinking about COVID.

In this study, we assessed how often participants thought about a future positive/negative/neutral event, activity, or goal through a daily reconstruction method that represented a "day in the life" of people in the United States during the early stages of the COVID-19 pandemic (late March and April, 2020). We also measured trait positive anticipation (optimism) and

its impact on emotions. The current study is a portion of a parent study that assessed coping strategy use during the early part of the COVID-19 pandemic (Waugh et al., Unpublished data). Although we assessed negative emotions and negative anticipation, positive emotions are prioritized in our hypotheses because of their importance in resilient responses to stressors (Tugade and Fredrickson, 2004).

MATERIALS AND METHODS

Participants

Participants were recruited using Qualtrics' Panels, in which potential participants previously agreed to take part in an online panel for sharing their thoughts and opinions for research. Eligible participants were those that were over 18 years of age and resided in the US. Participants were 55.3% female and 88.4% white (M age = 58.27, SD age = 14.22). Participants were recruited to take part in a parent study (Waugh et al., unpublished data), in which they were asked to complete three surveys approximately a week apart as well as daily diaries. For this paper, we are focusing on trait optimism measured at the initial survey and the daily diary portion of this study, which took place the week after this initial survey. These data and data analyses from this paper are not presented elsewhere. The full presentation of all the surveys and measures can be found elsewhere (Waugh et al., unpublished data). Although the sample size was selected based on power analyses for effects of interest in the parent dataset, the final sample size for this study was greater than that needed (N = 250) to have 87% power to detect a small effect size for time-varying predictors (b = 0.2) in multilevel models when the ICC is set to 0.5 calculated in a simulation with 1,000 replications using the simr package in R (Green and MacLeod, 2015). All data and analysis scripts and surveys from both the parent study and this study are available in a data repository (https://osf.io/znjd4/?view_only=d209143537c84110b45304b77b940b0a).

Due to low retention rates typically experienced with Qualtrics, we recruited enough initial participants (N = 1,499) to ensure that we would have enough participants complete the full study. Participants were invited to complete up to seven daily reconstruction method (DRM: Kahneman et al., 2004) daily diary entries (see below for description). Unfortunately, participants did not complete many of these DRM daily entries with n = 434 completing 1, n = 68 completing 2, n = 16 completing 3, and n = 2 completing 4 (total n = 520). Since only a small percentage of participants completed more than one entry, we decided to analyze the data from each participant's first complete DRM diary entry. This analysis represents a "day in the life" of people during the early stages of the COVID-19 pandemic in the US. After excluding each participant that did not have at least one complete DRM diary entry (reported on at least one episode per time period: morning, afternoon, evening) the final DRM sample size was n = 329.

Materials

Trait Optimism

During the initial survey, participants reported on their trait optimism using the Life Orientation Test (LOT; Scheier and Carver, 1985) on a scale from 1 (strongly disagree) to 5 (strongly agree); $\alpha = 0.92$.

Daily Diary

For the week after the initial survey, participants completed the daily diary entry at the end of each day – sometime after dinner but before bedtime. They were told that we were interested in what they did and how they felt that day. They were asked to reconstruct their day as if they were writing in a diary (Kahneman et al., 2004). Although retrospective, this method has been shown to accurately capture the emotional dynamics of daily life including how emotions at one time point impact emotions at another time point (Waugh et al., 2017). They described what happened for each episode that occurred in the morning, afternoon, and evening (up to 10 for each time frame for a possible total of up to 30) and what time it began and ended. An episode was included in the analyses if there was no more than one missing value for participants' subsequent ratings of that episode (M episodes = 11.2, SD = 5.74).

State Anticipation

For each episode, participants reported on how often during that episode they thought about a future positive/negative/neutral "event, activity, or goal" from 1 (not at all) to 4 (very often). These were single items because participants had to report these anticipatory thoughts on every episode of the day.

State Emotions

Participants rated their emotions during that episode on a 0 (not at all) to 6 (very) scale. They reported on their stress, control (of their feelings), pleasantness (positive emotions), and unpleasantness (negative emotions).

COVID-Related Issues

Participants also rated how often during that episode they thought about the coronavirus from 0 (not at all) to 6 (very) and how motivated they would be to engage in some activity related to dealing with issues caused by the coronavirus pandemic from 1 (not motivated at all) to 4 (very motivated).

Analyses

We first conducted bivariate correlations among trait optimism, mean levels of positive, negative, neutral anticipation as well as mean levels of the emotional outcomes (positive/negative emotions, stress, control) and the COVID-related outcomes (thinking about COVID, motivated to deal with COVID). To adjust for multiple comparisons, we applied the Benjamini-Hochberg correction (Benjamini and Hochberg, 1995) with the number of correlation tests set to 45. We note which findings did not survive multiple comparison correction.

We next conducted exploratory mediation analyses to more fully flesh out possible relationships among optimism, positive/negative anticipation, positive/negative emotions, and the COVID-related variables. We used PROCESS (Hayes, 2013), an SPSS macro, to calculate indirect and direct effects.

TABLE 1 | Descriptives and correlations among the variables of interest.

			Correlations								
	Mean (SD)	**ICC**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1. Optimism	3.6 (0.87)	–	–								
2. Positive anticipation	2.32 (0.88)	0.64	0.159**	–							
3. Neutral anticipation	1.9 (0.71)	0.64	−0.007	0.596**	–						
4. Negative anticipation	1.54 (0.66)	0.60	−0.289**	0.112*	0.497**	–					
5. Positive Emotions	4.11 (1.35)	0.55	0.336**	0.316**	0.110*	−0.229**	–				
6. Negative Emotions	1.38 (1.44)	0.60	−0.335**	−0.014	0.291**	0.737**	−0.367**	–			
7. Stress	1.35 (1.53)	0.62	−0.327**	0.067	0.314**	0.679**	−0.324**	0.899**	–		
8. Control	4.74 (1.35)	0.64	0.313**	0.211**	0.032	−0.308**	0.795**	−0.409**	−0.434**	–	
9. Think about COVID	2.09 (1.53)	0.52	−0.251**	0.099	0.332**	0.591**	−0.249**	0.747**	0.728**	−0.303**	–
10. Motivated to deal with COVID	2.5 (0.87)	0.62	0.253**	0.437**	0.293**	0.009	0.428**	−0.126*	−0.085	0.325**	0.049

***p corrected < 0.05, *p uncorrected <0.05.*

Lastly, we conducted separate multilevel models (MLM; with the R package lme4; Bates et al., 2015) with episode anticipation (positive, neutral, negative) as a person-centered predictor of episode-related positive emotions, negative emotions, stress, control of feelings, thinking about COVID, and motivation to deal with COVID. We first conducted a set of models testing the relationships between **concurrent** anticipation and outcomes (i.e., $anticipation_{e1}$ -> $outcome_{e1}$) to determine whether anticipating a future event affects current outcomes. We next conducted another set of models testing the **lagged** relationships between anticipation at one episode and outcomes at the next episode (i.e., $anticipation_{e1}$ -> $outcome_{e+1}$) to determine whether anticipating a future event affects subsequent outcomes. Lastly, we conducted a set of models testing **lagged with autocorrelation** relationships between anticipation at one episode and outcomes at the next episode controlling for autocorrelations by specifying an AR(2) structure for the error variance-covariance matrix (to account for effects of the prior two episodes) in the MLM models using the R package nlme (Pinheiro et al., 2021). These models test whether anticipation predicts outcomes in subsequent episodes above and beyond the effects of the outcomes from prior episodes. For all of the models, along with person-centered predictors, we also included each person's mean levels of the predictor at Level 1 nested within participant at Level 2. The mean levels of predictors allowed us to differentiate within-participant effects (e.g., concurrent, lagged) of anticipation on outcomes from between-participant effects of anticipation on outcomes. We report only the between-participant effects from the concurrent model because these included all of the outcome reports (vs. lagged when they included n−1 reports) and are therefore most comparable to the between-participant correlations. To adjust for multiple comparisons, we again applied the Benjamini-Hochberg correction with the number of tests set to 18 (3 predictors × 6 outcome variables for each effect of interest). We note which findings did not survive multiple comparison correction. Notably, controlling for age or gender at level 2 did not change any of the findings.

RESULTS

Relationships Among Optimism, Anticipation, and Emotional Outcomes

Correlations

Supporting our hypothesis, trait optimism and state positive anticipation were positively related to positive emotions (**Table 1**). Also consistent with our hypotheses, positive emotions were negatively related to thinking about COVID and positively related to motivation to deal with COVID (which were not correlated with each other).

More generally, trait optimism was related to an overall positive profile – lower state negative anticipation, lower negative emotions and stress, higher control and motivation to deal with COVID and less thinking about COVID (**Table 1**). Positive anticipation was also positively related to control and motivation to deal with COVID. Negative anticipation featured an overall negative profile that was almost exactly opposite to that of trait optimism with the exception that there was not a significant relationship between negative anticipation and motivation to deal with COVID.

Strangely, neutral anticipation was highly correlated with both positive and negative anticipation (which were only mildly related to each other) and therefore exhibited a mixed pattern of relationships with outcomes such as higher positive (uncorrected) and negative emotions/stress and more thinking about COVID but also being motivated to deal with COVID.

Mediations

Positive Anticipation/Emotion

Daily positive anticipation partially mediated the relationship between trait optimism and positive emotion (**Figure 1**). In addition, using both positive anticipation and positive emotion as serial mediators, they partially mediated the relationship between optimism and thinking about COVID and between optimism and motivation to deal with COVID (**Table 2**). Therefore, optimistic people more often anticipated positive events, which in turn led to more daily positive emotions, which in turn led to more beneficial responses to COVID.

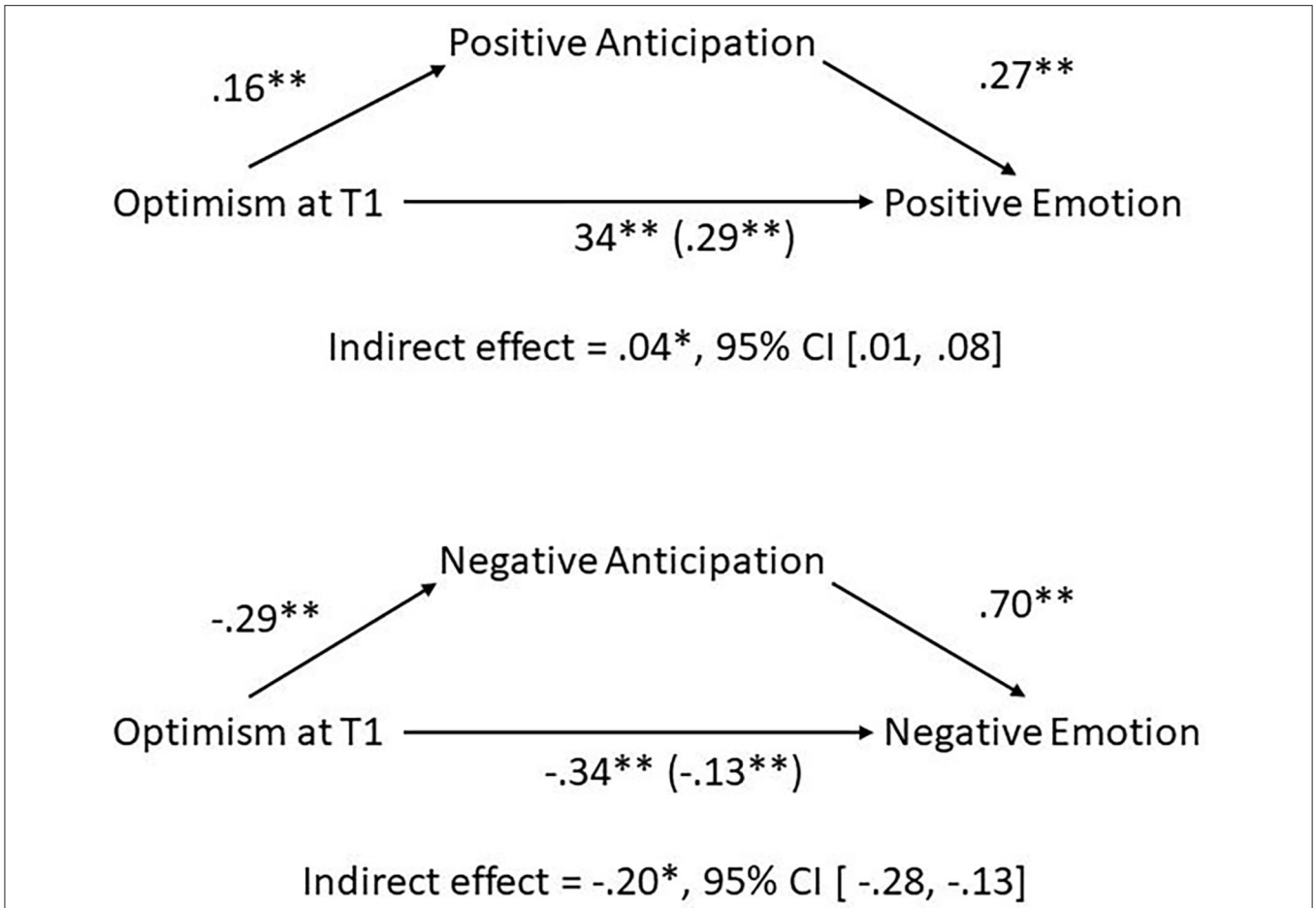

FIGURE 1 | Mediational relationships among trait optimism measured at T1 survey and daily reports of positive/negative anticipation and positive/negative emotions. Effects are standardized. *$p < 0.05$, **$p < 0.01$.

Negative Anticipation/Emotion

Daily negative anticipation partially mediated the relationship between trait optimism and negative emotion (**Figure 1**). Also, as serial mediators, negative anticipation and negative emotions partially mediated the relationship between optimism and motivation to deal with COVID, and fully mediated the relationship between optimism and thinking about COVID (**Table 2**). These findings mirror the ones found above for positive anticipation except that the link between increased trait optimism and decreased thinking about COVID was fully mediated by decreased negative anticipation and negative emotions.

Multilevel Modeling of the Relationships Between Anticipation and Emotional Outcomes

Positive Anticipation

Consistent with hypotheses, positive anticipation was a significant predictor of concurrent levels of higher positive emotion, control, and motivation to deal with COVID as well as lower negative emotion and stress (**Table 3**). Positive anticipation during one episode also predicted higher positive emotions, control and motivation to deal with COVID at the next episode, however it only predicted control during the next episode when accounting for autocorrelations. Positive anticipation was once again unrelated to thinking about COVID.

Negative Anticipation

Negative anticipation exhibited a pattern of relationships that was largely opposite to that of positive anticipation. It was related to lower concurrent positive emotions and control and higher concurrent negative emotions, stress and thinking about COVID. Negative anticipation at the current episode also predicted increased negative emotions, stress, and thinking about COVID at the next episode, however none of these relationships remained when controlling for autocorrelations.

Neutral Anticipation

Similar to the between-subject correlations, there was a mixed pattern of relationships between neutral anticipation and concurrent emotional outcomes in that it was related to higher

TABLE 2 | Mediational models with optimism predicting emotions through anticipation.

Outcome →	Motivated to deal with COVID issues				Think about COVID			
Predictor/Mediators ↓	**Direct effect (SE)**	**95% CI**	**Indirect effect (SE)**	**95% CI**	**Direct effect (SE)**	**95% CI**	**Indirect effect (SE)**	**95% CI**
Optimism	0.10 (0.05)	0.01, 0.20			−0.35 (0.10)	−0.54, −0.16		
➔ Pos Ant			0.05 (0.02)	0.01, 0.10			0.06 (0.03)	0.01,0.11
➔ Pos Emo			0.08 (0.02)	0.05, 0.13			−0.13 (0.04)	−0.21, −0.05
➔ Pos Ant			0.01 (0.01)	0.00, 0.03			−0.02 (0.01)	−0.04, −0.00
➔ Pos Emo								
Optimism	0.25 (0.06)	0.14, 0.36			0.01 (0.07)	−0.13, 0.14		
➔ Neg Ant			−0.07 (0.03)	−0.13, −0.02			−0.05 (0.05)	−0.15, 0.04
➔ Neg Emo			0.03 (0.01)	0.01, 0.06			−0.16 (0.05)	−0.26, −0.07
➔ Neg Ant			0.05 (0.02)	0.01, 0.08			−0.25 (0.06)	−0.38, −0.14
➔ Neg Emo								

Effects are unstandardized. SE, standard error; CI, confidence interval; Ant, anticipation; Pos, positive; Neg, negative; Emo, emotion.

TABLE 3 | Multilevel models of relationship between future thinking and emotional responses during daily diary events.

X↓/Y→	PE	NE	Str	CTL	Think COVID	Motiv COVID
Future positive						
Between-participants	0.08	0.08	0.12*	0.03	0.06	0.23**
Concurrent	0.21**	−0.1**	−0.07**	0.17**	0.02	0.14**
Lagged	0.07**	0	0.01	0.09**	0.03	0.06**
Lagged controlling for autocorrelation	0.05*	0.01	0.01	0.06**	0.3	0.03
Future neutral						
Between-participants	0.05	0.2**	0.23**	−0.07	0.14**	0.18**
Concurrent	0.05**	0.07**	0.06**	0.11**	0.14**	0.06**
Lagged	0.05*	0.03	0.05*	0.05*	0.02	0.05**
Lagged controlling for autocorrelation	0.05*	0.02	0.04*	0.03	0.00	0.03
Future negative						
Between-participants	−0.03	0.33**	0.31**	−0.2**	0.18**	0.01
Concurrent	−0.19**	0.34**	0.3**	−0.07**	0.33**	0
Lagged	0.01	0.08**	0.08**	0	0.06**	−0.01
Lagged controlling for autocorrelation	0.02	0.05*	0.05*	−0.01	0.02	−0.01

*Standardized betas are shown. PE, positive emotion; NE, negative emotion; Str, stress; CTL, control; Motiv, motivation. Between-participants' effects for mean predictors are shown for the model including the concurrent (within-participants) predictor of X on Y, but mean predictors were also controlled for in the other models (lagged, lagged controlling for autocorrelation). **p corrected <0.05, *p uncorrected <0.05.*

levels of all the outcomes. The only lagged relationship that survived correction was that neutral anticipation during one episode predicted increased motivation to deal with COVID at the next episode, however, this relationship did not remain significant (corrected) when controlling for autocorrelations.

DISCUSSION

This study aimed to demonstrate that state and trait positive anticipation are effective at increasing positive emotions during the COVID-19 pandemic. Positive anticipation and optimism were both found to predict increases in positive emotions concurrently. In addition, the more participants engaged in positive anticipatory thinking during one episode, the more they experienced positive emotions at the next episode of their daily lives. Because positive anticipation did not also predict changes in positive emotions from one episode to the next controlling for autocorrelations, this pattern of findings suggests that positive anticipation helps people feel good in the moment and that these current positive emotions may persist to subsequent activities rather than positive anticipation generating subsequent positive emotions unrelated to its effect on current positive emotions. Importantly, the relationships between positive anticipation and positive emotions were strong even though people were in the midst of the COVID-19 pandemic, which extends previous research that anticipating positive events can produce increases in positive emotion to discrete stressors in response to stressors (Monfort et al., 2015) to also include chronic, all-encompassing stressors. Similarly, optimism was found to predict positive emotions during this uncontrollable and persistent stressor which supports previous research on optimism (Scheier and Carver, 1985; Nes, 2016), and this relationship was partially mediated by positive anticipation throughout the day. This finding supports the idea that optimism works as a trait-level predictor of positive anticipation, but also leaves open the possibility that optimism predicts positive emotions through other mechanisms as well or that we did not fully capture optimism-related positive anticipation in our daily diaries.

The above findings suggest that state and trait positive anticipation can predict positive emotions during a stressor, but we also sought to demonstrate that they were important for dealing with COVID specifically. Consistent with our hypotheses, positive emotions were negatively related to thinking about COVID. Repetitive thoughts about uncontrollable stressors have been found to predict increased levels of psychological distress (Smith and Alloy, 2009), so this finding suggests that experiencing positive emotions may replace those negative repetitive thoughts (Quoidbach et al., 2010). Furthermore, our findings add to previous research on the negative relationship

between optimism and rumination (repetitive and intrusive thinking about negative emotions and events; Tucker et al., 2013), by showing that this relationship may be due to optimists anticipating positive, but not negative events and experiencing positive, but not negative emotions.

Previous research has shown that effective problem solving reduces the negative effects of stress (Brack et al., 1992; Miner and Dowd, 1996; Cheng, 2001), which highlights the importance of being motivated to deal with the problems associated with a chronic stressor such as COVID-19. Mirroring the above findings for thinking about COVID, we found that positive emotions were positively related with the motivation to deal with COVID, which supports the roles of positive emotions as motivators of adaptive behavior (Fritz and Sonnentag, 2007; Løvoll et al., 2017). Again, optimism and positive anticipation were also both related to motivation to deal with COVID through their relationship with positive emotions. Part of the power of positive anticipation is that it gives people something to look forward to and increases motivation to obtain that anticipated thing (Løvoll et al., 2017) – we showed that this motivation may also carry-over to dealing with the more unpleasant aspects of a chronic stressor.

Due to possible cultural differences in how people value emotions, this study can only generalize to individuals in the United States during the COVID-19 pandemic. Studies comparing cross-cultural differences in how people responded to this worldwide pandemic are needed, especially given cultural differences in the importance of high arousal positive emotions (Tsai, 2007), which usually accompany heightened positive anticipation. Additionally, all data were collected during the pandemic without a pre-pandemic baseline. Due to this limitation, we cannot determine whether these relationships change as a result of being in the COVID-19 pandemic or not. Additionally, for whatever reason, our recruitment methods resulted in an older sample than we intended. Although this is good for showing coping in those most vulnerable to the ill effects of the coronavirus (National Center for Health Statistics, 2020), it does suggest that we cannot fully generalize these findings to a younger sample.

SUMMARY

The COVID-19 global pandemic was a novel chronic stressor that severely impacted the United States, along with the majority of the world. Positive anticipation and optimism were effective strategies for coping with COVID-19 because they increased positive emotion. These findings suggest that anticipation of future emotional experiences and optimism for the future can be a powerful predictor of positive emotions during global pandemics and perhaps other similar chronic stressors that severely disrupt daily life, feature high levels of uncertainty, lead to increased isolation and loneliness, and do not have a foreseeable end. This study adds to the literature for adaptive coping with the COVID-19 pandemic, and uniquely explores the adaptive role of state and trait positive anticipation for a chronic stressor.

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 below: https://osf.io/znjd4/?view_only=d209143537c84110b45304b77b940b0a.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Wake Forest University Institutional Review Board. Participants provided their informed consent to participate in the study.

AUTHOR CONTRIBUTIONS

CL-M, CW, and VC were involved in the design of the study. CL-M and CW were involved in conducting the study. CW and VC were involved in data analysis. All authors were involved in writing the manuscript and approved the submitted version.

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Increase of Collectivistic Expression in China During the COVID-19 Outbreak: An Empirical Study on Online Social Networks

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The pathogen-prevalence hypothesis postulates that collectivism would be strengthened in the long term in tandem with recurrent attacks of infectious diseases. However, it is unclear whether a one-time pathogen epidemic would elevate collectivism. The outbreak of COVID-19 and the widespread prevalence of online social networks have provided researchers an opportunity to explore this issue. This study sampled and analyzed the posts of 126,165 active users on Weibo, a leading Chinese online social network. It used independent-sample *t*-tests to examine whether COVID-19 had an impact on Chinese collectivistic value-related behaviors by comparing the usage frequency of personal pronouns, group-related words, and relationship-related words before and after the outbreak. Overall, most collectivist words exhibited a significant upward trend after the outbreak. In turn, this tendency pointed to a rising sense of collectivism (versus individualism). Hence, this study confirmed the pathogen-prevalence hypothesis in real settings, finding that an outbreak of an infectious disease such as COVID-19 could exert an impact on collectivism and may deliver a theoretical basis for psychological protection against the threat of COVID-19. However, further evaluation is required to ascertain whether this trend is universal or culture-specific.

Keywords: collectivism, pathogen-prevalence hypothesis, online social networks, big data, COVID-19

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INTRODUCTION

The outbreak of COVID-19 has resulted in an ongoing pandemic and has become a global public health crisis. Economies, societies, and politics across the world have felt the impact of COVID-19 for several months (Mehta et al., 2020). Social distancing, lockdowns, and other isolating actions have been suggested and adopted as protective behavioral mechanisms facilitating the avoidance of parasitic transmission along with other methods of managing local parasitic infections (Parmet and Sinha, 2020; Prem et al., 2020; Viner et al., 2020). Because the time period of this study selected to explore is prior to the time of WHO's definition of COVID-19 as a pandemic, this study referred to coronavirus an epidemic instead of a pandemic. The hypothesis of pathogen prevalence (or the parasite stress model) hypothesizes that in the long term, inhabitants in regions with higher rates are more likely to become collectivist than the populations of regions that evince lower rates of infections (Fincher et al., 2008; Thornhill et al., 2010; Murray et al., 2011). However,

could a one-time outbreak of an infectious disease such as COVID-19 also enhance behaviors displaying collectivist values? There is little direct evidence of such an assumption in real settings. An increasing number of people spent more time on online social networks after the outbreak of COVID-19 to obtain epidemic information on the epidemic and to express their concerns. This inclination provided the authors the opportunity to track the changes in behaviors displaying collectivist values (e.g., collectivistic expression) with time cues following the outbreak of COVID-19 (Liu M. et al., 2018; Holmes et al., 2020; Li S. et al., 2020). The researchers engaged in this study were also inspired to examine whether the outbreak of COVID-19 triggered concerns toward ingroup members, a trend that could imply the growth of collectivist values. Results congruent with the abovementioned postulation would offer new evidence supporting the pathogen-prevalence hypothesis. Further, such a study may deliver a theoretical basis for psychological protection against the threat of COVID-19 (Germani et al., 2020).

Individualism/collectivism, as a fundamental cultural dimension, captures cultural perspectives in people's differentiation toward ingroups and outgroups (Oyserman et al., 2002; Fincher and Thornhill, 2012; Oyserman, 2017; Van de Vliert, 2020). The pathogen-prevalence hypothesis is thought to cause geographical or cultural differences in individualism/collectivism (Fincher et al., 2008). The pathogen-prevalence hypothesis postulates that in the long term, collectivistic values, such as ingroup–outgroup differentiation, ingroup favoritism, and outgroup xenophobia, would be strengthened in tandem with recurrent attacks of infectious diseases (Oyserman et al., 2002; Fincher and Thornhill, 2008a; Fincher and Thornhill, 2008b; Fincher and Thornhill, 2012; Fincher et al., 2008; Oyserman, 2017). This hypothesis is supported by substantial cross-cultural evidence. For example, Fincher and his colleagues drew on epidemiological data and the findings of worldwide cross-national surveys of individualism/collectivism finally found that the regional prevalence of pathogens evinces an extremely positive correlation with cultural indicators of collectivism and exhibits a strong negative correlation with individualism (Fincher et al., 2008). The severity of parasitical illnesses could also positively predict collectivist-value-related behavior, for example, family ties, xenophobia, philopatry (Fincher and Thornhill, 2012), obedience (Cashdan and Steele, 2013), and ingroup trust (Zhang, 2018). However, some of the evidence proffered by these studies did not exclude the interference caused by the confounding factors emanating from cross-cultural studies, such as interferences caused by varying degrees of modernization, and diverse social systems. Thus, it is difficult to establish a causal link between the severity of the localized outbreak of a parasite disease and the growth of collectivist sentiments (Yang, 1988; Oyserman et al., 2002; Kagitcibasi, 2005). Some scholars manipulated the exposure to pathogen cues and found that exposure to pathogen cues could elevate ethnocentrism (Navarrete et al., 2007), conformity (Wu and Chang, 2012), and outgroup prejudice (Tybur and Lieberman, 2016). Nevertheless, these extant experimental investigations could not guarantee the ecological validity like cross-cultural studies. Moreover, scholars also found that during a parasitic disease outbreak, collectivist-value-related behaviors buffered adverse outcomes in instances of outbreaks of parasitic disease. For example, Kim tested the influence of collectivism on xenophobic response to the threat of Ebola and found that collectivism—and the set of practices and rituals associated with collectivistic cultures—may serve as psychological protection against the threat of disease (Kim et al., 2016). All these findings lend impetus and support to the present study to employ an ecological method to explore whether a one-time outbreak of an infectious disease such as COVID-19 could enhance behaviors that showcase collectivist values in real settings and therefore to provide a theoretical basis for psychological protection against the threat.

The COVID-19 pandemic and the widespread prevalence and use of online social networks (OSNs) represented an opportunity for the present study. Various news outlets continuously warned their users officially and unofficially after the outbreak of COVID-19, labeling it as an extremely serious infectious disease. Many countries enforced and suggested interventions, such as isolation (Hellewell et al., 2020), quarantining (Parmet and Sinha, 2020), school closures (Viner et al., 2020), social distancing (World Health Organization, 2020a), and mask wearing (Feng et al., 2020). Individuals were also warned to perceive and experience the secondary threat of COVID-19. All these interventions and sources of information prompted people to use OSNs to demonstrate their concerns and express their feelings (Cinelli et al., 2020; Gao et al., 2020; Li S. et al., 2020).

The popularity and the proliferation of OSNs have encouraged extensive social interactions among users and have generated a large amount of social data. OSNs have been used to explore personal, societal, and cultural outcomes and represent rich resources for the apprehension of underlying psychological mechanisms. There were 3.08 billion registered social media network users worldwide as of 2020 (Statista, 2020a. Evidence has shown that people's digital records on social media are extended into real life and might be an efficient medium for expressing and communicating real personality traits (Back et al., 2010). Kosinski et al. (2013) utilized a dataset of over 58,000 volunteers who offered access to their Facebook likes and detailed demographic profiles and examined the results of several psychometric tests. Their study determined that Facebook likes could be used to automatically and accurately predict a range of highly sensitive personal attributes, including sexual orientation, ethnicity, religious and political views, personality traits, intelligence, happiness, use of addictive substances, parental separation, age, and gender (Kosinski et al., 2013). Other researchers have found that people living in individualist cultures were less egocentric in social networks than those residing in collectivist societies (Na et al., 2015). Moreover, individuals belonging to culturally tight (versus loose) states were more likely to express positive emotions and were less likely to express negative emotions (Liu P. et al., 2018). There are also some previous studies that have investigated the collectivism and social media postings (, Arpaci and Baloğlu, 2016; Arpaci et al., 2018, 2020). The investigation selected the leading Chinese OSN, Sina Weibo, which has 516 million registered users (Statista, 2020b), as its analytics platform. All of the microblogs on Sina Weibo

are publicly available and can be utilized to recognize individual psychological traits and to ascertain mental health statuses (Hao et al., 2015; Li S. et al., 2020), analyze emotional states (Liu M. et al., 2019), and apply the suicide ideation test (Li A. et al., 2018).

It is difficult to conduct a traditional survey or perform wide-ranging experimental manipulations during the ongoing COVID-19 epidemic. Also, it was impossible to measure collectivism in people in advance since the timing of the COVID-19 declaration was unknown. Moreover, the digital records of human behavior from OSNs can offer more ecological validity than classic psychological surveys and experimental manipulations. Thus, problems of documentation may be avoided, and real-time, non-invasive detection is made possible, ensuring the objectivity, timeliness, and continuity of the data.

In general, the outbreak of COVID-19 and the widespread use of OSNs accorded the researchers the opportunity to explore whether a one-time outbreak of an infectious disease would also advance behaviors displaying collectivist values in real settings. Meanwhile, the testing of the pathogen-prevalence hypothesis may present references for policymakers and help them plan and fight effectively against the COVID-19 pandemic. This study posits that the exposure to pathogen cues of COVID-19 has increased the usage of collectivist words and that people use such terms more after they know COVID-19 is infectious than before.

MATERIALS AND METHODS

Participants and Data Collection

The present investigation was based on microblog text analyses. The active users were sampled from the original Weibo data pool (Li et al., 2014), which contained more than 1.16 million active users. The retrieved data included information on user profiles and posts. The privacy of users was strictly protected during this process according to the ethical principles reference listed by Kosinski et al. (2015). The ethics code is H15009 approved by the Institutional Review Board at the Institute of Psychology, Chinese Academy of Sciences.

The active users were defined as Weibo members (1) who published 10 or more original microblogs during the epidemic period, (2) whose authentication type was non-institutional (such as individual users, etc.), and (3) whose regional authentication was not blank. Moreover, users who had registered from overseas locations such as Hong Kong, Macao, or Taiwan were excluded from the study. Ultimately, 126,165 active users (94,436 men, 31,729 women; median age = 29) were selected from the 1.16 million Weibo users. The participants were spread across 481 cities in 31 provincial administrative regions in mainland China. Their original posts published between December 1, 2019, and February 16, 2020, were then fetched for analysis; each user posted an average of 109.5 microblogs.

Word Selection

Language indicators were developed to measure individualism/collectivism, including pronouns (Kashima and Kashima, 1998; Twenge et al., 2013) and individualist/collectivist terms (Zeng and Greenfield, 2015). Pronouns have been proven to be indicators of individualism/collectivism. Kashima found that the pronouns employed in spoken language were positively predicted by collectivism among 71 cultures with 39 languages (Kashima and Kashima, 1998). First-person singular pronouns (I or me) have been linked to individualism; first-person plural pronouns (we or us) to collectivism in the "pronoun circle" paradigm (Oyserman and Lee, 2008) of cultural changes noted in Google Ngram Corpus database or other texts (Yu et al., 2016). Further, the second- and third-person pronouns have also been evidenced as potential indicators of individualism/collectivism. For example, Hamamura and colleagues found in Chinese that second- and third-person pronouns evinced similar trends in the Google Ngram Corpus database (Hamamura and Xu, 2015). It is suggested that singular pronouns are linked to individualism, and plural pronouns are associated with to collectivism (first-, second-, and third-person).

Two other kinds of words were analyzed to supplement the result and to explore whether the effects of COVID-19 on behaviors that presented collectivist values depended on the intimacy of ingroups. One is group-related words. In the collectivist Chinese culture, individuals are embedded in various groups, such as work units, communities, families, governments (Lu, 2012; Xie, 2016), and social networks (e.g., family, kinship, neighbor, acquaintances, colleagues). Interpersonal relationships are important to Chinese individuals, and all associations are not equal (Gold et al., 2002). Additionally, among all their groups, the Chinese cares most about their nuclear family, then their extended family, and then other kinship relations (Hwang, 1987). Good relationships with five cardinal groups (in Chinese, "五伦") have been used in China as measures of relational harmony for the appraisal of specific cultural influence on life satisfaction (Kwan et al., 1997). This phenomenon implies that group-related words may denote a novel method of verifying whether collectivist expressions are increasing in China. The other is relationship-related words. Compared with other languages, there are more words to point to specific relationships in Chinese in comparison to other languages. For example, in Chinese, "father's brother" could be "叔叔" or "伯伯," and "mother's brother" is "舅舅." However, in English, all these relationships are represented by the term "uncle." The specificity of relationship-related words may symbolize cultural differences that indicate the rigidity or laxity of the social structure and could be employed to verify whether collectivist expressions are increasing.

Finally, the frequencies of specific words were computed from the original posts published by the active users of Weibo. The words were selected based on the following methodology. (1) First-person singular pronouns, second-person singular pronouns, third-person singular pronouns, first-person plural pronouns, second-person plural pronouns, and third-person plural pronouns were selected on the basis of previously conducted research as the objects of analysis (Hamamura and Xu, 2015; Yu et al., 2016). (2) Word categories that can summarize varied groups, including family, kinship, neighbors, acquaintances, and colleagues (Oyserman et al., 2002), were selected by referencing previous methods of incorporating interpersonal relationships into individualism–collectivism research. (3) Further, the present investigation also

selected relationship-related words including father, mother, son, daughter, sister, brother, uncle, aunt, niece, nephew, grandmother, grandfather, grandson, and granddaughter to explore the extent of attention people paid to family members during the epidemic (Murdock, 1949; Lu, 2012; Xie and Hu, 2014). The detailed classification of personal pronouns, group-related words, and relationship-related words are shown in, respectively, displayed in **Table 1**.

Measures and Analysis

Original posts published by active Weibo users from December 1, 2019, to February 16, 2020, were fetched for analysis. This period was selected because China's first case of COVID-19 appeared on December 1, 2019 (Huang et al., 2020), and the National Health Commission of China officially identified COVID-19 as a class B infectious disease—a disease which may cause epidemics and is considered mandatory a notifiable disease (Li Y. et al., 2020), on January 20, 2020 (National Health Commission of the People's Republic of China, 2020). Some provinces in China began to sequentially resume work and production from February 10, 2020. The Joint Prevention and Control Mechanism of the State Council of China announced on February 16, 2020, that the proportion of severe cases diagnosed in the country had dropped significantly (World Health Organization, 2020b), which represented a positive sign that the situation had started to improve. Therefore, the selected time period was divided into two stages: Stage I (December 1, 2019–January 20, 2020) denoted the unclear stage of the epidemic when people were not aware of the infectiousness of COVID-19; Stage II (January 21, 2020–February 16, 2020) encompassed the severe stage of the epidemic. The Weibo data then divided into two parts from December 1, 2019, to January 20, 2020, and from January 21, 2020, to February 16, 2020 (hereinafter referenced as early stage and later stage).

The TextMind system developed by the Computational Cyber-Psychology Lab of the Institute of Psychology at the Chinese Academy of Sciences was used to extract the text features for this study (Gao et al., 2013). The Chinese word segmentation embedded in the TextMind system can divide the text into independent words using linguistic characteristics in accordance with the rules of Chinese grammar rules, to finally achieve the purpose of analyzing word frequencies using computers. The counts of each term were obtained on the basis of a psychoanalysis dictionary, and the ratio of the number of occurrences of each word was then computed vis-à-vis the total number of words used each day to control the impact of daily total word counts changes. **Figure 1** portrays the procedures adopted from feature extraction to word frequency. Therefore, the analysis of the change trend of each word during the epidemic was more accurately accomplished. Finally, we compared the differences between all word frequencies in early and later stages through independent-sample *t*-tests by using the Statistical Product and Service Solutions (SPSS) 22.0 (Corp, 2013) for data analysis.

TABLE 1 | The detailed information of collectivist words.

Word categories	Specific word categories	Specific words included in this article
Personal pronouns	First-person singular	我，咱
	First-person plural	我们，咱们
	Second-person singular	你
	Second-person plural	你们
	Third-person singular	她，他，它
	Third-person plural	她们，他们，它们
Group-related words	Family	家人
	Kinship	亲戚
	Neighbor	邻居
	Acquaintances	熟人
	Colleagues	同事
Relationship-related words	Son	儿子
	Daughter	女儿
	Father	爸爸，爹，父亲
	Mother	妈妈，娘，母亲
	Brother	哥，哥哥，弟，弟弟
	Sister	姐，姐姐，妹，妹妹
	Uncle	叔，叔叔，伯伯，大爷，舅，舅舅
	Aunt	姑，姑妈，姨，姨妈
	Niece	侄子，外甥，侄
	Nephew	侄女，外甥女
	Grandfather	爷爷，老爷，姥爷
	Grandmother	奶奶，姥姥
	Grandson	孙子，外孙
	Granddaughter	孙女，外孙女

RESULTS

Personal Pronouns

In this study, we compared the word frequency of personal pronouns between early and later stages. The detailed information of personal pronouns is seen in **Table 1**. The independent-sample *T*-test results for personal pronouns are shown in **Table 2**. After the outbreak of COVID-19, word frequency significantly increases in the category plural pronouns, including first-person plural pronouns ($t = -9.12$, $p < 0.001$, $d = 2.35$), second-person plural pronouns ($t = -9.41$, $p < 0.001$, $d = 0.72$), and third-person plural pronouns ($t = -9.20$, $p < 0.001$, $d = 0.67$). Word frequency significantly decreases in the category singular pronouns, including first-person singular pronouns ($t = 5.62$, $p < 0.001$, $d = 1.26$) and second-person singular pronouns ($t = 8.18$, $p < 0.001$, $d = 3.16$).

Group-Related Words

We also found significant differences in group-related words (see detailed information in **Table 1**) between early and later stages. As shown in **Table 3**, after the outbreak of COVID-19, a small part of word frequency significantly decreased in the group-related words, including colleagues ($t = 3.80$, $p < 0.001$, $d = 0.95$) and acquaintances ($t = 2.45$, $p = 0.018$, $d = 0.49$). Most of word frequency significantly increased in the category group-related words, including family ($t = -4.39$, $p < 0.001$, $d = 1.10$),

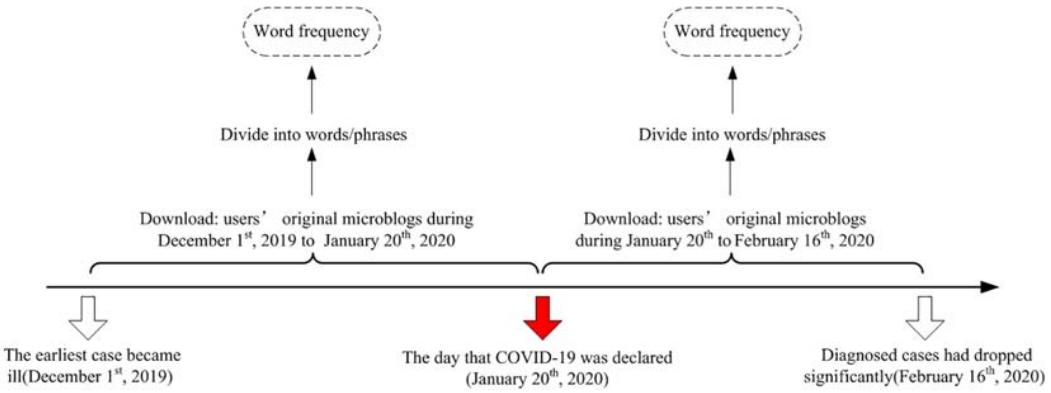

FIGURE 1 | Procedure from feature extraction to word frequency.

TABLE 2 | Comparison of personal pronouns between early and later stages.

Pronouns categories	Early stage (*N* = 50)		Later stage (*N* = 28)		*T*	*p*	*Cohen's d*
	M	*SD*	*M*	*SD*			
First-person singular	4502.60	366.35	3926.43	535.64	5.62	0.000***	1.26
First-person plural	242.05	30.94	368.15	69.41	−9.12	0.000***	2.35
Second-person singular	1454.14	171.12	1071.12	141.67	8.18	0.000***	3.16
Second-person plural	96.27	14.64	156.21	31.88	−9.41	0.000***	0.72
Third-person singular	532.59	52.79	523.76	86.55	0.56	0.577	0.12
Third-person plural	69.46	10.35	121.44	28.87	−9.20	0.000***	0.67

*"Early stage" represents the word frequency from December 1, 2019, to January 20, 2020. "Later stage" represents the word frequency from January 21, 2020 to February 16, 2020. ***p < 0.001.*

TABLE 3 | Comparison of group-related words between early and later stages.

Categories	Early stage (*N* = 50)		Later stage (*N* = 28)		*T*	*p*	*Cohen's d*
	M	*SD*	*M*	*SD*			
Family	23.79	11.68	41.84	19.94	−4.39	0.000***	1.10
Kinship	2.82	1.94	6.61	6.90	−2.85	0.008**	0.75
Neighbor	2.75	1.05	5.77	3.99	−3.94	0.000***	1.04
Acquaintances	1.82	3.14	0.70	0.65	2.45	0.018*	0.49
Colleagues	17.43	6.88	11.94	4.41	3.80	0.000***	0.95

*"Early stage" represents the word frequency from December 1, 2019, to January 20, 2020. "Later stage" represents the word frequency from January 21, 2020, to February 16, 2020. ***p < 0.001, **p < 0.01, *p < 0.05.*

kinship ($t = -2.85$, $p = 0.008$, $d = 0.75$), and neighbor ($t = -2.85$, $p = 0.008$, $d = 1.04$).

Relationship-Related Words

Results indicate significant differences of relationship-related words (see detailed information in **Table 1**) between early and later stages, as shown in **Table 4**. The word frequency of mother ($t = -1.93$, $p = 0.058$, $d = 0.44$) and niece ($t = -1.89$, $p = 0.063$, $d = 0.42$) significantly increased in marginal, while the word frequency of uncle ($t = -2.67$, $p = 0.009$, $d = 0.59$), grandfather ($t = -2.40$, $p = 0.022$, $d = 0.61$), and grandmother ($t = -3.29$, $p = 0.002$, $d = 0.76$) significantly increased. However, the word frequency of son ($t = 2.86$, $p = 0.006$, $d = 0.65$), brother ($t = 3.82$, $p < 0.001$, $d = 0.90$), and sister ($t = 6.87$, $p < 0.001$, $d = 1.68$) significantly decreased.

DISCUSSION

The present study used large-scale time-series data obtained from Sina Weibo to scrutinize the effects of COVID-19 on individual behaviors exhibiting collectivist values. As predicted, individuals were more inclined to use words related to collectivist values during the later stage and employed lesser terms displaying individualist values than the early stage. Specifically, individuals preferred to use more plural pronouns as well as

TABLE 4 | Comparison of relationship-related words between early and later stages.

Categories	Early stage (*N* = 50)		Later stage (*N* = 28)		*T*	*p*	*Cohen's d*
	M	*SD*	*M*	*SD*			
Son	23.12	5.24	19.24	6.59	2.86	0.006**	0.65
Daughter	15.38	4.24	14.38	12.29	0.42	0.678	0.11
Father	55.95	12.34	55.04	12.67	0.309	0.758	0.07
Mother	118.66	15.97	126.74	20.60	−1.93	0.058	0.44
Brother	221.49	30.23	193.64	31.98	3.82	0.000***	0.90
Sister	167.33	25.40	129.31	19.36	6.87	0.000***	1.68
Uncle	36.06	9.72	43.74	15.68	−2.67	0.009**	0.59
Aunt	43.27	10.72	41.84	6.06	0.75	0.456	0.16
Niece	1.23	1.09	1.76	1.40	−1.89	0.063	0.42
Nephew	1.80	1.32	1.75	1.17	0.17	0.867	0.04
Grandfather	16.38	7.57	23.19	13.92	−2.40	0.022*	0.61
Grandmother	16.47	5.45	20.93	6.25	−3.29	0.002**	0.76
Grandson	1.71	0.99	1.82	1.65	−0.37	0.738	0.08
Granddaughter	0.57	0.33	2.47	9.46	−1.06	0.298	0.28

*"Early stage" represents the word frequency from December 1, 2019, to January 20, 2020. "Later stage" represents the word frequency from January 21, 2020, to February 16, 2020. ***p < 0.001, **p < 0.01, *p < 0.05.*

group-related and relationship-related words and less singular pronouns during the later stage. These results lend support to the pathogen-prevalence hypothesis of collectivism, which posits that inhabitants tend to embrace collectivist values to protect themselves behaviorally from threats. In the course of the epidemic, individuals cared more about ingroup members and relied more on them to defend against the serious threat posed by the infectious diseases. In addition, behaviors related to collectivist values relied on the closeness of ingroups during the impact of COVID-19. At this juncture, colleagues and acquaintances were relatively less important than family members or significant ingroup members.

This study reports opposing results that could be attributed to the limitations of its data and/or factors not considered in its assumptions. First, the decrease of mentions of acquaintances and colleagues may be caused by the fact that the family represents the most important group, followed by kinship networks, neighbors, work colleagues, and acquaintances. These units form types of an individual's ingroup, but there exists an ingroup vigilance or peer pressure between work colleagues and acquaintances (Liu S. S. et al., 2019). Second, some relationship-related words indexing collectivistic values declined in frequency; these included son, brother, and sister. This outcome may be explained by the generalization of the kinship terms (Ren and Chen, 2019). The features of authority and gravity embedded in the numerous kinship morphemes in traditional cultures have gradually faded because of the influence of the openness of social culture and the diversification of online languages. The current generation commands a high degree of openness and entertainment. Many kinship terms can now be used as entertaining self-appellations (Cha and Gao, 2011; Wang, 2011; Xie, 2018) or be utilized by groupies (e.g., call idol "哥哥" or "姐姐"). The number of entertainment-related microblogs decreased in the later stage, perhaps symbolizing that Chinese individuals were more concerned about information on the epidemic.

In sum, the results of this study contribute to the extant literature in four ways. First, the present investigation expands the pathogen-prevalence hypothesis. Most evidence of the parasite-stress theory has thus far emanated from cross-cultural correlations (Fincher et al., 2008; Schaller and Murray, 2008; Thornhill et al., 2010; Li S. et al., 2020; Thornhill and Fincher, 2011; Zhang, 2018). Previously conducted research has indicated that inhabitants acquired adapted behavioral immune systems through prolonged recurrences of infectious diseases (Thompson, 2005). Whether the behavior of a population would change temporarily during the outbreak of a parasitic disease was not clear. This investigation tested the hypothesis in a real setting. Moreover, the cross-cultural tests based on historical data may incorporate an inherent weakness because historical sources may be coarse-grained and less accurate than modern disease prevalence data (Cashdan and Steele, 2013). The current study's results elucidate that the inhabitants of mainland China evinced observable collectivist behavioral transformations after the outbreak of an infectious disease.

Second, the study also contributes to cultural psychology through the use of big data, which can enhance our understanding of cultural psychology. Digital records of the behaviors of Sina Weibo constitute large-scale big data without the limitations of self-reports. These data evinced the link between collectivist behavior and the outbreak of COVID-19, and the ecological validity of this outcome is persuasive. Moreover, the Weibo results obtained by this study were adequately controlled for confounding factors such as the time window in comparison to the use of the Google Ngram Corpus for the analyses of collectivism (Zeng and Greenfield, 2015; Yu et al., 2016).

Third, the present investigation attempted to expand collectivist terminology to supplement the results. Pronouns, especially first-person, were used as indicators of individualism/collectivism (Kashima and Kashima, 1998; Hamamura and Xu, 2015). This idea was developed from cross-cultural comparisons in which some culture- or language-specific words were neglected. In this instance, two types of collectivist-related words were defined and constructed in congruence with the collectivist definitions and characteristics of the Chinese language: group-related and relationship-related words. The two kinds of collectivist terms evinced the same trends in this study along with the personal plural pronoun, offering preliminary evidence that these two types of words may be utilized as indicators of collectivism. More rigorous tests of these two types of terms could be performed in future investigations.

Finally, the current study tested the pathogen-prevalence hypothesis in the circumstances of a real epidemic. Such a basis may deliver a theoretical basis for psychological protection against the threat of COVID-19 (Germani et al., 2020) and may help policymakers to plan and fight against COVID-19 more effectively (). Although previous studies testing the pathogen-prevalence hypotheses command more internal validity, the current investigation was able to expand the external validity.

Some limitations of this study must, however, be acknowledged. First, this investigation pertains only to the trend toward collectivism for the duration of an outbreak. It remains to be explored whether the frequencies of such collectivist words will fall to the same normal levels after the epidemic as before the outbreak of COVID-19. Second, trends toward behaviors displaying collectivist values were observed by this study; however, it is uncertain whether this trend is universal or culture-specific. Third, this study only used a longitudinal design for Chinese culture using Weibo; the examination of its results should be tested in other cultures based on other social media such as Twitter and Facebook. Fourth, the segmentation of Chinese characters is a challenging problem. For example, the first-person singular pronouns are sometimes also used to indicate first-person plural pronouns as in expressions such as "我国" (our country). Finally, many factors were not controlled in the study. For example, other events may relate to the collectivist words used on Weibo. In the future, these uncertain factors should be controlled using experimental methods, which would make the study more robust. In short, the present study is still imperfect; however, it does indicate that the data obtained from Weibo was able to yield observations of certain changes in Chinese collectivism.

CONCLUSION

This study analyzed the frequencies of personal pronouns, group-related words, and relationship-related words in the early and later stages of COVID-19 on the basis of data obtained from Sina Weibo, a leading social media platform in China. The results of the study evince that first-person plural pronouns increased in frequency as the pandemic worsened; meanwhile, the word frequency of first-person singular pronouns deceased. Besides, Chinese individuals referred significantly more to group-related words and relationship-related words during the later stage of COVID-19 than in the early stage. Even though it is still indeterminate whether this trend is universal or culture-specific, the outcomes of this study indicate that an outbreak of an infectious disease such as COVID-19 could influence collectivism. Through this result, the present study is able to confirm the pathogen-prevalence hypothesis in a real setting. Moreover, study proved the validity of using data from OSNs for analyses in social–psychological research purposing to describe human behavior, especially in the context of culture.

DATA AVAILABILITY STATEMENT

Due to protect the privacy of the participants, the original posts used for the analysis are not publicly available but are available from the corresponding author on reasonable request.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Institutional Review Board at the Institute of Psychology, Chinese Academy of Sciences. Written informed consent from the participants' legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

NH, XR, and TZ conceived and planned this article. NH and XR carried out the search and revision of the literature. TZ collected and provided the data. NH and PW analyzed the data. NH drafted the study. XL, XR, and TZ reviewed and edited the writing. All authors revised the article critically for important intellectual content, commented on and approved the final manuscript, were accountable for all aspects of the work, read, and agreed to the published version of the manuscript.

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Identifying Resilience Factors of Distress and Paranoia During the COVID-19 Outbreak in Five Countries

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The ongoing COVID-19 pandemic outbreak has affected all countries with more than 100 million confirmed cases and over 2.1 million casualties by the end of January 2021 worldwide. A prolonged pandemic can harm global levels of optimism, regularity, and sense of meaning and belonging, yielding adverse effects on individuals' mental health as represented by worry, paranoia, and distress. Here we studied resilience, a successful adaptation despite risk and adversity, in five countries: Brazil, Colombia, Germany, Israel, and Norway. In April 2020, over 2,500 participants were recruited for an observational study measuring protective and obstructive factors for distress and paranoia. More than 800 of these participants also completed a follow-up study in July. We found that thriving, keeping a regular schedule, engaging in physical exercise and less procrastination served as factors protecting against distress and paranoia. Risk factors were financial worries and a negative mindset, e.g., feeling a lack of control. Longitudinally, we found no increase in distress or paranoia despite an increase in expectation of how long the outbreak and the restrictions will last, suggesting respondents engaged in healthy coping and adapting their lives to the new circumstances. Altogether, our data suggest that humans adapt even to prolonged stressful events. Our data further highlight several protective factors that policymakers should leverage when considering stress-reducing policies.

Keywords: pandemic (COVID-19), coping behavior, thriving, protective factor, mental health

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INTRODUCTION

On 31 December 2019, China informed the World Health Organization (WHO) about cases of pneumonia with unknown etiology, later connected to the SARS-CoV-2 virus. The Coronavirus spread globally and on the 11th of March 2020 the WHO classified it as a global pandemic. Even though governments around the world employed various countermeasures in an attempt to contain the virus, the pandemic evolved into a severe global health problem (Adhanom Ghebreyesus, 2020), threatening to lead to a temporary collapse of numerous local healthcare systems (Zhu and Peng, 2019; WHO, 2020).

Designed as protective measures for physical health, these countermeasures drastically changed the lifestyle of most members of present-day societies by recommending and even enforcing social isolation. Such abrupt changes in everyday life inevitably led to a heightened sense of personal and societal uncertainty, increasing mental illness and distress worldwide (Mækelæ et al., 2020; Okruszek et al., 2020; Torales et al., 2020; Xiang et al., 2020). Indeed, a longitudinal study comparing the distress of US citizens before and at an early stage of the pandemic found three times more depression and anxiety during the pandemic (Twenge and Joiner, 2020). Mental health is a multifaceted construct defined as more than the mere absence of illness (Foundation, 2005). Mental health relies on two distinct yet correlated dimensions of mental illness and positive mental health (Westerhof and Keyes, 2010; Provencher and Keyes, 2011). Elevated levels of illness can coincide with high levels of well-being, but the absence of illness does not imply the presence of well-being, and vice versa (Sin and Lyubomirsky, 2009). Mental illness can manifest as affective, anxiety and personality disorders (e.g., depression, anxiety, paranoia) or feelings of distress. These disorders, in turn, are linked to negative health outcomes as well as impaired mental, physical and social functioning (Corey, 2002; Sun et al., 2019). Positive mental health is multifaceted and encompasses both hedonic- and eudaimonic well-being. Hedonic or emotional well-being includes positive emotions such as happiness and life satisfaction. Eudaimonic well-being includes psychological factors such as meaning, coherence and purpose in life, as well as social factors such as a sense of belonging, integration and contribution. Positive mental health is linked to increased work and social functioning, as well as a decreased health risk and positive behaviors (De Neve et al., 2013).

Although adverse events can damage people's mental health, individuals can also adapt during harsh times. Traumatic experiences sometimes uncover an incredible resilience that can even lead to growth (Linley and Joseph, 2004).

Protective Factors for Mental Health

During trying times, a number of factors can help individuals survive, manage and adapt. Bassi et al. (2021) found that Italian health workers classified as *thriving* individuals were less likely to have post-traumatic stress (PTSD) during the pandemic. The term thriving denotes the state of fully functioning in mental, physical, and social terms (Su et al., 2014). Thriving includes a range of dynamic factors including, but not limited to, *gratitude* (Emmons et al., 2003; Cheng et al., 2015; Otto et al., 2016), *belonging* (Baumeister and Leary, 1995), *Social- contribution, integration, and actualization* (Provencher and Keyes, 2011), *meaning* (Schueller and Seligman, 2010), *pride* (Tracy and Robins, 2007; Williams and DeSteno, 2008; Fredrickson, 2013), *compassion* (Seppala et al., 2013), and *learning from the situation* (Jenkins and Mostafa, 2015). Broader literature about mental health has highlighted the protective role thriving has in buffering against mental illness (Provencher and Keyes, 2011).

Additional lines of investigations point to the contribution of regular routines to mental health. A recent longitudinal study conducted during the three first months of the pandemic in Germany (Bendau et al., 2020) found that the following factors protected against anxiety and depression: self-efficacy, *normalization of routines*, maintaining social contacts, and knowledge about where to get medical support. Moreira et al. (2021), investigating the same topic during the COVID-19 outbreak in Portugal, found that working (online or in-person) and *physically exercising on a regular basis*, not having previous psychological/physical diseases, not consuming COVID-19 information and doing remote psychotherapy served as protective factors for mental health. These results align with a body of literature that points out that *regularity* has a beneficial effect on mental health (Sano et al., 2017; Murray et al., 2020) in the same way unpredictability in the environment is seen as a potential risk for later mental illness (Glynn and Baram, 2019). Other works showed that regularity of sleep, exercise and social rhythm correlated with improved mental health and well-being (Margraf et al., 2016; Boland et al., 2019; Logan and McClung, 2019).

In addition to person-focused factors, society-directed attitudes can also play a protective role in the context of the pandemic. Although some authors claim that societal trust increases after natural disasters due to the shared need to overcome the event (e.g., Toya and Skidmore, 2014), others maintain that disasters can foster suspicion conspiracy theories about the event (Wilson and Rose, 2014). These society-level outcomes, in turn, impact mental health. O'Hara et al. (2020), for instance, found that in countries that distrusted the government, an increase in policy stringency was associated with men reporting more depression—but no more worries—and women reporting both worries and depression. Thus, *trust in government* can impact well-being (Helliwell and Huang, 2008), and *low perceived efficacy of governmental actions* can reduce mental health (Mækelæ et al., 2020), especially during pandemic times when governments have to impose behavioral restrictions.

Finally, decades of research demonstrate that social connections are vital to the well-being and coping with difficult situations (Sibley et al., 2020). Thus, *social support* and *close and caring relationships* may both help individuals cope with life's adversities, as well as foster growth and development (Feeney and Collins, 2014). Social support is well-known to be a protective factor for mental disorders (Puschner, 2018), including paranoia (Freeman et al., 2011; Crush et al., 2018) and depression (Høifødt et al., 2020).

Risk Factors for Reduced Mental Health

Numerous risk factors are also present during trying times, having an adverse effect on the physical and mental health of individuals. Bendau et al. (2020) found that anxiety and depression are exacerbated by routine suppression, unhealthy diet, reduced physical activity, increased substance abuse, and a longer daily time thinking about the pandemic Xiong et al. (2020), in turn, found that women, younger people ($\leq$40 years), individuals with chronic/psychiatric illnesses, unemployed, students, and people frequently exposed to COVID-19 news experience more negative impact on their mental health in eight countries (China, Spain, Italy, Iran, USA, Turkey, Nepal, and Denmark). An additional study conducted in China (Guo et al., 2020) has identified, in addition to the factors mentioned

above, the following risk factors: reduced income, having family members with chronic diseases, concerns related to COVID-19 infection for themselves/family members, living alone, having family conflicts, having sedentary time per day, and worsened sleep quality. Furthermore, a study conducted in the USA found that fear, worry, and threat were significant predictors of both depressive and anxiety symptomatology, even after controlling social vulnerability measures (Fitzpatrick et al., 2020).

The studies above suggest that excessive worry, catastrophizing thoughts, feeling scared about COVID-19 infection together with other fears, and experiencing a lack of control are all components of a *negative mindset* related to poor mental health. These studies also highlight vulnerability conditions, for example *low socio-economic status* (Link and Phelan, 1995; Reiss, 2013), *low levels of education* (Araya et al., 2003), *presence of financial worries* (Bareket-Bojmel et al., 2020), unemployment (Xiong et al., 2020), or reduced income (Guo et al., 2020), are risk factors for the mental health of specific importance during unpredictable times, such as a pandemic. Finally, the frequent exposure to COVID-19 news (Bendau et al., 2020; Xiong et al., 2020) accompanied by *low perceived efficacy of governmental actions* (Mækelæ et al., 2020) can make people react with suspicion and develop conspiracy theories about it (Wilson and Rose, 2014). According to Uscinski et al. (2020), during the COVID-19 outbreak there has been an increase in irrational beliefs or conspiracy theories, possibly due to decreased social interactions (Graeupner and Coman, 2017), potentially leading to detrimental outcomes for individuals (Bierwiaczonek et al., 2020) and societies alike (Jolley and Paterson, 2020; Romer and Jamieson, 2020).

The Current Study

Although some of the aforementioned factors are fairly universal, other factors depend to varying degrees on local spatial and temporal contexts. For example, countries vary in their age distribution, levels of trust in the local government, the prevalence of higher education among citizens, and degree of social equality to name a few parameters. Opinion papers have highlighted the potential contribution of psychological science to coping with the pandemic (Arnot et al., 2020; Garfin, 2020; van Bavel et al., 2020) and a couple of reviews (Serafini et al., 2020; Talevi et al., 2020) and empirical papers have investigated the impact of COVID-19 on the mental health of individuals (e.g., Bendau et al., 2020; Martínez et al., 2020). However, only some of these studies about COVID-19's detrimental impact on mental health have been conducted across countries (see e.g., Gobbi et al., 2020; Xiong et al., 2020; Alzueta et al., 2021; Gato et al., 2021).

Several international organizations published first recommendations (e.g., WHO, 2020) highlighting potential risk and protective factors that might assist in the prevention of mental health issues arising from the COVID-19 pandemic. Here we aimed to further characterize the robustness of factors that help maintain mental health during the COVID-19 outbreak through a two-wave observational study conducted across five countries. The goal of this work was two-fold. First, we wanted to determine whether the prolonged disruption of normal life and imposed social restrictions increased general distress and paranoia. Second, we aimed to identify which factors contribute to maintaining mental health during the pandemic. We hypothesized that the negative effects of social restrictions will be attenuated by the presence of protective factors (having high trust in the government/authorities, thriving, exercising, engaging in actions for own and others' well-being, maintaining a regular schedule, and having no financial worries). We further hypothesized that these negative effects will be amplified by the presence of risk factors (having high perceived risk, financial worries, and lower education). Identifying the factors that improve mental health (by reducing general distress and paranoia) can assist governments worldwide in handling the long-term social and economic costs associated with coping with the societal and psychological aspects of a pandemic (Nicola et al., 2020).

METHODS

Design

The present study used a longitudinal observational design with two waves of data collection (April and July 2020) in a convenience sample composed of participants from five countries: Brazil, Colombia, Germany, Israel and Norway. In mid-April 2020 we launched a survey in seven languages targeting five countries: Norway (Norwegian), Germany (German), Israel (Hebrew and Arabic), Colombia (South American Spanish), Brazil (Brazil-Portuguese). We included these specific countries to allow rapid data collection in an early stage of the pandemic (see Mækelæ et al., 2020). The survey was also available in English in all countries but Israel.

Recruitment and Participants

The first wave (W1) occurred in mid-April 2020 and was composed of over 2,200 participants. The second wave (W2) happened in July and was composed of over 700 participants who took the follow-up survey. **Table 1** reports the sample characteristics for the five countries collected in wave 1.

The inclusion criteria were to have internet access and to be older than 18 years old. The exclusion criteria were to complete the survey in <3 min and to answer fewer than 70% of the items on a scale. Participants were recruited via social media (FB ads) and snowballing. All participants were encouraged to answer all items. Responding took around 15 min in April and around 10 min in July. All participants provided their informed consent and they did not receive any compensation. After answering the first wave, we asked respondents whether they would volunteer to partake in a follow-up in ∼2 months later. If they consented they were transferred to a new survey collecting their email addresses.

Assessments

Our survey included several distinct constructs, some developed anew, e.g., trust scale, thriving and negative mindset scale, others modified from established scales (e.g., CORE-10, CAPE-42, epistemic belief), across four categories. We describe the measures for each category below.

TABLE 1 | Sample demographics, affection and selected daily activities in April.

	Brazil	Colombia	Germany	Israel	Norway
N_April/N_July	384/86	353/118	273/61	372/77	832/389
Mean age (range)	44 (18–72)	25 (18–72)	46 (19–74)	37 (18–73)	40 (18–74)
Female/male/other	303/80/1	228/122/3	214/58/1	255/116/1	617/213/2
Female/male %	79/21%	65/35%	78/22%	69/31%	74/26%
Urban vs. rural	361 vs. 23	333 vs. 19	155 vs. 113	308 vs. 57	593 vs. 230
in %	94%	94%	57%	83%	71%
Single households (%)	60 (16%)	11 (3%)	60 (22%)	38 (10%)	165 (20%)
Wealth (low-middle-upper)	16-153-202	108-235-8	74-186-7	61-262-37	90-696-31
	4/40%	31/67%	27/68%	16/70%	11/84%
% higher education	87%	76%	58%	52%	85%
Affected					
Governmental Quarantine	58%	93%	7%	63%	9%
Self-chosen Quarantine	35%	15%	18%	36%	24%
Social distancing	82%	97%	52%	30%	64%
Has/had COVID-19	3/2	0/0	1/5	1/1	1/4
Family COVID-19	2	10	4	6	6
Essential worker (%)	23 (6%)	4 (1%)	57 (21%)	69 (19%)	174 (21%)
Daily activities					
Home office (>2 h) vs. N/A	65 vs. 12%	80 vs. 3%	41 v 39%	62 vs. 15%	59 vs. 22%
Office (>2 h) vs. N/A	14 vs. 68%	6 vs. 85%	31 v 48%	18 vs. 68%	27 vs. 52%
Childcare	34%	15%	37%	45%	51%
Exercising	75%	78%	86%	87%	89%
At least 30 min outside	53%	38%	83%	63%	75%
Watch news > 2 h	39%	13%	27%	25%	22%
Communicating > 2 h	35%	29%	11%	26%	12%

Wealth is grouped into low by pooling the lowest two self-ratings (belonging to the bottom 10 and 11–30%), middle by pooling the self-rating belonging to 31–60% and 61–90%, upper is self-rated top 10%.

COVID-19 Restrictions, Reactions, and Reported Behavior

Experienced Restrictions

We asked what outbreak-related impacts the respondent has experienced. Answers included government-issued quarantine, self-determined social quarantine, being an essential worker, and having COVID-19 or have recovered from COVID-19. We measured the experienced restrictions on a nominal scale, with multiple answers possible per participant.

Perceived Efficacy of Actions

We measured the perceived efficacy of own, others', and governmental actions on a 5-point Likert scale (0 = don't agree, 4 = fully agree) (Mækelæ et al., 2020). We calculated an average efficacy of action score from these three items. Internal consistency was McDonalds $\omega = 0.615$ in April and $\omega = 0.592$ in July.

Timeframe

We asked how long people think the COVID-19 outbreak will last, and how long the governmental-issued restrictions will last. Answer options ranged from 1 to 2 weeks, 2 to 4 weeks, 1 to 3 months, 3 to 6 months, 6 months to 1 year, 1 to 2 years, to forever.

Protective Behavior

We asked how often on a usual day each of 17 activities was done. Answer options ranged from <30 min, 30 min to 2 h, 2 to 5 h, more than 5 h, and not applicable. Activities were: (1) working at one's regular workplace, (2) working from home, (3) going out of the house, (4) exercising, (5) DIY activities, (6) doing chores around the house, (7) providing emotional support to somebody, (8) caring for kids, (9) watching news, (10) watching movies, (11) playing, (12) meditating, (13) praying or other religious activities, (14) talking to or messaging with friends and family, (15) communicating with friends and family, (16) helping friends and family, (17) procrastinating. Not all activities were applicable when in quarantine, e.g., working outside the house and not everybody may have to care for children.

Regularity

We measured the extent to which respondents maintained a regular schedule on a three-item scale; (a) keeping a regular schedule, (b) eating regularly and (c) sleeping at a regular time during the outbreak, measured on a 5-point Likert scale (0 = no regularity, to 4 = high regularity). We calculated an average score and the scale's reliability had $\omega = 0.749$ in April and $\omega = 0.804$ in July.

Finances

We asked whether the outbreak changed the financial circumstances of the respondent. Answer options were; yes, lost income; No; don't want to answer; and yes, increased income. We also asked about their financial worries, which was measured on a VAS ranging from not worried at all (coded as 0) to extremely worried (coded as 100).

COVID-19 Psychological Measures

Perceived Risk

We included five items to ask about perceived risk of (a) contracting COVID-19 within the next week, (b) within the next 2 months, (c) getting seriously ill if contracted; (d) chance of having COVID-19 and infecting others (asymptomatic spreader), and (e) chance of dying during the outbreak. The first three items are identical to the scale used by Mækelæ et al. (2020). We used a visual analog scale (VAS) ranging from 0 (no risk) to 100 (certainty). We calculated an average perceived risk score and the scale's reliability had $\omega = 0.738$ in April and $\omega = 0.783$ in July.

Trust in Authorities

Overreaction. We asked respondents whether their country does enough to fight the outbreak. Answer options were: "does enough," "don't know," "does not enough," and "overreacting" (Mækelæ et al., 2020). Furthermore, if they chose overreacting participants were asked three additional items; (a) overreacting because the virus is not that dangerous, (b) unreasonable restricting my personal freedom, (c) personal and financial costs are greater than the threat by the virus. This was measured on a 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5).

Trust. We used 8 items, newly created, to ask about trust, belief and confidence in government, the healthcare system and researchers/science on a 5-point Likert scale from 0 (don't agree) to 4 (fully agree). We used the average score and the scale's reliability had $\omega = 0.936$ in April and $\omega = 0.944$ in July.

Conspiracy Score. We asked how much respondents endorsed different conspiracy theories such as "The virus is part of a Chinese biological weapons program." We also presented three factual statements, e.g., "the virus belongs to the SARS family." Responses were scored on a VAS from 0 = not true at all to 100 = absolutely true (Mækelæ et al., 2020). We calculated a difference score between belief in conspiracy theories and knowledge. A positive score indicates endorsement of conspiracy theories. McDonald's ω was 0.734.

Thriving. We used a newly created Thriving Scale based on research into optimal human functioning and positive psychology (Maslow, 1965; Antonovsky, 1979; Ryff and Singer, 1996; Ryan and Deci, 2000; Keyes, 2005; Diener et al., 2009; Seligman, 2011). The scale was adapted to assess important factors for thriving in the situation of a large scale crisis, and items were created similar to our ESM studies (Lüdtke et al., 2021). It has eight items on a 5-point Likert scale ranging from 0 (don't agree) to 4 (strongly agree). Items probed social contribution and finding meaning ("Helping and contributing in this time feels meaningful"), Sense of belonging ("This situation makes me feel like a part of a larger community"), Pride and social actualization ("I am proud of how my community is responding to this crisis"), Gratitude ("In this situation I still have so much to be grateful for"), Compassion ("I am moved by others suffering and I want to help"), social integration and common purpose ("We all need to work together in this situation"), belief in growth and learning ("We can learn a lot from this situation"), and social norms ("I follow the guidelines"). We calculated an average score. McDonalds ω was 0.817 in April and ω was 0.755 in July.

Negative Mindset. We used a newly created Negative Mindset Scale with six items on a 5-point Likert scale. The items were; excessive worry ("I am very worried about the outbreak"), catastrophizing thoughts ("I fear that the infrastructure will break down," "I feel humanity will never be the same after this outbreak"), experiencing a lack of control ("The uncertainty of this time scares me," "I feel we can control the outbreak" (reverse scored), and feeling scared ("I am scared of the outbreak"). We calculated an average score. Internal consistency was $\omega = 0.777$ in April and $\omega = 0.775$ in July.

Epistemic Belief. We adapted two items from the epistemic-aleatory uncertainty scale (Ülkümen et al., 2016); (a) The COVID-19 outbreak has an element of randomness; (b) The COVID-19 outbreak becomes more predictable with additional knowledge or skills. Scoring was on a VAS from 0 = not at all true to 100 = absolutely true. We calculated a difference score of epistemic and aleatory uncertainty, i.e., average VAS score for (b) and (a). A positive score might indicate a more scientific thinking style.

General Distress. We measured global distress with 9 items from the Clinical Outcomes in Routine Evaluation (CORE-10) (Connell et al., 2007). As advised by the ethical committee, we omitted the "I made plans to end my life" item as a high score on this item mandates counseling. The scale ranged from not at all (0) to most or all of the time (4). We calculated a sum score for the CORE-9. Internal consistency was $\omega = 0.86$ in April and $\omega = 0.859$ in July.

Paranoia. We measured paranoid thoughts with 10 items on persecutory and grandiose delusions, and on anomalous perceptions through the Brief 10-Item Community Assessment of Psychic Experiences-Positive Scale (Brief CAPE-P10, items: 2, 6, 7, 10, 13, 22, 32, 33, 42) (Stefanis et al., 2002). Answer options were from never (0) to nearly always (3). We calculated an average score. The Brief CAPE-P10 score had $\omega = 0.833$ in April and $\omega = 0.812$ in July.

Demographics. We asked for age, gender, country of residency, education (five steps from <8 years of schooling coded as 0 to Master/PhD education coded as 4), SES (asking in five steps from bottom 10% to top 10%), people (separate children) living in the household, living space (asking from <10 square meters to more than 120 square meters). We also asked coarsely for political affiliation, i.e., "In political matters, people often talk of 'the left' and 'the right'. How would you place your views

on this scale, generally speaking?" in all but the Norwegian and German survey.

The same items were used in the July survey with the exception of omitting the knowledge about the virus scale, i.e., there was no conspiracy score. We also asked for fewer demographic items in the July survey. Presentation of the order of items within a scale were randomized.

Statistical Analysis

To test which factors predict general distress (hypothesis 1) we conducted a linear mixed model with the general distress score (CORE-9) as the outcome, country as a random effect and thriving, regularity, trust, financial worry, paranoia, negative mindset, perceived risk, perceived efficacy of actions, gender, and education as the predictors. Survey distribution time (April or July) was entered as a fixed effect.

To address hypothesis 2 we run a linear mixed model for the paranoia score (CAPE-P10) as the dependent variable and as fixed effects: thriving, regularity, trust, financial worry, negative mindset, general distress, perceived risk, perceived efficacy of actions, gender and education. Country was entered as a random effect and wave as fixed effect. We also run a linear mixed model with the same predictors complemented with the conspiracy score for the April data.

Since we expected a positive relationship between general distress and paranoia (Sun et al., 2019; Mækelæ et al., 2020), we applied mediation analysis with general distress being the predictor, paranoia score the outcome and thriving, regularity, trust, negative mindset, perceived risk and perceived efficacy as mediators.

To examine the predictors of satisfaction and dissatisfaction with the actions taken to counteract the outbreak in one's country (hypothesis 3) we conducted a generalized mixed model with satisfaction as the binary outcome variable with the following predictors: thriving, regularity, trust, financial worry, conspiracy score, paranoia, negative mindset, general distress, perceived risk, efficacy of actions, gender and education. Country was included as a random effect. For comparing April and July (fixed effect) the predictor conspiracy score was omitted.

To examine the relationship between usual day activities and general distress we performed correlation analyses and compared April and July correlations using z transformation.

We used frequentist analysis and a significance criterion of $p < 0.05$ for the two mixed models and for the logistic regression (pre-registered hypotheses). All predictors and outcomes were centered. For the exploratory analysis we corrected for multiple testing. We used Jamovi (The Jamovi Project, 2021) and R (R Core Team, 2017) for data analysis and visualization. Results without country as a predictor are reported in the **Supplementary Material** (SOM).

The analyses in this study were formally pre-registered. However, the analyses presented below deviate from the pre-registration and are only conceptually similar, as our statistical approach focused on longitudinal outcomes and required us to collect over 1,000 responses in July. In reality, we were able to collect only 731 valid responses in July.

Power Analysis

There is considerable variation in the recommendation of required samples for multiple and hierarchical regression analysis. We follow a rule of thumb for multiple regression (Brysbaert, 2019), i.e., 100 participants plus another 100 for every predictor. Since we had up to 11 predictors, we aimed to recruit at least $N = 1{,}200$ participants to partake in each survey.

RESULTS

Over 2,500 participants answered our April survey, with 2,214 respondents from our five target countries. The remaining respondents were from Sweden ($n = 37$), the US ($n = 85$), UK ($n = 21$), Canada ($n = 15$), France ($n = 10$), Austria ($n = 8$), Denmark ($n = 6$) and the remaining from over 25 other countries. In July 844 participated in the follow-up survey, with 731 from the five target countries and the remaining respondents were from the US ($n = 33$), Austria ($n = 7$) and over 15 other countries.

Our sample was well-educated, over 70% female, most identified themselves as belonging to the middle class, and very few had an infection with SARS-CoV-2 (for details see **Table 1**). The sample in July was similar in age [$F_{(1,\ 2{,}932)} = 4.94$, $p = 0.026$, $\eta_p^2 = 0.002$], gender ($\chi^2 = 1.37$, $p = 0.504$), education [$F_{(1,\ 2{,}655)} = 0.078$, $p = 0.78$, $\eta_p^2 < 0.001$] and reported SES [$F_{(1,\ 2{,}477)} = 1.53$, $p = 0.0216$, $\eta_p^2 = 0.001$], suggesting no systematic attrition.

The countries differed markedly in the proportion of participants stating that their country overreacted, 46.5% of German respondents said so, followed by 15% of participants from Israel, 4% from Norway, 2% from Brazil and <1% from Colombia. Those participants felt that the costs of a lockdown are too high and their personal freedom was too restricted. Only half of them stated that the virus is harmless.

As can be seen in **Figure 1** from April to July there was no change in general distress and paranoia [statistical details, reporting difference between the countries are reported in the **Supplementary Material** (SOM)]. Thriving decreased in four of the five countries from April to July. Regularity, on the other hand, increased slightly from April to July. As for trust in their authorities, overall trust did not change from April to July. On average, there was a reduction in negative mindset from April to July whereas the predictability rating of the pandemic slightly increased from April to July. Across all five countries, perceived risk of COVID-19 did not change from April to July. Financial worries, on average, reduced from April to July. Regarding the expected duration of the restrictions, across all countries participants expected longer lasting restrictions when asked again in July.

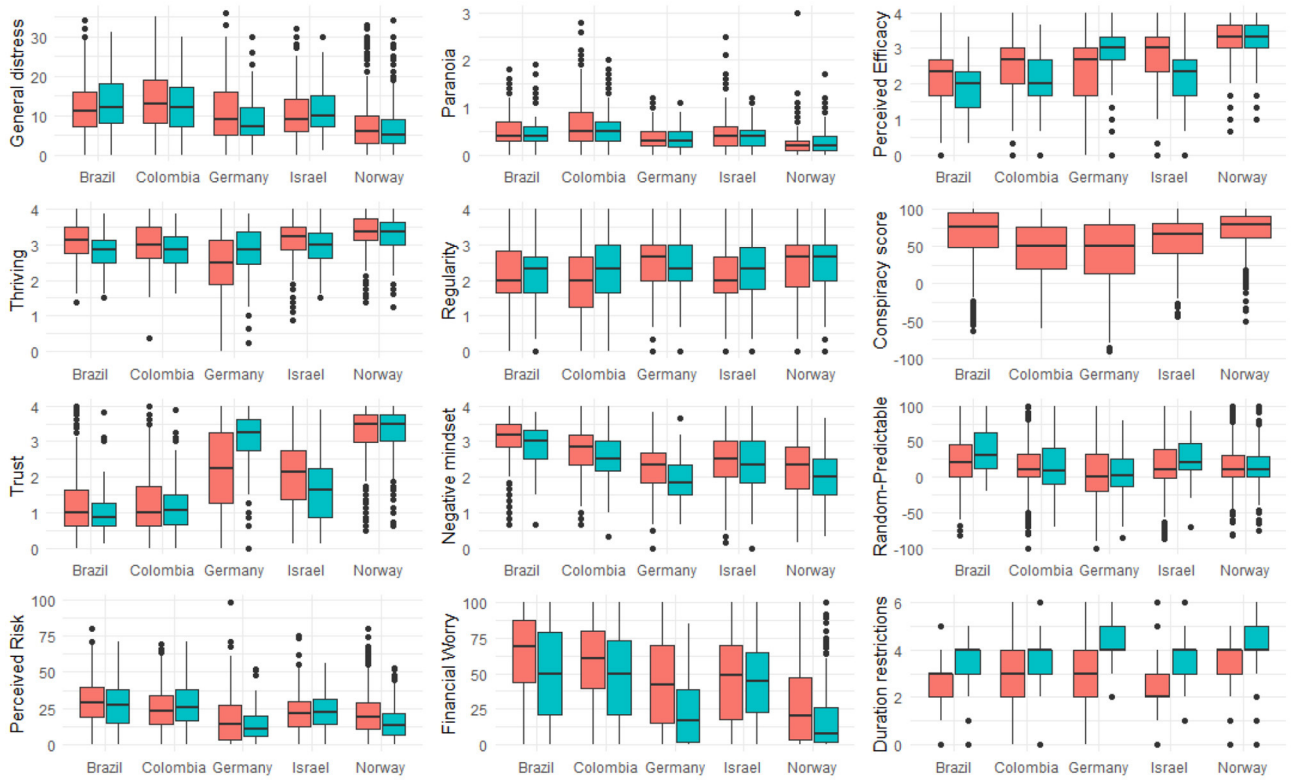

FIGURE 1 | Boxplots indicating the median, second and third quartiles and outliers for the dependent and independent measures included in our study. Red = April data, Blue = July data. No data are available for conspiracy theories in July as we omitted this scale. For statistical details see **Supplementary Material**, page 3ff.

Protective and Risk Factors for General Distress

The linear mixed model testing our first hypothesis explained 44.7% of the variance. There was no significant change in distress from April (Mean= 9.73, SD = 0.291) to July (Mean = 10.11, SD = 0.395). Perceived efficacy of governmental reactions and trust in authorities were not significant predictors of general distress. Thriving and maintaining a regular schedule demonstrated protective qualities, i.e., higher scores yielded lower general distress. A negative mindset, paranoia, high perceived COVID-19 infection risk, financial worries and being female predicted more distress. The random effect of country was significant (LRT[1] = 9.27, $p = 0.002$). **Table 2** reports the estimates of the mixed model and **Figures 2**, **3** shows the estimates per country and for the April and July survey, respectively.

Protective and Risk Factors for Paranoia

The linear mixed model for paranoia and for April and July explained 25.5% of the variance. The fixed effect of wave was small, $F_{(1, 2,498)} = 4.042$, $p = 0.045$. We therefore report the model for April only but including the conspiracy score as predictor. The mixed model for paranoia in April explained 24.5% of the variance. The paranoia score differed by country (LRT = 75.4, $p < 0.001$). The less regularity and trust respondents reported, and the lower their level of education, the more paranoia they experienced. Being male was also associated with paranoia, so was a higher conspiracy score and general distress. Financial worries, negative mindset, perceived risk, perceived efficacy and trust were not associated with more paranoia. **Table 3** reports the estimates and **Figure 4** shows that there is more variation between the indices than the countries.

We found the same pattern of results when analyzing data from April and July separately, using all data irrespective of country. Thriving and regularity were protective whereas paranoia, negative mindset, financial worry and being female were risk factors for general distress (see **Supplementary Material** for details). Similarly, general distress was a significant predictor for paranoia. The overall pattern for general distress and paranoia emerged also when using the longitudinal subset ($n = 525$), i.e., participants who took part both in April and July (see **Supplementary Material** for details, page 20).

Which Factors Mediate the Relationship Between Distress and Paranoia?

As **Figures 2–4** show there is a positive relationship between general distress and paranoia. We therefore investigated (using the April data) whether any of the protective and risk factors

[1]LRT, Loglikelihood ratio.

TABLE 2 | Fixed effects parameter estimates for general distress.

Predictor	Estimate	SE	95% confidence interval		df	*t*	*p*
			Lower	Upper			
(Intercept)	9.918	0.311	9.309	10.527	4.86	31.929	<0.001
Thriving	−2.071	0.206	−2.474	−1.667	1,386.07	−10.05	<0.001
Regular schedules	−1.5	0.119	−1.733	−1.267	2,496.67	−12.643	<0.001
Trust in authorities	−0.225	0.151	−0.521	0.07	567.56	−1.494	0.136
Financial worry	0.034	0.004	0.027	0.042	2,464.44	8.772	<0.001
Paranoia	4.69	0.35	4.003	5.376	2,349.32	13.394	<0.001
Negative mindset	2.103	0.167	1.777	2.429	2,391.18	12.629	<0.001
COVID-19 risk	0.031	0.008	0.016	0.047	2,497.91	3.99	<0.001
Perceived efficacy	−0.032	0.178	−0.382	0.317	2,349.51	−0.182	0.855
Gender	1.303	0.238	0.837	1.769	2,491.69	5.478	<0.001
Education	−0.221	0.126	−0.469	0.026	1,890.57	−1.753	0.08
T2July - T1April	0.38	0.308	−0.224	0.984	2,418.79	1.234	0.217

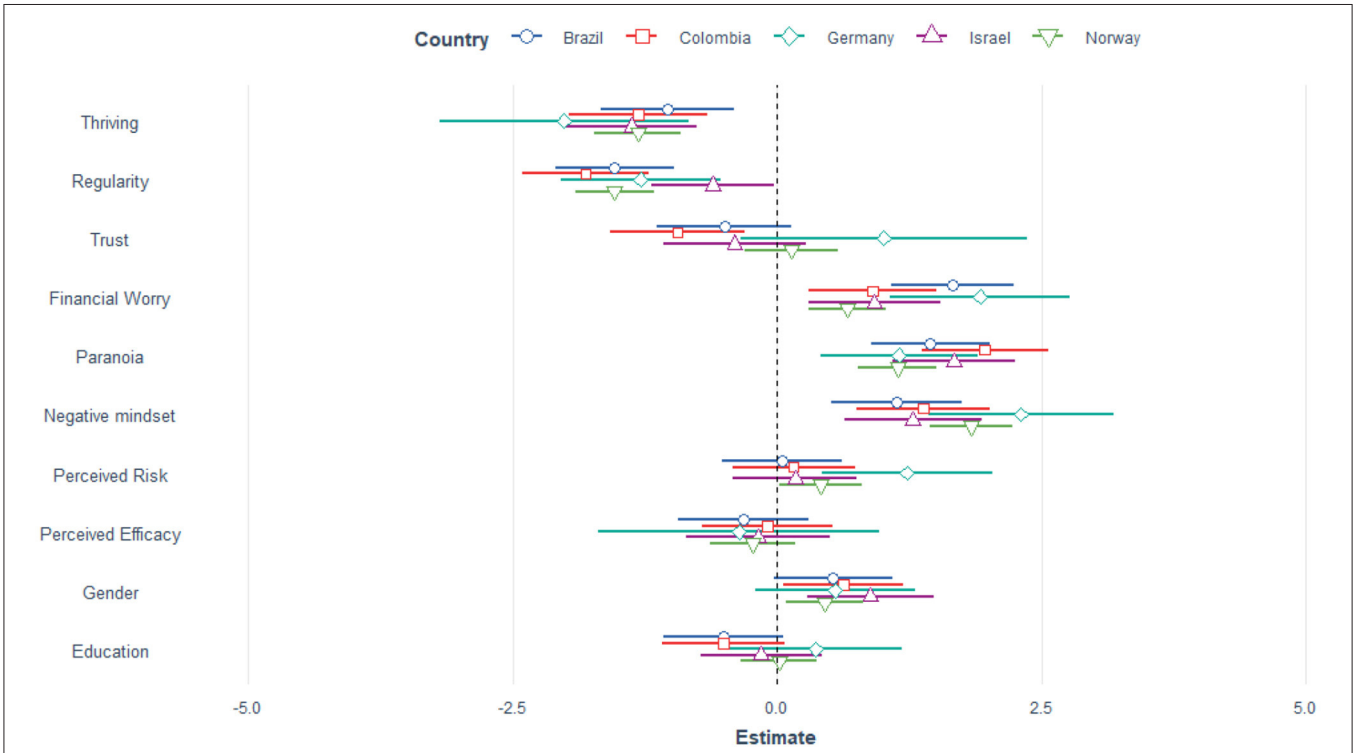

FIGURE 2 | Estimates for the 10 predictors of general distress per country, April data. Gender is coded as male = 0, 1 = female, 2 = other.

could mediate the relationship, i.e., would there be a significant indirect effect. Mediators were thriving, regularity, trust, negative mindset, perceived risk and perceived efficacy. The direct effect between distress and paranoia explained 98% of the variance whereas the indirect effect of thriving explained only 2%, $Z = 1.75$, $p = 0.079$. Similarly a negative mindset did not mediate the relationship, 2.68%, $Z = 1.65$, $p = 0.1$. On the other hand regularity significantly mediated the relationship between distress and paranoia, 9.27%, $Z = 5.03$, $p < 0.001$, so did trust: 17.1%, $Z = 9.27$, $p < 0.001$, perceived risk: 2.51%, $Z = 2.62$, $p = 0.009$ and perceived efficacy: 7.46%, $Z = 5.86$, $p < 0.001$. Thus, a more regular schedule, higher trust in authorities, lower perceived risk and higher perceived efficacy of actions reduced the association between distress and paranoia.

What Characterizes Those Who Think Their Country Overreacted?

Finally, our third hypothesis that predicted more distress and paranoia among those who think that their country overreacted was not confirmed. Firstly, the relative number of participants stating that their country overreacted was lower in July than in April [estimate = −4.42, exp(B) = 0.012, z = −4.84, $p < 0.001$].

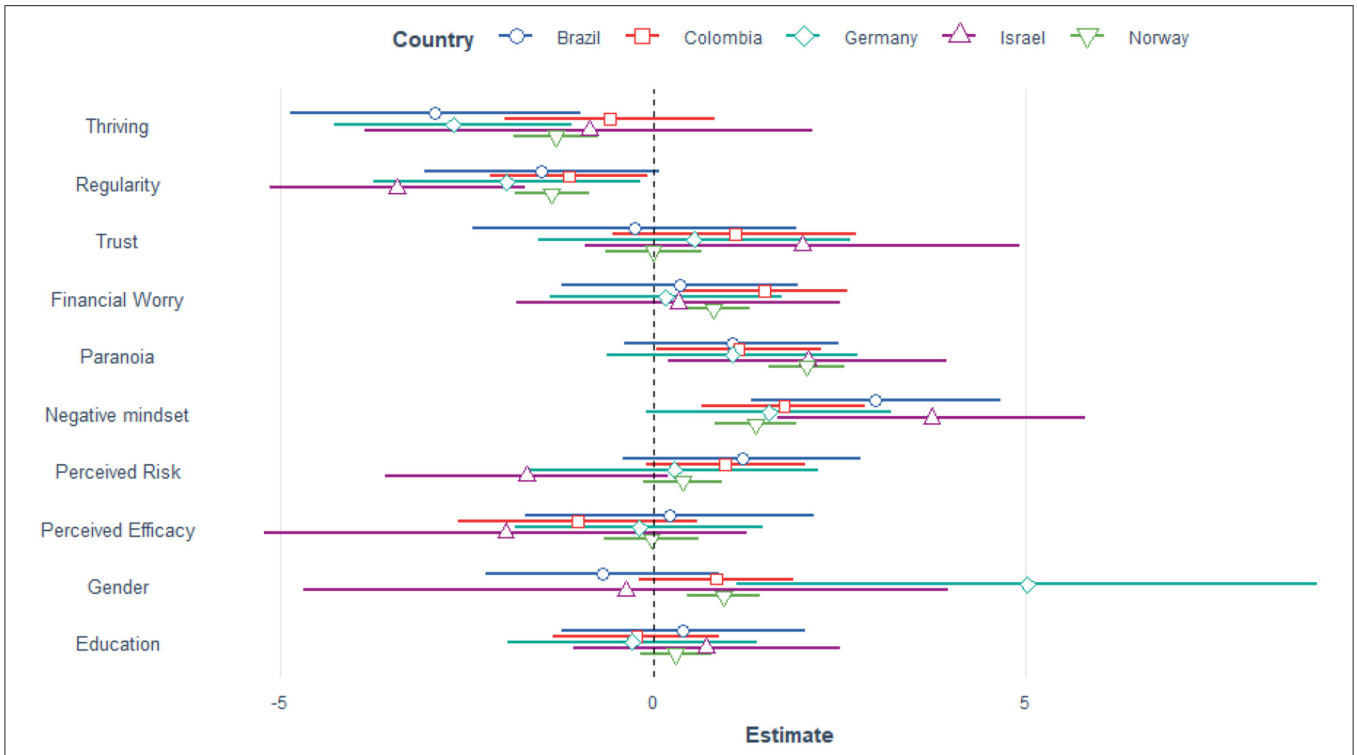

FIGURE 3 | Estimates for the 10 predictors of general distress per country, July data. As can be seen, the difference between the months and between the countries is smaller than between the predictors. Gender is coded as male = 0, 1 = female, 2 = other.

TABLE 3 | Fixed effects parameter estimates for paranoia.

			95% confidence interval				
Predictor	**Estimate**	**SE**	**Lower**	**Upper**	**df**	***t***	***p***
(Intercept)	0.415	0.044	0.329	0.5	4.09	9.478	<0.001
Thriving	0.008	0.012	−0.015	0.031	2,475.05	0.699	0.485
Regular schedules	−0.024	0.007	−0.037	−0.011	2,495.66	−3.572	<0.001
Trust in authorities	−0.012	0.009	−0.029	0.005	2,348.3	−1.41	0.159
Financial worry	0.0004	0.0002	−0.0001	0.001	2,497.58	1.633	0.103
Negative mindset	−0.008	0.009	−0.027	0.011	2,497.99	−0.85	0.396
General distress	0.014	0.001	0.012	0.016	2,495.58	13.299	<0.001
COVID-19 risk	0.001	0.0004	0.0002	0.002	2,495.19	2.49	0.013
Perceived efficacy	−0.02	0.01	−0.04	−0.001	2,497.99	−2.063	0.039
Gender	−0.053	0.013	−0.079	−0.027	2,496.78	−4.055	<0.001
Education	−0.032	0.007	−0.046	−0.019	2,493.36	−4.612	<0.001
T2July - T1April	0.034	0.017	8.55E-04	0.067	2,497.64	2.01	0.045

Secondly, applying generalized mixed model (logit link function, country as cluster variable/random intercept) for the April data (**Table 4**), dissatisfied participants had a significant lower score on thriving ($\chi^2 = 21.05$, $p < 0.001$), trust in authorities ($\chi^2 = 17.11$, $p < 0.001$) and perceived efficacy ($\chi^2 = 10.09$, $p < 0.001$), but also demonstrated less characteristics of a negative mindset ($\chi^2 = 27.35$, $p < 0.001$) and endorsed conspiracy theories more ($\chi^2 = 36.73$, $p < 0.001$). They showed no differences in general distress, financial worries, regularity, education, gender or paranoia. Their perceived risk was somewhat higher but not significantly so. Overall the model explained 68.5% of the variance (R^2 conditional). Applying a similar model without the conspiracy score but with wave as fixed effect yielded very similar results, i.e., thriving, trust in authorities, perceived efficacy and negative mindset were significant predictors. In addition, lower perceived risk significantly predicted dissatisfaction with the governmental response [estimate = −0.02, exp(B) = 0.978, z = −3.102, $p = 0.002$].

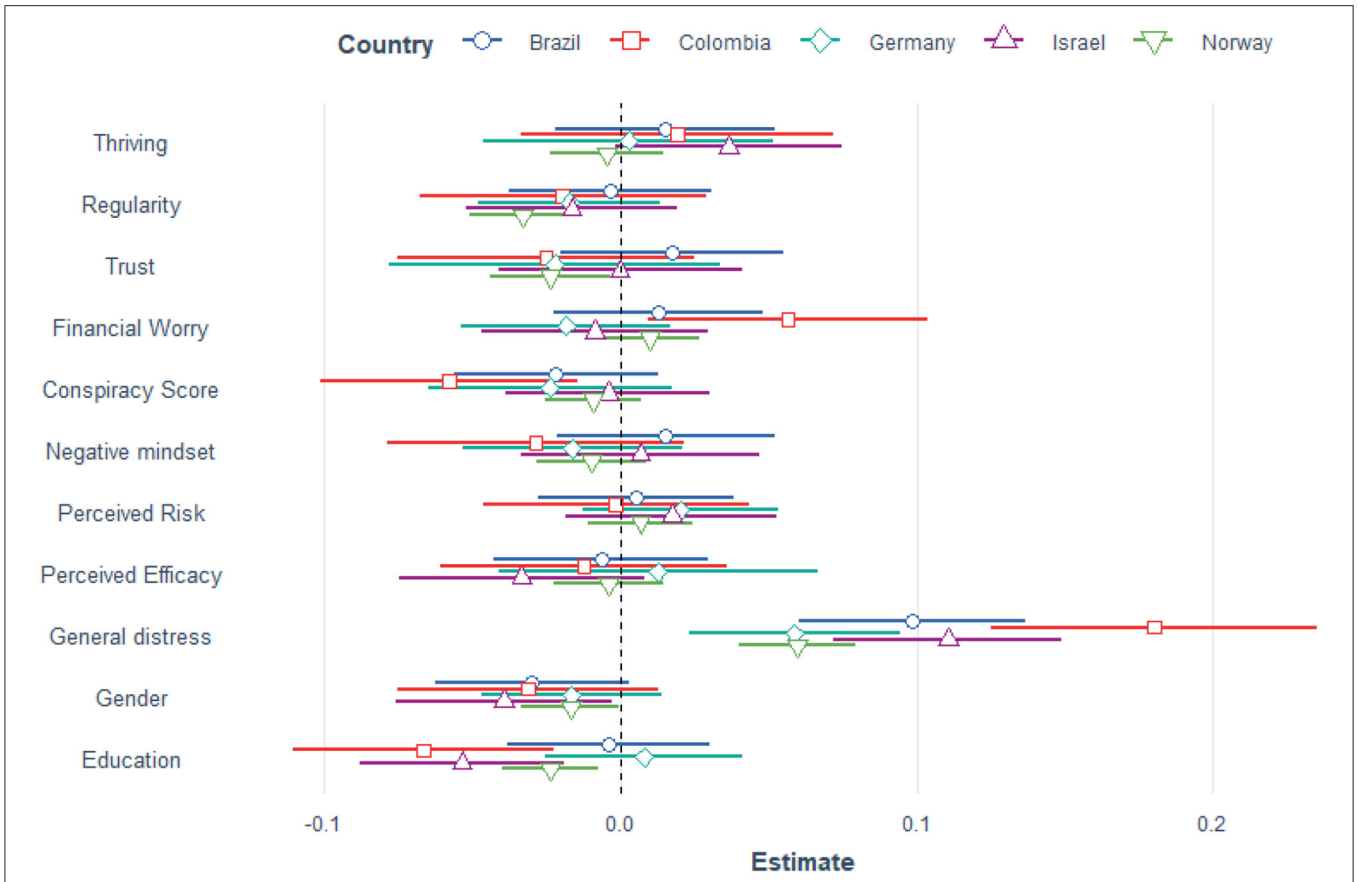

FIGURE 4 | Estimates for paranoia per country, April data.

TABLE 4 | Fixed effects parameter estimates for satisfaction.

				95% Exp(B) Confidence Interval			
Predictor	**Estimate**	**SE**	**exp(B)**	**Lower**	**Upper**	**z**	***p***
(Intercept)	−3.786	0.895	0.023	0.004	0.131	−4.229	<0.001
Thriving	−0.830	0.181	0.436	0.306	0.621	−4.587	<0.001
regular schedules	−0.032	0.115	0.968	0.774	1.212	−0.281	0.778
Trust in authorities	−0.59	0.143	0.555	0.419	0.733	−4.137	<0.001
Financial worry	0.003	0.004	1.003	0.996	1.010	0.824	0.410
Conspiracy score	−0.019	0.003	0.982	0.976	0.988	−6.061	<0.001
Paranoia	0.245	0.348	1.278	0.647	2.526	0.705	0.481
Negative mindset	−0.881	0.168	0.415	0.298	0.577	−5.230	<0.001
General distress	−0.019	0.019	0.981	0.945	1.018	−1.009	0.313
Risk	−0.015	0.007	0.985	0.971	0.999	−2.050	0.040
Perceived efficacy	−0.545	0.171	0.58	0.415	0.812	−3.177	0.001
Gender	−0.335	0.227	0.716	0.459	1.116	−1.477	0.140
Education	0.028	0.112	1.028	0.826	1.280	0.248	0.804

Comparison to March Data

In addition to the data described so far, we have also collected data in March 2020, investigating the perceived efficacy of COVID-19 restrictions and how those affect mental health (Sun et al., 2019; Mækelæ et al., 2020). The following will capitalize on similarities in the collected measures to cross-sectionally compare general distress, paranoia, conspiracy score and perceived risk, four measures that were identical (distress and

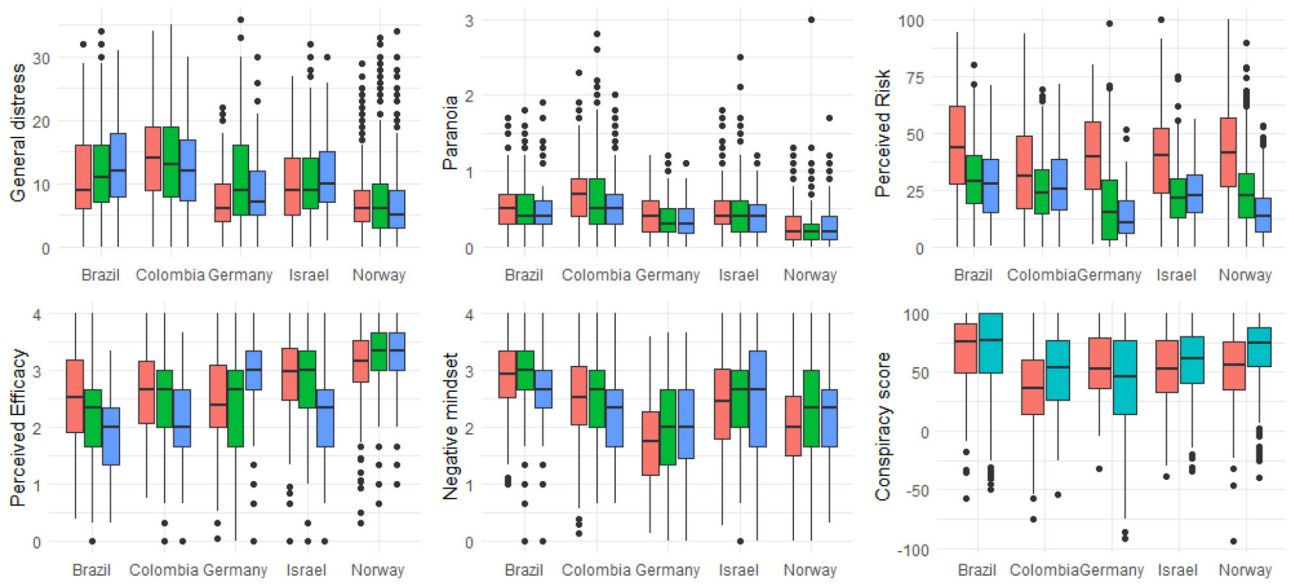

FIGURE 5 | Comparison to our March data. Paranoia and perceived risk declined from March to July. For more details, please see the **Supplementary Material**.

paranoia) or had overlapping items (conspiracy score, perceived risk) in all three surveys, see **Figure 5**.

Distress increased from March to April, $F_{(2,\ 4{,}671)} = 11.851$, $p < 0.001$, $\eta_p^2 = 0.004$. Paranoia, on the other hand, decreased in all countries from March to April, $F_{(2,\ 4{,}677)} = 16.189$, $p < 0.001$, $\eta_p^2 = 0.006$. There was a large reduction in perceived risk from March to April and an even greater reduction in July, $F_{(2,\ 4{,}656)} = 359.994$, $p < 0.001$, $\eta_p^2 = 0.129$. Finally, we compared the conspiracy score in March with April, and this score increased, $F_{(1,\ 3{,}891)} = 11.981$, $p < 0.001$, $\eta_p^2 = 0.003$, indicating that in April participants were more likely to endorse Covid-19 related conspiracy theories. Details by country and the interactions can be found in the **Supplementary Material**, page 21ff.

Exploratory Analysis of Usual Day Activities

Participants were asked to indicate how much time on a usual day they engage in each of 17 activities. Apart from procrastination we assumed that all other activities are either neutral (e.g., child care) or beneficial for mental health (being outdoors). Briefly, we found that procrastinators had a higher score on general distress than participants who spent no or little time procrastinating ($\rho = 0.249$, $p < 0.001$). General distress was also lower among those who exercised ($\rho = -0.131$, $p < 0.001$) and could and did go outdoors ($\rho = -0.107$, $p < 0.001$). Details are reported in the **Supplementary Material**, page 30.

DISCUSSION

This study aimed to identify resilience factors protecting from distress and paranoia during the 2020 COVID-19 outbreak. We collected data from more than 2,000 participants in 5 countries (Norway, Germany, Brazil, Columbia, and Israel) in two waves in April and July. We found that the prolonged disruption of normal life and imposed social restrictions did not lead to a gradual increase across time in general distress and paranoia. Compared to pandemic-onset levels in March, paranoia decreased, though distress in April was higher than in March. Furthermore, we identified protective factors that contributed to reducing general distress and paranoia during the pandemic. Our data show a beneficial effect of thriving and maintaining a regular schedule, with little to no influence of demographic factors such as gender, age and education. As predicted, financial concerns increased distress and paranoia. In what follows, we provide a detailed overview of our main findings and their potential implications.

As far as distress and paranoia are concerned, we found no change between April and July. Even though the various countermeasures enacted by governments led to a prolonged disruption of normal life, distress and paranoia did not gradually increase. In fact, paranoia levels even decreased compared to data collected in March (Mækelæ et al., 2020). Rather, our results indicate that the majority of respondents in our sample grew accustomed to the changed circumstances and may have even perceived them as "The new normal." Supporting this interpretation, our participants indicated in July that they can better maintain a regular schedule (regularity), rated the pandemic as more predictable, and predicted it will last longer compared to the April ratings. In addition, both protective and risk factors for distress exerted decreased influence in July compared to April. It is possible that regularity, predictability and reduced uncertainty had offset the negative impact of the demanding nature of dealing with a pandemic. Increased regularity and predictability may have assisted individuals to perceive the pandemic as more manageable and to better arrange their resources (Lazarus and Folkman, 1974). This is consistent with Antonovsky's (1979) work showing that resilience

is enhanced when an event is appraised as comprehensible, manageable and meaningful. Such adaptation might also benefit from self-efficacy (Southwick and Charney, 2012). Already in our March sample, we saw that high perceived efficacy, including own actions, was associated with a feeling of controlling the outbreak (Mækelæ et al., 2020). Together with high levels of social support and physical exercising that may result from regularity, self-efficacy leads to active problem-focused coping and reduce stress levels (Taylor and Stanton, 2007; Southwick and Charney, 2012). Overall, our data show that people may adapt to a demanding situation once it is perceived as predictable and manageable.

Adaptation is a core tenet of human behavior. Within the field of happiness economics, it is known that individuals adapt to both prosperity and to adversity and return to their natural levels of happiness (Carol, 2009; Simchon et al., 2020). Furthermore, people are better at adapting to an unpleasant certainty than they are to uncertainty. A long-term study found a reduction or return to normal levels of anxiety among people in isolation during MERS (Jeong et al., 2016). Studies also have shown reductions in worry (Bendau et al., 2020; Varga et al., 2021) and a slight increase in happiness during the late phase of the COVID-19 lockdown in April 2020 (Stieger et al., 2021). Similarly, a recent study (Bendau et al., 2021) found that COVID-19-related fear, anxiety, and depressive symptoms decreased on average over time (March to June), again showing that most people grow accustomed to challenging new situation over time. Our investigation joins these studies in showing that as far as explicit manifestations of mental well-being go, humans display high adaptability to adverse events.

At the beginning of the pandemic in March, the perceived risk of contagion was higher in the five countries compared to the perceived risk in April (Mækelæ et al., 2020). Perceived risk of contagion across all five countries did not change from April to July, and the perceived risk in July was lower than the perceived risk from March. As perceived risk mediated the relationship between distress and paranoia, fostering valid estimations of perceived risk might assist in attenuating detrimental mental health-related outcomes. Further, risk communication should exploit graphical, verbal and numerical formats to nurture realistic perceived risks (Engeset et al., 2018; van der Bles et al., 2019).

In this study, we used a newly created thriving scale based on research into optimal human functioning and positive psychology (Maslow, 1965; Antonovsky, 1979; Ryff and Singer, 1996; Ryan and Deci, 2000; Keyes, 2005; Diener et al., 2009; Seligman, 2011). The scale had good reliability and its goal was not to measure the minimization of loss but instead a positive response to challenges (O'Leary and Ickovics, 1995). Participants who scored high on thriving, reported less general distress, and were more satisfied with how their country reacted to the outbreak. Our finding suggests that an individual's ability to create meaning and a sense of belonging in a challenging situation, as well as finding opportunities for growth and learning, can act as a buffer against distress. Thriving may benefit from social contribution and actualization, as well as pro-social emotions such as gratitude, compassion, and pride (Tracy and Robins, 2007; Williams and DeSteno, 2008; Schueller and Seligman, 2010; Provencher and Keyes, 2011; Cheng et al., 2015; Otto et al., 2016). Indeed, the interpersonal aspect may be substantial and could act as a catalyst for thriving (Feeney and Collins, 2014). Similarly, social support, mastery and optimism are found to be coping resources for stressful events (Taylor and Stanton, 2007; Southwick and Charney, 2012).

Regularity of sleep, eating and daily schedule was greatly beneficial for reducing both general distress and paranoia. These findings are consistent with previous work showing that regularity of sleep, exercise and social rhythm is linked to improved mental health and well-being (Grandin et al., 2006; Margraf et al., 2016; Boland et al., 2019; Logan and McClung, 2019). Maintaining regularity is especially important if circadian rhythms and related routine social cues (zeitgebers) are hampered during the pandemic, and can be a potential target for intervention (Murray et al., 2020).

We did not find that trust in government was a protective factor against general distress and paranoia. Notably, previous investigations have highlighted trust as an important factor in preserving mental well-being (Helliwell and Huang, 2008). This is true also in the specific context of the early phase of the Covid-19 pandemic (Bäuerle et al., 2020; Harris and Sandal, 2020; Jovančević and Milićevi, 2020; Mækelæ et al., 2020; Paolini et al., 2020). The countries included in the present study differed significantly on trust in authorities and distress with Brazilians and Colombians reporting lower trust and higher distress than the citizens of other countries (see **Figure 1** and **Supplementary Material**), potentially indicating the specific socio-political circumstances in each country that might have led to different contributions of trust across these countries.

In the domain of risk factors, we found that excessive worry, catastrophizing thoughts, feeling scared and experiencing a lack of control, all components of the negative mindset scale, were consistently related to increased general distress. Catastrophizing, broadly conceived as an exaggerated negative "mental set," is associated with high levels of situational depression, anxiety, anger, and sadness. These transient subclinical states of emotional distress could be the vehicle through which catastrophizing impacts on pain mental health (Sullivan et al., 2001). This is in line with a breadth of recent research on worry and mental health (Freeman et al., 2011; Sun et al., 2019; Bendau et al., 2020; Lüdtke et al., 2021). Similarly, the similar levels of general distress compared to March accompanied by the reduced perceived risk of contagion suggest that financial and additional worries (measured by the negative mindset scale) contribute to general distress after the initial uncertain phase of the pandemic has passed.

Our results are also in line with previously reported strong relationships between irrational beliefs and distress (Vîslă et al., 2016). Indeed, recent research links paranoia and delusions to heightened perceived volatility (Deserno et al., 2020; Kreis et al., 2021). A reduced feeling of control, in combination with reduced regularity and less trust, might explain why a small proportion of respondents endorse conspiracy theories and paranoid ideations (Graeupner and Coman, 2017; Bierwiaczonek et al., 2020; Jolley and Paterson, 2020; Jovančević and Milićevi, 2020; Romer and Jamieson, 2020; Uscinski et al., 2020).

Limitations

Our study is a convenience sample, biased toward educated and female respondents and only very few have had a SARS-CoV-2 infection or a close family member who have had it. Particularly in Brazil, a country with high social inequality and unequal access to the internet (Silva et al., 2020), our sample is mostly from the middle class.

To ensure a high completion rate of the survey we limited the number of protective and risk factors. We did not ask about sleep quality, though sleep quality is beneficial for mental health, e.g., Lüdtke et al. (2021). We used an abbreviated version of the CAPE positive scale and the short form of the clinical outcome (CORE) measure. We also did not ask about protective behavior, or used scales to measure anxiety.

The different scales implemented in this study generally had good internal consistency, both across and within countries (see **Supplementary Material** for details). One notable exception pertains to the perceived efficacy of actions scale, with internal consistency around 0.6. Accordingly, the lack of effect of this scale on distress and paranoia, as well as its role in mediating the relationship between distress and paranoia, should be interpreted with caution.

The selection of the five countries is due to the researcher's location and access to those data. Our focus was not in comparing those five countries, quite the opposite. We set out to find similarities despite known economic and cultural differences.

Conclusions

Our study exploited the unprecedented opportunity to measure general distress and paranoia in the general population across five countries varying in their socio-economy during the early phase of the COVID-19 outbreak. Despite large differences in the countries' welfare system and handling of the pandemic, we found the same psychological factors being associated with distress and paranoia. Maintaining a regular schedule was greatly beneficial for both general distress and retaining low paranoia. Across all countries, thriving was highly beneficial for reducing general distress, whereas financial worries and a negative mindset were associated with increased general distress. In summary, our data show the remarkably adaptive and resilient nature of human beings as they grow accustomed to new situations when they have a supportive community and a sense of meaning in life. We hope that by shedding light on the factors contributing to adversarial growth our society will be better prepared for the upcoming events in this pandemic and in future prolonged negative society-level experiences.

DATA AVAILABILITY STATEMENT

The datasets for this study can be found on the Open Science Framework [https://osf.io/cx4yg/].

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the local ethics board at UiT (2017/2019), by the Norwegian Centre for research data (ref nr.: 287376) covering Europe. The study was also approved by the local ethics committee at Ben Gurion University and by the ethics committee from Facultad de Ciencias Humanas Universidad Nacional de Colombia. Sede Bogotá (Ethical approval No. B.VIE-FCH-21-2020). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

GP and MM conceived and designed the study. KK, ND, NR, RD, and RT recruited participants and translated the material. GP performed the statistical analysis. GP, MM, and NR wrote the first draft of the manuscript. All authors contributed to manuscript revisions and read and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.661149/full#supplementary-material

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Effects of Pandemic on Feelings of Depression in Italy: The Role of Age, Gender, and Individual Experiences During the First Lockdown

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The restrictions to physical contacts that have been imposed in different countries to deal with the coronavirus disease 2019 (COVID-19) pandemic may have contributed to an increase in feelings of depression on top of other negative consequences of the pandemic. This study examines the consequences of the COVID-19 pandemic on feelings of depression using original data collected in Italy between April 14 and 24, 2020. Quota sampling (N = 3,026) was performed to target the population of 18+ and, together with post-stratification weights, permitted obtaining a representative sample of the Italian population with respect to key sociodemographic factors. We find that 47% of the respondents have increased depressive feelings during the Covid-19 lockdown. Adopting a life-course perspective, we revealed great heterogeneity in feelings of depression consequences by age, gender, and difficulties experienced during the first national lockdown. Identifying groups of population at higher risk of suffering from feelings of depression as a result of COVID-19 is crucial to limit indirect long-term consequences of the pandemic.

Keywords: coronavirus disease 2019, depressive feelings, life-course, gender, age, Italy

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INTRODUCTION

The health and economic crisis generated by the coronavirus disease 2019 (COVID-19) pandemic is unprecedented in recent human history. To this day, most scientific efforts have been dedicated to the study of the direct consequences of the pandemic on mortality and morbidity, especially among the oldest groups of the population (e.g., Drefahl et al., 2020), although studies focusing on consequences in other domains have been increasing as shown by Luppi et al. (2020) on fertility plans and Churchill (2020) on employment. Apart from physical health, the COVID-19 pandemic has affected psychological well-being. Previous studies have documented increased levels of depression (Arpino et al., 2020a; Mazza et al., 2020; Roma et al., 2020), stress (Mazza et al., 2020; Roma et al., 2020), loneliness (Orgilés et al., 2020), and anxiety (Mazza et al., 2020) during the lockdown period (for review Serafini et al., 2020 and Xiong et al., 2020). In fact, although necessary non-pharmaceutical measures implemented to fight the spread of COVID-19 have had and will likely produce profound and enduring consequences on the life of people (e.g., income and employment and interpersonal relationships), which, in turn, affect the psychological well-being of an individual.

Previous research has identified several factors associated with worsened psychological well-being during the lockdown. For example, studies have found that women and younger individuals have particularly suffered in terms of increased anxiety, depression, and stress (Mazza et al., 2020; Roma et al., 2020). However, age and gender have been usually analyzed as separate independent factors (e.g., Mazza et al., 2020; Pieh et al., 2020; Roma et al., 2020), and intersectionality among them has been overlooked. By adopting a life-course approach (Elder, 1994), this study contributes to growing literature by examining combined heterogeneities in the consequences of lockdown on self-reported changes in feelings of depression by age and gender among Italians aged 18+ during the first nationwide lockdown. Indeed, a life-course approach to the study on psychological consequences of the pandemic is crucial because individuals of all ages have been strongly affected by the pandemic, although differently and for different reasons (Settersten et al., 2020). Within the life-course approach, the impact of any event on individuals needs a time-based perspective, since the magnitude of effects likely depends on the age of an individual, which makes people more or less likely to be exposed to events, and it also influences their reaction to them (Settersten et al., 2020). Thus, for a better understanding of pandemic effects on the feelings of depression of individuals, it is crucial to look at age-differentiated phenomena that occurred during the lockdown. The pandemic and the restrictions implemented to fight it have indeed created a variety of stressors that are more or less likely to apply to an individual depending on their age. The youngest individuals have been affected, for example, by school and university closures and subsequent distance learning re-organization (Champeaux et al., 2020), resulting in negative psychological consequences (Liu et al., 2020; Spinelli et al., 2020). Many adults have been affected in terms of their income and employment (Churchill, 2020) or relationships, especially within the household because of more time spent at home (Balzarini et al., 2020; Bellani and Vignoli, 2020). Precarious work and poor relationship with partner or other people are known risk factors for depression (Paul and Moser, 2009; Teo et al., 2013). Thus, negative consequences of the lockdown in these areas are additional factors that have likely increased feelings of depression.

The COVID-19 pandemic may have an impact on psychological well-being because of bereavement for COVID-related deaths of close relatives or friends. A large number of individuals may have lost their partner or parent (Verdery et al., 2020), and, apart from death, the pandemic also brings with it worries of contagion of loved ones. However, a recent study has found that being in contact with an infected person had no effect on the psychological and emotional states of individuals (Kopilaš et al., 2021). Bereavement and worries of contagion represent transversal consequences of the pandemic to all life-course stages; however, their prevalence may vary by age, and they may also impact differently on individuals of different ages. Since COVID-19 containment measures also affected sport-related activities, home workout was the only option to play sports and stay active during the pandemic. Thus, another evident cross-age consequence of the lockdown and restrictive measures was reduced physical activity (Maugeri et al., 2020). Studies have found that the psychological well-being of individuals who reduced their level of physical exercise during the lockdown has been negatively affected (Callow et al., 2020; Maugeri et al., 2020; Pieh et al., 2020).

The life-course perspective also emphasizes that the effects of events experienced by individuals vary by their structural roles within the society. In particular, the consequences of the pandemic and containment measures are likely to be gendered because all the events that have been mentioned above may entail gendered dynamics. For example, more time spent at home has implied a re-organization of family work with greater burden on the shoulders of women, at least in more traditional contexts like Italy (Del Boca et al., 2020). More women seem to have lost their job because of lockdowns and physical distancing measures (Churchill, 2020). Also, the higher number of deaths for men from COVID-19 (Nasiri et al., 2020) implies that women are more likely to suffer from bereavement due to the death of their partner.

Given the above discussion, we examine the consequences of COVID-19 pandemic on feelings of depression in Italy according to three dimensions: age, gender, and type of negative events experienced during the first nationwide lockdown. More specifically, we consider the effect on the self-reported increase in feelings of depression of having experienced any of the following: reduction in physical activity, worsened relationship with the partner, worsened relationship with other people, suffered income loss, job loss, difficulties with organizing work or study from home, death of a relative or friend due to COVID-19, or infection of a relative or friend. We focus on Italy as it has been the first country outside Asia to be severely hit by the pandemic. Italy was also the first among Western countries to implement a nationwide lockdown, which has been one of the strictest and longest worldwide (Plümper and Neumayer, 2020).

The contribution of this study to the growing literature on the psychological consequences of the pandemic is 2-fold. First, we examine a large set of specific events that Italians may have experienced during the first lockdown. Second, inspired by the life-course perspective, we examine the combined heterogeneities in the consequences of these negative experiences by age and gender.

MATERIALS AND METHODS

Data

The data were drawn from an online survey implemented in April 2020 on population aged 18+. The survey has been carried out through the online market survey platform called Lucid, which offers the opportunity to purchase samples for survey research and produces high quality, representative samples (Coppock and McClellan, 2019). Although an online survey can lead to coverage bias, the representativeness has been guaranteed by defining the sample quotas based on gender, age, region of residence, and education. Performing quota sampling ensures that the final sample is nearly identically

distributed as the country benchmark given by the statistics provided by the national statistical offices on the key socio-demographic factors listed above. Additionally, we have used post-stratification weights to adjust for small deviations in the sample from the benchmark population statistics.

The analytic sample consists of 3,026 individuals aged 18+ living in Italy and involved in the survey between the 14th and 24th of April, 2020. For more information on the survey, and to consult the full questionnaire employed, refer to Arpino et al. (2020b).

Dependent Variable

The dependent variable is a measure of self-reported changes in depressive feelings during the lockdown as compared with the pre-pandemic period. More specifically, the respondents were asked whether they felt sad or depressed either "more," "equally," or "less" often than usual (or not depressed at all) during the COVID-19 lockdown. This item allowed us to measure self-reported changes in feelings of depression in the absence of a pre-pandemic measure. The variable has been dichotomized, taking value 1 if a respondent reported to have felt sad or depressed more often than usual and 0 otherwise. Given the low number of individuals who reported feeling "less" depressed than before the lockdown (N = 115), when we tried dropping them from the analyses, the results were unchanged compared with those reported below.

Explanatory Variables

The main independent variables are gender and age of respondents and events experienced during the pandemic. Gender is a dummy variable (1 = female, 0 = male). Age has been categorized and included in the analyses as a set of dummy variables for the age groups (18–25 = reference, 26–35; 36–49; 50–64; and 65+). A set of dummy variables accounted for whether the respondents have experienced (=1) or not (=0) each of the following during the lockdown: "reduction in physical activity;" "worsened relationship with partner;" "worsened relationship with other people;" "suffered income loss;" "lost job;" "difficulties with organizing work or study from home;" "death of a relative or friend due to COVID-19;" and "a relative or friend was infected." Note that the respondents could report having experienced none of the previous circumstances, some of them, or even all of them.

Control Variables

The multivariate analyses include a series of control variables that have been found to be related to feelings of depression or related measures in previous studies in the context of the pandemic (e.g., Arpino et al., 2020a; Callow et al., 2020; Mazza et al., 2020) and before it (e.g., Teo et al., 2013). Sociodemographic characteristics, such as subjective economic situation of the respondents ("living comfortably on present income" or "coping on present income" vs. "finding it difficult on present income" or "finding it very difficult on present income") and the availability of kin (parents, children, and grandchildren) have been used as control variables. In addition, we controlled for the level of education (three levels based on the International Standard Classification of Education: "low" = below secondary education, "medium" = up to high school, and "high" = university education or above) and whether the respondents were or were not employed in the pre-COVID-19 period. Health was controlled by including two-health-related variables with regard to the period antecedent to the COVID-19 pandemic: self-perceived health of the respondents (0 = very good or good; 1 = fair, poor, or very poor) and any reported chronic disease (such as heart disease, hypertension, stroke, or cancer). An additional variable accounted for the severity level with which the region, where the respondents live was hit by the pandemic according to the tertiles of the distribution of Case-Fatality Rates (CFR) of COVID-19 at the regional level (NUTS-2).

Statistical Methods

We first performed descriptive analyses on the main variables. Then, we used logistic regression models to examine the associations between the probability of increased perceived depressive feelings and gender, age, and difficulties experienced during the lockdown (Model 1). Then, we added to the model an interaction term between age and gender to test whether the two variables had a combined effect on the probability of increased depressive feelings (Model 2). Finally, we included three-way interactions between age, gender, and each of the potential issues experienced during the pandemic listed above. In other words, we tested whether age and gender moderated the effects on the worsened psychological well-being of reduction in physical activity, worsened relationship with the partner or with other people, having suffered income loss or loss of job, any difficulties with organizing work or study from home, death of a relative or friend due to COVID-19, or infection of a relative or friend (Model 3). To ease the interpretation of results, we calculated predicted probabilities by age and gender (based on estimates from Model 2) and by whether or not the respondents experienced each of the above-mentioned pandemic effects (based on Model 3).

RESULTS

Weighted descriptive statistics for the main variables of interest are reported in **Table 1**. During the lockdown, about 47% of Italians aged 18+ have felt sad or depressed more often than usual. The sample of respondents was equally composed of men and women (50%), and about 1/4 of them were aged 65+, while the youngest individuals (18–25 years old) constituted about 10% of the total sample. With regard to the difficulties experienced during the 1st month of lockdown, descriptive findings show that about 47% of the individuals have reported a reduction in physical activity. About 10–15% of the respondents reported worsened relationship with the partner and with other people. In addition, about 35% of the individuals have been affected by income loss and 6% have lost their job during the lockdown. Overall, 15% of the surveyed individuals have suffered from difficulties in organizing work/study at home. Finally, in this sample, the percentage of individuals who had at least a

TABLE 1 | Descriptive statistics.

Variables	%
Dependent variable	
Increased feeling of depression	47.25
Independent variables	
Age categories	
18–25	9.52
26–35	13.25
36–49	24.40
50–64	27.04
65+	25.79
Gender	
Female	50.00
Difficulties experienced during the lockdown	
Reduction in physical activity	46.60
Worsened relation with partner	9.04
Worsened relation with other people	14.20
Suffered income loss	34.62
Lost job	6.12
Difficulties with organizing work or study from home	15.16
Death of a relative or friend due to Coronavirus	7.59
A relative or friend was infected	13.05
Education: Low	16.06
Education: Medium	75.81
Education: High	8.13
Difficult or very difficult coping with income	34.50
Poor health	34.06
Chronic diseases	29.34
Employed	48.92
Any child(ren)	59.09
Any grandchild(ren)	22.55
Parents alive	50.34
In couple	60.23
Living with at least one coresident	88.87

N = 3,026. Post-stratification weights are used. Source: Intergen-coronavirus disease 2019 (COVID) online survey. Data were collected between April 14 and 24, 2020.

relative and/or friend infected or died from COVID-19 was 8 and 13%, respectively.

Full tables of estimated coefficients from the logistic regression models are reported in **Supplementary Table A.1**. In the following, we, mostly, focus on predicted probabilities from Models 2 and 3 described above. Regression results from Model 1 point to a higher probability of increased feelings of depression for women ($p < 0.001$; **Supplementary Table A.1**). As for age, apparently, there are no statistically significant effects, although estimates from Model 1 point to an age gradient with older individuals displaying lower probabilities of increased feelings of depression compared with the reference category (age 18–25; **Supplementary Table A.1**). However, and more interestingly, some age differences appear more clearly from the predicted probabilities based on Model 2, which adds interactions between age and gender (**Table 2**).

Predicted probabilities, as shown in **Tables 2** and **3**, are presented together with CIs for pairwise comparisons. These intervals are centered on the predictions and have lengths equal to 2 × 1.39 × SEs. As shown by Goldstein and Healy (1995), this is necessary in order to have an average level of 5% significance for pairwise comparisons. In other words, in this way, we can compare any pair of CIs and interpret an overlap between them as no statistically significant difference between the corresponding predictions, whereas non-overlap reflects that they are at the 5%.

TABLE 2 | Predicted probabilities of increased feeling of depression by age and gender (CI for 5% pairwise comparisons).

Gender	Age				
	18–25	26–35	36–49	50–64	65+
Men	0.41 (0.35; 0.47)	0.49 (0.44; 0.55)	0.40 (0.36; 0.44)	0.39 (0.35; 0.43)	0.35 (0.30; 0.39)
Women	0.53 (0.47; 0.59)	0.54 (0.49; 0.58)	0.56 (0.52; 0.60)	0.51 (0.48; 0.55)	0.54 (0.49; 0.59)

N = 3,026. Post-stratification weights are used. Non-overlapping CIs indicate that the corresponding predicted probabilities are statistically significant with difference at the 5% level. Source: Intergen-COVID online survey. Data were collected between April 14 and 24, 2020.

Table 2 displays predicted probabilities of increased feelings of depression by age and gender (Model 2) showing that women are considerably more likely to have experienced increased feelings of depression compared with men. In fact, predicted probabilities for women are between 12 and 19 percentage points higher than those of men, but gender differences are statistically significant ($p < 0.05$) only for the three oldest age groups considered (36+). As for age, we observe a gendered pattern. While predicted probabilities of increased feelings of depression do not substantially vary across age groups for women (and all of them are above 50%), younger men tend to report considerably higher predicted probabilities compared with the oldest ones. In particular, men aged 26–36 represent the group at highest risk of increased depressive feelings, with a predicted probability of 49%, which is between 10 and 14 percentage points higher (and also statistically different) than those for the oldest age group considered (50–64 and 65+, respectively). Overall, women and adult men aged 26–36 are those who seem to have suffered more during the lockdown.

As for the events experienced during the lockdown, the results from Models 1 and 2 are very similar and show that most of the considered circumstances are significantly associated with a higher probability of increased feelings of depression, with few exceptions (**Supplementary Table A.1**). However, interests of authors are in assessing whether these effects vary by age and gender.

Table 3 shows predicted probabilities of increased feelings of depression by difficulties experienced during the lockdown, age groups, and gender. As expected, different circumstances showed a meaningful association with increased feelings of depression during the lockdown for different subgroups of the population. Reduced physical activity significantly increased the probability of increased feelings of depression especially among women aged 26+ and men aged 65+ ($p < 0.01$). The effects are also significant from a substantive point of view, especially for the oldest individuals. For example, among men aged 65+, those who did not reduce their physical activities had a 25% probability of increased feelings of depression compared with a 46% probability for those who did experience a reduction in physical activity. Having experienced a deterioration in relationship quality with partner was associated with an increased

TABLE 3 | Predicted probabilities of increased feeling of depression by age, gender, and difficulties experienced during the lockdown (CI for 5% pairwise comparisons).

Difficulties experienced during the lockdown	Age				
	18–25	26–35	36–49	50–64	65+
Reduction in physical activity					
Yes					
Men	0.50 (0.40; 0.60)	0.59 (0.50; 0.67)	0.43 (0.38; 0.49)	0.41 (0.36; 0.45)	0.46 (0.40; 0.52)
Women	0.47 (0.38; 0.55)	0.65 (0.59; 0.72)	0.64 (0.59; 0.69)	0.58 (0.53; 0.64)	0.62 (0.55; 0.70)
No					
Men	0.34 (0.27; 0.41)	0.42 (0.35; 0.49)	0.38 (0.33; 0.43)	0.39 (0.34; 0.44)	0.25 (0.19; 0.31)
Women	0.57 (0.50; 0.65)	0.45 (0.39; 0.51)	0.49 (0.44; 0.54)	0.45 (0.40; 0.50)	0.47 (0.39; 0.54)
Worsened relation with partner					
Yes					
Men	0.28 (0.09; 0.48)	0.73 (0.59; 0.87)	0.77 (0.66; 0.88)	0.70 (0.59; 0.81)	0.71 (0.57; 0.85)
Women	0.76 (0.65; 0.88)	0.66 (0.55; 0.76)	0.81 (0.72; 0.90)	0.70 (0.58; 0.81)	0.41 (0.19; 0.64)
No					
Men	0.43 (0.37; 0.49)	0.47 (0.41; 0.53)	0.37 (0.33; 0.41)	0.36 (0.32; 0.40)	0.31 (0.26; 0.36)
Women	0.51 (0.44; 0.58)	0.53 (0.49; 0.58)	0.54 (0.50; 0.58)	0.50 (0.46; 0.53)	0.53 (0.48; 0.59)
Worsened relation with other people					
Yes					
Men	0.53 (0.41; 0.66)	0.54 (0.42; 0.66)	0.57 (0.48; 0.66)	0.53 (0.55; 0.63)	0.47 (0.34; 0.60)
Women	0.59 (0.45; 0.74)	0.66 (0.56; 0.76)	0.62 (0.52; 0.71)	0.58 (0.48; 0.69)	0.55 (0.35; 0.75)
No					
Men	0.38 (0.32; 0.45)	0.49 (0.43; 0.55)	0.36 (0.32; 0.41)	0.37 (0.33; 0.41)	0.33 (0.28; 0.37)
Women	0.53 (0.46; 0.59)	0.52 (0.47; 0.57)	0.55 (0.51; 0.59)	0.50 (0.46; 0.54)	0.53 (0.48; 0.59)
Suffered income loss					
Yes					
Men	0.42 (0.28; 0.55)	0.54 (0.46; 0.63)	0.48 (0.42; 0.54)	0.43 (0.37; 0.48)	0.47 (0.37; 0.56)
Women	0.52 (0.46; 0.58)	0.52 (0.46; 0.58)	0.61 (0.56; 0.66)	0.52 (0.46; 0.57)	0.56 (0.45; 0.67)
No					
Men	0.39 (0.33; 0.46)	0.47 (0.40; 0.54)	0.34 (0.30; 0.39)	0.37 (0.33; 0.42)	0.31 (0.26; 0.36)
Women	0.55 (0.43; 0.67)	0.58 (0.52; 0.64)	0.53 (0.49; 0.58)	0.51 (0.47; 0.56)	0.52 (0.46; 0.59)
Lost job					
Yes					
Men	0.48 (0.26; 0.70)	0.53 (0.36; 0.70)	0.45 (0.33; 0.57)	0.51 (0.38; 0.65)	0.37 (0.10; 0.64)
Women	0.51 (0.32; 0.70)	0.60 (0.47; 0.73)	0.70 (0.58; 0.81)	0.42 (0.29; 0.55)	0.20 (−0.00; 0.41)
No					
Men	0.40 (0.34; 0.46)	0.49 (0.43; 0.55)	0.39 (0.36; 0.43)	0.38 (0.34; 0.42)	0.35 (0.30; 0.39)
Women	0.54 (0.47; 0.60)	0.53 (0.48; 0.58)	0.55 (0.51; 0.58)	0.52 (0.48; 0.55)	0.55 (0.50; 0.60)
Difficulties with organizing work or study from home					
Yes					
Men	0.54 (0.43; 0.65)	0.72 (0.60; 0.84)	0.40 (0.31; 0.49)	0.50 (0.40; 0.59)	0.42 (0.24; 0.61)
Women	0.65 (0.56; 0.74)	0.67 (0.57; 0.76)	0.60 (0.52; 0.68)	0.81 (0.73; 0.89)	0.63 (0.33; 0.93)
No					
Men	0.38 (0.31; 0.45)	0.45 (0.39; 0.51)	0.40 (0.36; 0.45)	0.37 (0.33; 0.41)	0.33 (0.28; 0.37)
Women	0.52 (0.44; 0.59)	0.52 (0.47; 0.57)	0.56 (0.52; 0.59)	0.47 (0.44; 0.51)	0.52 (0.46; 0.58)
Death of a relative or friend due to Coronavirus					
Yes					
Men	0.64 (0.41; 0.88)	0.61 (0.34; 0.87)	0.36 (0.23; 0.50)	0.19 (0.10; 0.29)	0.35 (0.21; 0.48)
Women	0.62 (0.43; 0.82)	0.60 (0.44; 0.76)	0.63 (0.45; 0.81)	0.60 (0.49; 0.72)	0.81 (0.66; 0.96)
No					
Men	0.40 (0.34; 0.46)	0.49 (0.43; 0.54)	0.40 (0.36; 0.44)	0.41 (0.37; 0.45)	0.35 (0.31; 0.40)
Women	0.52 (0.46; 0.59)	0.53 (0.49; 0.58)	0.55 (0.51; 0.59)	0.50 (0.47; 0.54)	0.51 (0.46; 0.57)
A relative or friend was infected					
Yes					
Men	0.35 (0.19; 0.50)	0.62 (0.49; 0.76)	0.45 (0.34; 0.56)	0.39 (0.28; 0.49)	0.28 (0.17; 0.39)
Women	0.62 (0.46; 0.79)	0.51 (0.41; 0.62)	0.67 (0.59; 0.75)	0.53 (0.44; 0.63)	0.67 (0.53; 0.82)
No					
Men	0.41 (0.35; 0.48)	0.47 (0.41; 0.53)	0.39 (0.35; 0.43)	0.39 (0.35; 0.43)	0.35 (0.31; 0.40)
Women	0.52 (0.45; 0.58)	0.55 (0.50; 0.59)	0.54 (0.50; 0.58)	0.51 (0.47; 0.55)	0.53 (0.47; 0.58)

N = 3,026. Post-stratification weights are used. Non-overlapping CIs indicate that the corresponding predicted probabilities are statistically significant with difference at the 5% level. Source: Intergen-COVID online survey. Data were collected between April 14 and 24, 2020.

probability of feelings of depression, and differences were statistically significant for almost all age and gender groups. Of note is that for two subgroups (men aged 18–25 and women aged 65+), CIs are rather large because of the low proportion of individuals with a partner within these subgroups. When statistically significant, the effect of worsened relationship with the partner is also substantial: worsened association with partner is associated with about 20 percentage points higher probability of increased feelings of depression. Worsened relationship with other people, instead, displays a statistically significant effect only among adult men aged 36–64. Gaps are also rather substantial, amounting to about 10 additional percentage points of increased feelings of depression for those who experienced poorer relationship quality compared with those who did not.

Turning to the economic consequences of the pandemic, although income loss was significantly associated with the probability of increased feeling of depression in the whole sample (Models 1 and 2, **Supplementary Table A.1**), when interacting it with age and gender, it has a significant effect only on two groups (men aged 36–49 and men aged 65+). Having experienced a job loss (this was the case only for about 6% of the sample, **Table 1**) was never statistically associated with increased depressive feelings, with the exception of women aged 36–49 who were considerably more at risk of losing their job and thus suffering psychologically from it (predicted probabilities: 70 and 55% for those who experienced job loss and who did not experience job loss, respectively, in this age group).

Difficulties in organizing work or study from home negatively affected feelings of depression, especially for younger individuals. In particular, men aged 26–35 who experienced these negative effects of the lockdown displayed a probability of increased feelings of depression of 72 vs. 45%, in case they were not affected in this respect.

Finally, as for the health consequences of the pandemic, the respondents who have experienced death of a relative or friend due to COVID-19 were, as expected, more likely to have felt sad or depressed more often than usual. However, the differences within age-gender subgroups are usually not statistically significant because of the small number of individuals in this study sample, who experienced this event. Exceptions are found among the oldest individuals, and, in particular, for women aged 65+, it is found that one of the highest predicted probability of increased feeling of depression across all cells if they experienced a COVID-related death of a relative or friend (81 vs. 51% if they did not experience the event). Knowing that a relative or friend had been infected with COVID-19 was not significantly associated with increased feelings of depression.

DISCUSSION

This study has adopted a life-course approach for assessing the feelings of depression among Italians aged 18+ during the early phase of the COVID-19 pandemic. More specifically, we have examined the probability of increased feelings of depression according to three dimensions: age, gender, and type of negative events experienced during the first national lockdown.

Empirical findings, based on original data collected in April 2020, showed that the pandemic has created a variety of stressors whose effects strongly depend on the gender and age of individuals. In line with existing studies (e.g., Mazza et al., 2020), we found that women reported more frequently than men to have experienced increased feelings of depression. In addition, consistent with similar findings from Italy (e.g., Roma et al., 2020), younger respondents were generally more likely to have experienced increased feelings of depression. However, the results showed that this was especially the case for men. Finally, while all age and gender sub-groups suffered a considerable increase in their feelings of depression when compared with the pre-COVID period, we found a substantial degree of heterogeneity in the extent this was the case. Specifically, we examined this heterogeneity as a function of specific events experienced during the early phase of the COVID-19 pandemic. **Figure 1** graphically summarizes these results.

Some of the consequences of the pandemic that we accounted for negatively affected feelings of depression among almost all demographic subgroups we considered. This was the case for worsened quality of partnership relationship and reduction of physical activity (especially for women). These findings are in line with those of some previous studies (e.g., Teo et al., 2013; Maugeri et al., 2020). Instead, other events experienced during the early stage of the pandemic had age- and/or gender-specific effects on feelings of depression (**Figure 1**). A group-specific effect was increased feelings of depression associated with worsened relationship with people other than the partner that emerged only for adult men aged 36–64. Although the data were not informative about this, we may speculate that this might be driven by relationships with coworkers. The youngest individuals (aged 18–35) suffered, especially, because of difficulties in organizing study and work from home. The only subgroup displaying a meaningful effect on increased feelings of depression due to the economic consequences of the lockdown and restrictive measures, i.e., income loss was constituted by adult men aged 36–54. Older people aged 50+ experienced more frequently than other groups increased feelings of depression due to the death of a relative or friend from COVID-19. Instead, and in line with previous findings (Kopilaš et al., 2021), this results did not provide evidence on the link between the contagion of relatives or friends with increased feelings of depression.

As shown in **Figure 1**, the associations between having experienced or not certain events during the pandemic and increased feelings of depression that we have found were not only significant from a statistical point of view, but they were also substantial, with differences in the predicted probability of increased feelings of depression ranging between 6 and 40 percentage points. The strongest effect was found for having experienced worsened relationship with partner among men aged 36–49 and 65+ (40 percentage points higher predicted probability of increased depression feelings among those who experience this change during the lockdown).

Overall, the economic consequences of the pandemic (income and job loss) were insignificant (both statistically and substantially) in this study, with few exceptions. This may

Difficulties experienced during the lockdown	Men					Women				
	18-25	26-35	36-49	50-64	65+	18-25	26-35	36-49	50-64	65+
Reduction in physical activity		17			21		20	15	13	15
Worsened relation with partner		26	40	34	40	25		27	20	
Worsened relation with other people			21	16						
Suffered income loss			14		16					
Lost job								6		
Difficulties with organizing work or study from home		27							13	
Death of a relative or friend due to Coronavirus										30
A relative or friend was infected								13		

FIGURE 1 | Visual summary of main results: statistically and substantively significant effects of difficulties experienced during the lockdown on the probability of increased feelings of depression by age and gender. Gray cells highlight statistically significant (at the 5% level) and substantively important associations. The numbers in the highlighted cells are the difference in the predicted probability of increased depression feelings for those who did and did not experience each event (percentage points).

be because of the fact that we conducted this study at a time, where the effects of the pandemic were not yet clear, and the duration of the pandemic was also uncertain, so some of the individuals who experienced economic shocks might have relatively positive expectations on a rapid solution of the health crisis and about the recovery of the general economic situation and their job and income status. This finding, however, may also relate to the relatively small number of individuals in this study sample, who experienced negative economic effects, especially job loss. Thus, this finding requires further investigation in future studies, especially with data collected at the following stages of the pandemic.

One limitation of this study is that the results may not generalize to the whole population, because the data are based on an online survey. However, online data collection was almost the only choice we had during the lockdown. Additionally, by quota sampling and post-stratification weights, we made the sample representative of the Italian 18+ population with respect to key sociodemographic variables. We could not explore some aspects because of the restrictions to the questionnaire length required by the online data collection mode. For example, we did not collect information on how work or study was organized at a distance. Also, worsened relationship quality was distinguished only if related to the partner or other people, but more detailed differentiation, e.g., between children, other relatives, friends, and co-workers, is an interesting topic for future studies. Finally, this study uses a self-reported measure of increased feelings of depression during the lockdown, instead of a validated scale of depression. The measure used in this study might be subjected to several sources of bias, such as social desirability bias.

Despite these limitations, this study contributes to the identification of subgroups of population at higher risk of worsened psychological well-being due to the COVID-19 pandemic, which is crucial to limit long-term consequences of this pandemic. The results point to the fact that although all individuals may have experienced negative effects on psychological well-being, the extent of these effects greatly varies across different subgroups. Combinations of several dimensions, such as age and gender, are crucial in identifying individuals who suffered the most. Future studies may consider further relevant dimensions, such as socioeconomic status.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because the individual data cannot be provided but descriptive statistics and questionnaire are available at a dedicated website: https://sites.google.com/unifi.it/intergen-covid. Requests to access the datasets should be directed to https://sites.google.com/unifi.it/intergen-covid.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

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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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.660628/full#supplementary-material

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Affective States, Coping and Mutual Understanding in Russian Families During the Coronavirus Disease 2019 Pandemic Lockdown

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The purpose of the empirical study (April–May 2020) was to determine the type and level of affect, specifics of coping styles during the coronavirus disease 2019 (COVID-19) pandemic lockdown, as well as mutual understanding between parents and children. We hypothesized that the combination of positive and negative affect magnitude is a factor in well-being and mutual understanding with children, as well as the coping style during the lockdown. The study involved 705 respondents aged 16–77, including 435 parents living with children under 16. Personal traits, positive and negative affect, coping styles, and well-being were studied by Ten-Item Personality Inventory (TIPI)-RU, Positive and Negative Affect Scale (PANAS)-RU, Brief COPE, Satisfaction with Life Scale (SWLS), respectively. Mutual understanding was studied using a self-report questionnaire. Cluster analysis (k-means method) was used to divide the sample into clusters in accordance with the combination of positive and negative affect. According to the data obtained, parents from the "positive-affective" cluster have much better mutual understanding with both younger and older children than participants from other clusters.

Keywords: COVID-19, lockdown in Russia, stress, coping, positive and negative affect, well-being, mutual understanding, parents and children

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INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic is a global challenge to humanity. According to the website of the Center for Systems Science and Engineering (CSSE) of Johns Hopkins University (Johns Hopkins Coronavirus Resource Center, 2021), more than 154 million cases of COVID-19 infection have been officially reported worldwide in 192 countries. The total number of deaths in May 2021 was more than 3.2 million people. The proliferation of COVID-19 can be considered a psychotraumatic situation characterized by several distinctive features (Bykhovets and Cohen-Lerner, 2020). New evidence suggests that the incidence of post-traumatic stress and psychological stress in the general population is increasing due to COVID-19 (Cooke et al., 2020).

Psychological stressors include lifestyle changes associated with imposed restrictions, switching to remote forms of work and studying; economic difficulties caused by the lockdown; informational impact from the media; lack of understanding of the people about the nature of the viral infection; and the mechanisms of its spread.

Changes in the socio-economic sphere are another significant source of psychological stress. Delay or reduction of wages, actual job loss or risk of losing it, forced unpaid leave, suspension or loss of business of an individual act as sources of deep emotional experiences and increase stress levels.

From the perspective of modern ecological immunology, the well-being of an organism is maintained by efficiently matching biological and behavioral priorities to the demands of the environment. The data on the influence of the number and intensity of social contacts on the level of immunity are quite contradictory (Segerstrom, 2010). On the one hand, epidemiological evidence correlating fewer social networks with increased all-cause mortality supports the idea that social relationships buffer against stress and improve health (House et al., 1988). On the other hand, extensive social contacts have been associated with poorer cellular immunity in healthy young adults and patients with HIV (Miller and Cole, 1998; Segerstrom, 2008). However, social network size was either unrelated to immunity and health or had negative consequences, particularly in prospective studies (Segerstrom, 2010). For certain categories, social support is especially important. For example, availability of social support leads to later symptoms of HIV infection onset and longer survival (Miller and Cole, 1998). So, the perceived social support (especially within the family) plays a special role.

There were additional stressors in the families with school-age children during the COVID-19 pandemic lockdown. They include the constant joint stay at home (in a limited space) of all family members as well as the need for parents to independently organize the education and leisure of children. Not all families had enough gadgets and satisfactory Internet connection for full-fledged distant work and study at the same time, which was an additional stress factor for families with children. In many families, parent-child relations worsened during the COVID-19 lockdown (Hiraoka and Tomoda, 2020). High levels of anxiety and depressive symptoms are associated with higher child abuse potential (Brown et al., 2020).

In accordance with Hobfoll's Conservation of Resources Theory (COR) psychological stress is defined as a reaction to the environment in which there is (a) a threat of a net loss of resources, or (b) a lack of resource gain following the investment of resources Hobfoll (1989). Both perceived and actual loss or lack of gain are envisaged as sufficient for producing stress (Hobfoll, 1989). During the COVID-19 lockdown, almost everyone had decreased resources, both material, physical, and psychological, which led to severe stress. It should be noted that any person during their life has developed well-established patterns of reaction to stress (coping styles).

Various approaches and models of human stress response have been developed now. Categories and systems used to classify coping have been developed (Skinner et al., 2003). In accordance with the Carver approach 14 coping styles are distinguished: Active Coping, Planning, Suppression of Competing Activities, Restraint Coping, Seeking Social Support (instrumental and emotional reasons), Positive Reinterpretation and Growth, Acceptance, Turning to Religion, Focus on and Venting of Emotions, Denial, Behavioral Disengagement, Mental Disengagement, Alcohol-Drug Disengagement (Carver et al., 1989). Some of these styles (planning, positive reinterpretation, etc.) can be categorized as stress overcome resources leading to personal development, better understanding in the family, positive emotional mood, and well-being. That is why we suggested the relationship between coping styles, affect the magnitude, well-being, and mutual understanding between parents and their children.

Parenting behaviors cannot be fully understood without considering the emotional dysregulation of parents and their emotional regulation strategies (Barros et al., 2015); their overall subjective emotional well-being is a cause of somatic and mental health as well as success in various areas of life (Diener and Tay, 2017; Diener et al., 2018).

To measure subjective well-being, the model of Diener uses combination indicators of positive and negative emotions, such as the Positive and Negative Affect Scale (PANAS; Watson et al., 1988) or the Positive and Negative Experiences Scale (SPANE; Diener et al., 2009), and life satisfaction, such as the Life Satisfaction Scale (SWLS; LSS; Diener et al., 1985). Productive coping styles (as opposed to destructive coping styles) also promote subjective emotional well-being, one of the factors of mutual understanding in the family (Kryukova et al., 2019).

During the year 2020, research groups around the world have conducted numerous studies on the psychological effects of the COVID-19 pandemic. The totality of these studies, performed in different countries, at different times, on different samples, presents a very complex mosaic. It will take some time for the scientific community to comprehend the results of these multiple and diverse studies. The purpose of this study is to add to the scientific evidence on mutual understanding in families during the COVID-19 lockdown.

So, we hypothesized that the combination of the positive and negative affect magnitude of parents influences their well-being and mutual understanding with children, as well as their coping style during the COVID-19 lockdown.

The purpose of the empirical study was to determine the type and level of affect, specifics of coping with stress during the pandemic lockdown, as well as mutual understanding between parents and children.

MATERIALS AND METHODS

This study was carried out in accordance with the recommendations of the Declaration of Helsinki and the Ethical Committee of the Russian Psychological Society.

Data were collected in May 2020. In the study, we conducted two different cross-sectional surveys. There were 705 adult respondents in the combined sample: 597 female, age 36.52 ± 0.40, and 108 male, age 37.49 ± 1.15 (Khavylo and Leonova, 2020). The sample involved 435 parents (51 men, 384 women) living with children under 16. The surveys were completely anonymous and conducted online (Google forms and open-source application «1KA»); the responses of the individual participants were confidential. Participants received an invitation to participate and an informed consent form through both the educational online platform Network City

(Kaluga region) and social networks (Facebook, VKontakte). Participants did not receive the remuneration for participation in the study.

Personal traits, positive and negative affect, coping was studied by Russian versions of well-known tests.

We have used the Ten-Item Personality Inventory (TIPI), which is a brief assessment of the Big-Five personality dimensions: (1) Extraversion, (2) Agreeableness, (3) Conscientiousness, (4) Emotional Stability, and (5) Openness to Experience (Gosling et al., 2003; Sergeeva et al., 2016). The Big-Five framework has become the most widely used and extensively researched model of personality (Costa and McCrae, 1992; John and Srivastava, 1999). The Big-Five framework is a hierarchical model of personality traits with five factors, which represent personality at the broadest level of abstraction. Each bipolar factor summarizes several more specific facets, which, in turn, subsume a large number of even more specific traits. The Big-Five framework suggests that most individual differences in human personality can be classified into five broad, empirically derived domains.

We have applied the PANAS-RU that measures two main aspects: positive and negative affect. Positive affect (PA) reflects the degree of activity, enthusiasm, and alert of a person. High PA is a state of high energy, concentration, and pleasure, while low PA is characterized by sadness and lethargy (Watson and Tellegen, 1985; Watson et al., 1988; Osin, 2012). Negative affect (NA) is a state of general distress and unpleasant interaction, with a low NA level reflecting calmness and serenity. Cronbach's alpha coefficients for the current study were for PA scale 0.92, for NA scale 0.91.

Also, we have used the Brief COPE (Carver, 1997; Kryukova et al., 2019), which is a 28-item multidimensional measure of strategies used for coping or regulating cognitions in response to stressors. This abbreviated inventory (based on the complete 60-item COPE Inventory) is comprised of items that assess the frequency with which a person uses different coping styles. There are 14 two-item subscales within the Brief COPE, and each is analyzed separately: (1) Self-distraction, (2) Active Coping, (3) Denial, (4) Substance Use, (5) Use of Emotional Support, (6) Use of Instrumental Support, (7) Behavioral Disengagement, (8) Venting, (9) Positive Reframing, (10) Planning, (11) Humor, (12) Acceptance, (13) Religion, and (14) Self-blame. Cronbach's alpha coefficients for the current study ranged between 0.38 and 0.85 for all aforementioned subscales of Brief COPE.

To measure satisfaction with life, we have used the SWLS (Diener et al., 1985; Osin and Leont'ev, 2008). It is a short five-item instrument designed to measure global cognitive judgments of satisfaction with the life of an individual. The SWLS was developed to assess satisfaction with the lives of people as a whole. The scale does not assess satisfaction with specific life domains, such as health or finances, but allows subjects to integrate and weigh these domains in whatever way they choose. Cronbach's alpha coefficients for the SWLS scale for the current study were 0.89.

Mutual understanding between parents and their children (older and younger separately) was assessed by themselves *via* a five-point Likert scale (from 0 to 4): 0, no mutual understanding, frequent conflicts; 1, there is no mutual understanding, but conflicts are rare; 2, continuous conflicts and reconciliations; 3, mutual understanding in general, conflicts are rare; and 4, complete mutual understanding. We asked parents to assess their mutual understanding with both older and younger children twice: before COVID-19 lockdown (retrospectively) and during spring lockdown.

Survey participants with children were slightly older, but the average age difference was less than 3 years, which allows us to consider these groups as homogeneous in age.

RESULTS

Data analysis includes a comparative analysis (Student's *t*-test) of coping styles and personality traits (among respondents with and without children) and Cluster analysis (k-means method) to divide the sample into groups with a similar ratio of positive and negative affect and subsequent comparison of the indicators of mutual understanding with children and coping styles in these groups. Statistica v.13 and SPSS v.26 software were used for computations.

At the first stage of data analysis, a comparative analysis of coping styles and personality traits among respondents with and without children was carried out.

To assess the significance of differences between the groups of respondents, the Student's *t*-test was used. The respondents with children have significantly lower scores of PA ($p = 0.011$) and such coping styles as Self-distraction ($p = 0.002$), Behavioral Disengagement ($p = 0.047$), and Acceptance ($p = 0.002$). On the other hand, this group has higher scores of Active Coping ($p = 0.022$), Denial ($p = 0.025$), and Positive Reframing ($p = 0.034$). Comparative analysis revealed differences in individual personality traits among respondents with and without children. Respondents with children had higher scores on Conscientiousness ($p = 0.004$), Agreeableness ($p = 0.051$), Extraversion ($p = 0.053$), and lower scores on Openness to Experience (<0.001).

At the second stage of data analysis, to test the hypothesis that the combination of positive and negative affect magnitude is a factor in well-being and mutual understanding with children, we divided the sample into four clusters in accordance with the severity of positive and negative affect (**Figure 1A**). The division into clusters was done using the k-means method. The cluster extraction criterion was Fisher's *F*-test ($F_{PA} = 495{,}3^{**}$; $F_{NA} = 825{,}8^{**}$).

Cluster 1 included respondents ($n = 169$) with relatively low scores on the scales of PA and NA. This group received a conditional name "low-affective." Cluster 2 included respondents ($n = 155$) with higher scores compared to cluster 1 on the scales of PA and NA. This group received the conditional name "high-affective." Participants in the survey with high scores on the NA scale and relatively low scores on the PA scale were included in cluster 3 ($n = 121$). This group was conditionally named "negative-affective." Finally, the survey participants with high PA scores and relatively low PA scores comprised cluster 4 ($n = 260$). This group was conditionally named "positive-affective." The *t*-test showed that all clusters except cluster 3 are characterized by a significant predominance of PA over Negative ($p < 0.001$).

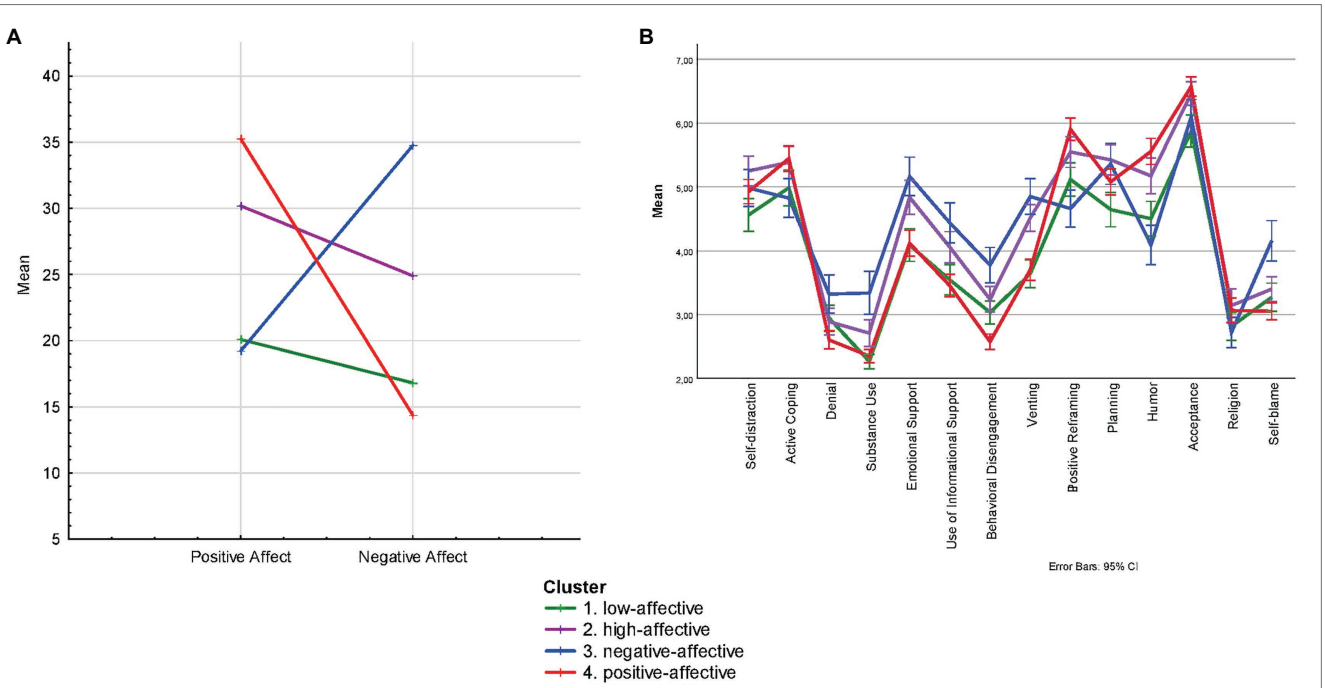

FIGURE 1 | Mean values for each Cluster **(A)** and profile of coping styles in the Cluster **(B)**.

TABLE 1 | Mutual understanding with older and younger children: differences between clusters of parents, *t*-test absolute values.

Cluster number		1. Low-affective		2. High-affective		3. Negative-affective	
		Oldest	Youngest	Oldest	Youngest	Oldest	Youngest
1. Low-affective	Oldest						
	Youngest						
2. High-affective	Oldest	0.68					
	Youngest		0.34				
3. Negative-affective	Oldest	0.45		1.02			
	Youngest		0.15		1.17		
4. Positive-affective	Oldest	2.92**		2.01**		3.05**	
	Youngest		2.85**		2.25**		2.63**

**$p < 0.01$.

In the next stage, we compared the selected groups of participants according to such indicators as coping styles used, personality traits, and features of relations with children. The statistical significance of differences between clusters was assessed using ANOVA. The general profile of coping styles is similar in all clusters (**Figure 1B**).

"Positive-affective" parents often use Positive Reframing, Humor, Acceptance (along with high-affective), humor and as well as, like "high-affective" parents, Humor and Active Coping. These parents are characterized by higher scores on the Openness to Experience, Conscientiousness, Extraversion, Agreeableness and Emotional Stability scales. According to the data obtained, "positive-affective" parents have much better mutual understanding with both younger and older children than parents from other clusters (**Table 1**).

"Negative-affective" parents tend to use coping styles such as Denial, Substance Use, Use of Informational Support, Behavioral Disengagement, Venting, Self-blame. Parents in this group have lower Extraversion and Emotional Stability scores than other respondents. It can be assumed that the reduced affect is largely due to the personality traits of the representatives of this cluster.

"High-affective" parents are more likely to use Self-distraction and Planning (along with "negative-affective" parents).

Those parents who were combined in a "low-affective" cluster are less likely to use coping styles, especially such as Self-distraction and Planning.

Thus, we can say that the ratio of positive and negative affect during the pandemic is interconnected with the coping styles used. Probably, to a certain extent, the ways of reaction are conditioned by the expression of certain personality traits. Parents with a strong predominance of PA have better relationships with their children of different ages during the COVID-19 pandemic.

DISCUSSION

High PA can be defined as a state of pleasant engagement, high energy, and total concentration as opposed to dejection and lethargy (low PA). High NA corresponds to subjectively experiencing suffering and unpleasant involvement (variously anger, disgust, contempt, guilt, fear, and irritability) vs. calm and serenity (low NA).

According to numerous studies, NA scores correlate with the experience of stress and difficulties in coping with it, with the frequency of unpleasant life events, and with neuroticism (Watson et al., 1988). In turn, PA scores correlate with the frequency of pleasant events, extraversion, social engagement, close relationships, and measures of religiosity and spirituality (Watson, 2002). This agrees well with the results obtained in this study.

According to results, the respondents with children have significantly lower scores of PA compared to respondents without children. Though respondents with children are more conscientious, friendly, extraverted, they are less open to a new experience, as known, monotony does not contribute to emotional uplift. This is due, in our opinion, to the lesser possibility of emotional relief and relaxation in families with children during quarantine.

According to Banou et al. (2009), having a traumatic experience mediated through a decrease in available interpersonal resources increases susceptibility to psychological distress. On this basis, it can be assumed that traumatic relationships between children and their parents, the experience of family violence (and the observation of its manifestations between parents) during the pandemic may lead to a decrease in the level of available interpersonal resources in the long term.

The respondents with children rarely use coping styles as Self-distraction, Behavioral Disengagement, and Acceptance. On the other hand, this group has higher scores of Active Coping, Denial, and Positive Reframing. The reason for such results may be added responsibility of caring for children. This imposes restrictions on the use of certain coping styles.

Dividing the sample of parents into four categories according to the combination of the severity of positive and negative affect allowed us to test the hypothesis that the combination of the positive and negative affect magnitude of parents is influenced by their well-being and mutual understanding with children, as well as the coping style. It turned out that parents from the "positive-affective" cluster frequently use Positive Reframing, Humor, Acceptance, and, like the participants from the "high-affective" cluster, Active Coping. These people are characterized by higher scores on the Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Emotional Stability scales. As noted above, high scores on these scales can act as favorable psychological conditions for building good relationships with their children. According to the data obtained, people in this group have much better mutual understanding with both younger and older children than participants from other clusters.

The results of the study showed the role of positive emotions for general well-being, mutual understanding in families, avoidance of destructive coping styles during COVID-19 lockdown when many families were in a difficult situation. This is consistent with the results we obtained earlier (Leonova, 2020). On the other hand, the results confirm that mutual understanding can be considered as one of the resources in stressful situations (Pięta et al., 2019).

The research results help to understand the directions of psychological assistance and self-help for mutual understanding with children in conditions of limitations. Resource constraints do not affect the relationship directly. By choosing positive coping styles, it is possible to relieve the tension of an individual and not worsen relations with children.

We should note the following limitations of this study.

1. Only parents took part in the study (mostly mothers). It may be interesting to study mutual understanding from several points of view: both parents and each of their children in different living conditions.
2. Regional specificity of the results, most respondents live in Russian small and middle cities with a mild isolation regimen during the lockdown.
3. Mutual understanding before the lockdown was assessed retrospectively. Most of the participants that completed this survey, however, agreed to participate in a subsequent survey. In the future, we plan to conduct this study longitudinally. We believe that these efforts will help parents to correct their coping styles and increase mutual understanding with their children.

DATA AVAILABILITY STATEMENT

The dataset, called COVID19_Kaluga_RUS (Khavylo and Leonova, 2020) is deposited at https://doi.org/10.6084/m9.figshare.14229278 and has SPSS 22 format. The variables are described inside the dataset.

ETHICS STATEMENT

Ethical approval was not provided for this study on human participants because Ethical standards in psychological studies in Russia are not legally accepted, but there are recommendations of the Ethics Committee of the Russian Psychological Society, which are consistent with the Declaration of Helsinki, and these recommendations were followed by us. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

The research results help to understand the directions of psychological assistance and self-help for mutual understanding with children in conditions of limitations. Resource constraints do not affect the relationship directly. By choosing positive coping strategies, it is possible to relieve one's own tension and not worsen relations with children. All authors contributed to the article and approved the submitted version.

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Mistrust and Beliefs in Conspiracy Theories Differently Mediate the Effects of Psychological Factors on Propensity for COVID-19 Vaccine

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Vaccination is considered a key factor in the sanitary resolution of the COVID-19 pandemic. However, vaccine hesitancy can undermine its diffusion with severe consequences on global health. While beliefs in conspiracy theories, mistrust in science and in policymakers, and mistrust in official information channels may also increment vaccine hesitancy, understanding their psychological causes could improve our capacity to respond to the pandemic. Thus, we designed a cross-sectional study with the aim of probing vaccine propensity in the Italian population and explored its relationship with sociodemographic and psychological variables, and with misbeliefs in COVID-19. A battery of questionnaires was administered to a sample of 374 Italian adults during the first national lockdown (April 2020). The materials included an original instrument—Beliefs in COVID-19 Inventory—and questionnaires measuring perceived stress, anxiety, death anxiety, psychological distress, psychoticism, paranoia, anger, and somatization. The exploratory factor analysis (EFA) on Beliefs in COVID-19 suggested the existence of three factors: belief in conspiracy theories, mistrust in medical information, and mistrust in medicine and science. These factors were positively correlated with female sex, age, religious beliefs, psychiatric conditions, and psychological variables, while negatively correlated with education levels. We conducted a mediation analysis by means of a structural equation model, including psychological factors as predictors, beliefs in COVID-19 scales as mediators, and vaccine propensity as an outcome. The model showed that death anxiety had a direct positive effect on the propensity to get vaccinated. It also showed that death anxiety reduced the propensity to get vaccinated through a mediated path in believing in conspiracy theories, whereas paranoia was linked to a reduction in vaccination adherence with the mediation effect of mistrust in medical science. Psychological distress reduced vaccination propensity by increasing both conspiracy beliefs and mistrust. On the other hand, anxiety increased the propensity to get vaccinated through a decrease in both belief in conspiracy theories and mistrust in science. Our results suggest that psychological dimensions are differentially related to belief in conspiracy theories, to mistrust in science, and to the propensity to get

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vaccinated. Based on this result, we propose an original interpretation of how conspiracy beliefs build on a paranoid and suspicious attitude. We also discuss the possible clinical implications of treatment for such pathological beliefs.

Keywords: vaccine propensity, vaccine hesitancy, conspiracy theories, mistrust, paranoia, death anxiety, COVID-19

INTRODUCTION

Given the extent and severity of COVID-19 around the world, global population vaccination has been proposed as the key to halting the spread of the pandemic. As early as last March-April 2020, science began to find vaccine remedies for COVID-19 (Lurie et al., 2020) and governments supported the academic community and pharmaceutical industry in identifying a safe and effective vaccine remedy (Kaur and Gupta, 2020). Vaccines would be suitable and necessary to reduce transmission, hospitalization, and the high number of intensive care patients. However, global vaccination is not easy to reach as a goal: It requires not only a sufficient health system capacity, but also efficacy strategies capable of bringing people to accept and trust in the vaccine and in those who deliver it. Some studies already highlighted in the early stages of the pandemic that it was urgent to plan actions to reassure the general population and to promote trust in biomedical research (Palamenghi et al., 2020). In fact, the scientific evidence relating to COVID-19 has been found to be so uncertain and contradictory that it has changed, even in the medium term, the social representation of scientific knowledge (Provenzi and Barello, 2020). For all these reasons, a skeptic position toward vaccination may emerge in the population. Vaccine hesitancy is a well-known phenomenon indicated by the WHO as one of the main global health threats (Sallam et al., 2021).

Vaccine hesitancy can be defined as the delay in acceptance or refusal or reluctance of vaccine acceptance despite the availability of vaccination services (McDonald, 2015; Mannan and Farhana, 2020; Sallam et al., 2021). Hesitancy behavior should be understood as a continuum between those who totally accept and those who totally refuse all vaccines, with the hesitant individuals placed in between these two extremes (Sato, 2018). Previous studies have shown that some sociodemographic factors are associated with vaccine hesitation or refusal. In particular, females tend to be hesitant and more skeptical of the COVID-19 vaccine (Lazarus et al., 2020; Mannan and Farhana, 2020; Lin et al., 2021; Murphy et al., 2021; Patelarou et al., 2021). Also, younger age, higher levels of education, and religious beliefs have been related to vaccine hesitancy and resistance (Malik et al., 2020, Palamenghi et al., 2020; Lin et al., 2021; Murphy et al., 2021). However, some studies reported higher vaccine acceptance among females (Al-Mohaithef and Padhi, 2020; Lazarus et al., 2020) and those with higher education levels (e.g., Lazarus et al., 2020).

Psychological Factors Associated With Vaccination Behavior

Trust in vaccination seems to be affected also by psychological factors, such as anxiety or perceived stress. The psychological condition of the population was greatly affected by the pandemic and the related restrictive measures. Distress, depression, and death anxiety characterized the psychological response to the first pandemic spread (e.g., Simione and Gnagnarella, 2020) and the prevalence of psychological symptoms greatly increased during this period (Ran et al., 2020). In addition, hostility and anger increased as a response to quarantine and lockdown measures (Duan et al., 2020). In this weak psychological condition, the feelings of fear of dying, anguish, vulnerability, and insecurity that the person can experience could lead to higher levels of confidence in COVID-19 vaccination (Kang and Jung, 2020; Mannan and Farhana, 2020; Patelarou et al., 2021). However, anger and negative emotions were also related to lower levels of vaccine acceptance (Betsch and Böhm, 2016; Sun et al., 2021). Thus, differential psychological symptoms, ranging from stress to death anxiety, seems to be associated with either higher or lower vaccine acceptance. Chou and Budenz (2020) proposed that key factors in determining the influence of emotions and psychological factors on COVID-19 vaccine propensity are conspiracy beliefs, mistrust or skepticism, and misinformation. Considering these factors would lead to a better comprehension of the mechanisms by which certain psychological variables increase the vaccine hesitancy, while others reduce it.

Trust in Medicine and Science Affects Vaccine Propensity

The issue of trust in medicine and science associated with vaccination has been the subject of many studies over the years even before the COVID-19 pandemic. Studies on trust in vaccination and medicine generally focused on a single element or phenomenon more than a generalized trust (Larson et al., 2018). Instead, trust is a multilayered concept (Chryssochoidis et al., 2009), which includes sociocultural and personality factors, but also the perceptions of institutions, the health system, the capacity of science and pharmaceutical companies, and the reliability of the health professionals involved (Liu and Yang, 2020; Patelarou et al., 2021). As highlighted by some authors (Larson et al., 2018; Liu and Yang, 2020), in the context of vaccination, trust may be considered on three levels: trust in the product (e.g., hepatitis B vaccine), trust in the vaccine provider (e.g., healthcare professionals), and trust in policymakers (e.g., the government and the healthcare system). Each level of trust may influence the public's safety and effectiveness perception of the vaccine, and consequently the adherence to vaccination campaigns. COVID-19 vaccine acceptance seems to be influenced by variables common to those recorded for other vaccines (efficacy, minor adverse effects, and protection duration; Kreps et al., 2020) or in previous health emergencies, such as HIV, SARS, MERS, and Ebola (Lazarus et al., 2021). However, the COVID-19 scenario was also characterized

by specific factors that could increase mistrust in science and health experts, such as the unusually rapid speed of vaccine development, the uncertainty about medical information, and the documented concerns about vaccine safety (see Chou and Budenz, 2020). These specific factors could undermine people's trust in institutional actors, and then influence their willingness to engage in preventive health behaviors. Thus, both trust in medical science and trust in policymakers seem to be important factors in determining vaccine adherence.

Beliefs in Conspiracy Theories Decrease Vaccine Propensity

Associated with distrust in science and skepticism, the literature highlights the prominent role of conspiracy theory beliefs. Conspiracy theories can be defined as a "subset of false beliefs in which the ultimate cause of an event is believed to be due to a plot by multiple actors working together with a clear goal in mind, often unlawfully and in secret" (Swami and Furnham, 2014, p. 220). One of the central aspects of the conspiracy beliefs comes from distrust in political institutions, which can also lead to resistance to important medical and public health interventions (Ford et al., 2013; Oliver and Wood, 2014; Landrum and Olshansky, 2019), without diminishing the seriousness of the pandemic threat. In fact, according to Hornsey et al. (2021), conspiratorial people tend to feel alienated, mistrustful, and angry. Moreover, they tend to be predominantly focused on their own personal interest and well-being, and less concerned with the well-being of those close to them. Conspiratorial thinking seems to protect these people from the anxiety and anguish of death, leading them to deny the problem of COVID-19 infection and, therefore, also to refuse the vaccine.

Vaccine distrust of conspiratorial people could be linked to a generic belief system characterized by negative attitudes toward powerful groups, such as medical or political institutions (Bertin et al., 2020). Distrust and suspicion in conspiracy theorists are also accentuated in the present pandemic scenario by the economic interests of pharmaceutical companies related to the vaccine, where Big Pharma may exaggerate the benefits of vaccines by minimizing their dangers (Jolley and Douglas, 2014; Hornsey et al., 2021).

Role of Trust in Information Sources in Vaccination Behavior

Another important factor in determining vaccine hesitancy is the information relative to COVID-19 and to its vaccines (Sherman et al., 2020). This is particularly true for the present situation where we only have first-generation vaccines whose long-term effects are unknown. In turn, this lack of information could lead to both vaccine hesitancy and distrust in the institutional organizations providing the vaccine. The source of information has also an effect on trust in science and vaccine hesitancy. Malik et al. (2020) found that participants who had more trust in medicine got information from healthcare workers and health officials, whereas those who collected sources from social media had less trust in medical science. Similar results were found by Patelarou et al. (2021), showing that those who got information from newspapers, television, radio, and government agencies had more trust in the COVID-19 vaccine than those who had self-perceived knowledge or collected information through social or online media. In fact, misinformation is more available on the internet where the information may be less accurate or verified (Liu and Yang, 2020; Obiała et al., 2020; Patelarou et al., 2021). Skeptics also use online platforms to advocate vaccine refusal. Hussain et al. (2018) found that as many as 50% of tweets about vaccination contain anti-vaccine beliefs, and this may increase the perception of vaccination risks and decrease perceptions of the risks of non-vaccination (Benecke and DeYoung, 2019).

Lastly, information plausibility and processing impact the formation of vaccine-related behaviors. Mannan and Farhana (2020) highlighted that many government decisions may be unwelcome as they are felt to be disproportional with the pandemic status or not justified enough by scientific knowledge about COVID-19. This could undermine trust in governments and in scientific national committees who issue lockdown or restrictive measures to prevent the virus spreading, and in turn this may affect vaccine propensity, as vaccines would be offered to the population by the very same actors.

Overall, these studies point out the important role of information in determining vaccine propensity. In particular, the trust in the information source, the understandability of information, and how it is received by individuals are all important determinants of the effect of information on vaccine hesitancy (Pagliaro et al., 2021).

Mistrust, Misinformation, and Conspiracy Beliefs Could Mediate the Effect of Psychological Factors on Vaccine Propensity

Importantly, mistrust and belief in conspiracy theories are related to psychological factors. Several studies have indicated the role played by distress in driving people to adhere to conspiracy theories as a strategy to find meaning, order, or controllability of otherwise ambiguous events (Swami et al., 2017; Georgiou et al., 2020). van Prooijen and Douglas (2018) found that a higher degree of conspiracy beliefs arises from hypervigilance and reactions to stressful situations. Conspiracy theories beliefs seem also to be strongly associated with underlying psychopathological traits, which make a person more likely to develop erroneous beliefs (Hart and Graether, 2018; Georgiou et al., 2019, 2020). For example, significant correlations with schizotypy (Buchy et al., 2007; Barron et al., 2014, 2018; Eisenacher and Zink, 2017) and paranoia (Murphy et al., 2021) were found. In particular, paranoid ideation seems to be associated with mistrust, suspicion, and conspiracy beliefs (Imhoff and Lamberty, 2018). The existential threat could also fuel the belief in conspiracy theories, in particular when an antagonistic outgroup can be identified, e.g., Big Pharma, healthcare workers, or policy makers (van Prooijen, 2020). Conspiracy beliefs, mistrust, and misinformation are related to both decreased vaccine acceptance and worst psychological

conditions. Following Chou and Budenz (2020), these factors could potentially mediate the effect of psychological state on vaccine acceptance, by increasing fear of vaccination and then hesitancy.

Aim and Hypotheses of the Present Study

In the present study, we investigated this complex relationship pattern between psychological factors, mistrust, and COVID-19 vaccine propensity during the first stage of the pandemic, when the vaccines were not yet available. To this aim, we administered an online battery of questionnaires to a general sample of the Italian population. In this battery, we collected data about sociodemographic information that were relevant for vaccination behavior or psychological well-being, i.e., sex (Malik et al., 2020), education (Lazarus et al., 2020), religious beliefs, familiar, and economic status (Murphy et al., 2021), working condition, i.e., if in smart working (Mari et al., 2021) or in the healthcare system (Simione and Gnagnarella, 2020), and history of a diagnosed psychological condition or medical condition relevant for COVID-19 severity (Sherman et al., 2020). We also measured psychological symptoms that were credited to be relevant in the context of COVID-19, vaccination, and mistrust/conspiracy beliefs, i.e., anxiety and depression (Kar et al., 2021), death and disease anxiety (Simione and Gnagnarella, 2020), somatization (Shigemura et al., 2020), anger (Trnka and Lorencova, 2020), paranoid ideation (Lopes et al., 2020), and psychotic symptoms (Hajdúk et al., 2020; D´Agostino et al., 2021). Lastly, we designed a new inventory that probed the presence of belief in conspiracy theories related to COVID-19, mistrust in science and in policy makers, and mistrust in scientific information on the pandemic.

Following the literature review presented, we hypothesized that psychological variables would influence the mistrust/conspiracy beliefs factors, and these, in turn, would reduce the propensity to get vaccinated. To test this hypothesized relationship scheme, we developed a mediation model in which the psychological factors of stress, general distress, anxiety, death anxiety, paranoia, psychoticism, somatization, and anger were the predictors, mistrust/conspiracy belief/misinformation factors were the mediators, and vaccine propensity was the outcome. In particular, we hypothesized that anxiety would increase vaccine propensity by increasing trust in medical science (Mannan and Farhana, 2020), whereas stress would lead to increased adherence to conspiracy beliefs and in turn to increased vaccine hesitancy (van Prooijen and Douglas, 2018). Psychopathological symptoms such as paranoid ideation, psychoticism, and hostility/anger would increase mistrust/conspiracy belief/misinformation and thus decrease vaccine propensity (Imhoff and Lamberty, 2018; Georgiou et al., 2019; Murphy et al., 2021). The presence of psychosomatic symptoms would increase health worries related to COVID-19 infection (Grönros et al., 2020), thus increasing the vaccine propensity. Lastly, death anxiety would increase the propensity to get vaccinated (Patelarou et al., 2021), whereas, on the contrary, a mistrust and suspicious position (van Prooijen, 2020) could decrease the vaccine propensity.

MATERIALS AND METHODS

Participants

We enrolled 374 Italian adults for this study. We removed 24 participants as multivariate outliers (see section Data Analysis for details), and we obtained a final sample of 350 participants for the analysis. Descriptive statistics of the sample are reported in **Table 1**. This sample included 292 females (81%) and 58 males (19%), with a mean age of 40.77 years (SD = 10.74) and a mean education level of 15.07 years (SD = 4.10). Of our participants, 52 (15%) reported working as medical doctors or in the healthcare system. Of our participants, 52 (15%) reported working as medical doctors or in the healthcare system, and 246 (70%) reported they were in a relationship. With regard to religious belief, 105 (30%) reported to be atheist or agnostic, 164 (47%) to be non-practicing Catholics, and 81 (23%) to be practicing Catholics. With regard to psychological and medical conditions, 31 (9%) reported having one or more psychiatric disorders such as depression or anxiety, while 67 (19%) reported at least one medical condition associated with an increased risk in the event of COVID-19 infection (mean = 1.40). While our sample was unbalanced for sex (81% of females), we conducted a series of Holm's corrected two-sample *t*-tests in order to assess differences between females and males in the other measured variables. The analysis revealed that, with respect to males, females reported on average lower education level, lower presence of smart working, and higher religious beliefs. No difference emerged for the other variables.

Procedure

The entire procedure was administered through online forms. In the first form, participants read the informed consent and gave their agreement to participate. In the second form, we collected demographic information. Then, a series of questionnaires was presented in successive online forms, in the same order as reported in Materials and Methods section. All data were collected in a completely anonymous format. Ethical approval for this study was granted by the Research Ethics and Integrity Committee of CNR, and all procedures performed were in accordance with the ethical standards of the 1964 Helsinki Declaration.

Materials

We administered a battery of questionnaires to the participants, including measures for stress, anxiety, death anxiety, psychological distress, psychoticism, paranoid ideation, anger, and somatization. Prior to assessing psychological data, we collected demographic information, including sex, age, education level, if in a relationship, if working as a healthcare worker, religious belief, presence of psychological or psychiatric conditions, and presence of medical conditions associated with increased risk in the event of COVID-19 infection. The latter measure was computed as the raw sum (from 0 to 8) of eight possible conditions measured by means of a checklist, including cardiovascular diseases, diabetes mellitus, hypertension, chronic pneumopathies, neoplasms, immunodeficiencies, hematological pathologies, and neuromuscular diseases.

TABLE 1 | Descriptive statistics for the demographic and psychological variables ($N = 350$).

Demographic variables	**Yes (1)**	**No (0)**	
In smart working	30%	70%	
Healthcare worker	15%	85%	
In a relationship	70%	30%	
Psychological condition	9%	91%	
	M	**SD**	
Age	40.77	10.74	
Education (in years)	15.07	4.1	
Number of children	1.06	0.95	
Religious beliefs (0 = atheist, 1 = non-practicing, 2 = practicing)	0.93	0.73	
Medical conditions relevant for COVID-19	0.27	0.62	
Psychological variables	**M**	**SD**	**Cronbach's α**
PSS	19.59	6.95	0.81
STAI	14.3	4.33	0.87
ECQ	8.72	5.66	0.90
GHQ	18.14	5.79	0.83
SCL-90 somatization	14.43	10.98	0.91
SCL-90 anger	4.71	4.41	0.85
SCL-90 psychoticism	5.62	6.31	0.84
SCL-90 paranoid ideation	5.1	4.9	0.81

M, mean; SD, standard deviation. Healthcare worker is coded as 0 = no, 1 = yes; In a relationship is coded as 0 = no, 1 = yes; Religious belief is coded as 0 = atheist/agnostic, 1 = non-practicing, 2 = practicing; Psych. condition is coded as 0 = no, 1 = yes; Med. condition is coded from 0 to 8.

With regard to psychological conditions (see **Table 1** for descriptive statistics), we administered the 10-item Perceived Stress Scale (PSS; Cohen et al., 2006), assessing a total score measuring how respondents perceive their lives as unpredictable and overloaded. In our sample, PSS showed a good internal reliability, Cronbach's $\alpha = 0.81$. In measuring anxiety, we used a short version of the State-Trait Anxiety Scale (STAI; Marteau and Bekker, 1992), using only six items. This scale showed an excellent internal reliability in our sample, Cronbach's $\alpha = 0.87$. Then, we measured death anxiety as a fear of death, illness, and in general of the unpredictability of life. We administered the 5-item subscale of the death anxiety scale of the Existential Concerns Questionnaire (ECQ; Van Bruggen et al., 2017), which showed an excellent internal reliability, Cronbach's $\alpha = 0.90$. We also measured general distress and depression symptoms by means of the 12-item version of the General Health Questionnaire (GHQ; Giorgi et al., 2014). We computed a total score from the 12 items, showing a good internal reliability in our sample, Cronbach's $\alpha = 0.83$.

In measuring psychological symptoms, we administered four subscales of the Symptom Checklist (SCL-90; Prunas et al., 2012). In particular, we used the 10-item subscale for psychoticism (as the presence of social withdrawal, isolation, and schizoidia), the 6-item subscale for paranoid ideation (as the presence of suspect and ideas of reference), the 6-item subscale for hostility/anger (as the presence of anger, irritability, and resentment), and the 12-item subscale for somatization (as the presence of perception of bodily dysfunctions and somatic concerns). All these measures showed good to excellent internal reliability in our sample, with Cronbach's α ranging from 0.81 to 0.91.

Lastly, we administered the items that we designed about Beliefs on COVID-19 (BOC-19). A first version of the inventory was created by the authors LS and CG. This first version had 16 items, including four items for each of the following dimensions: beliefs on conspiracy theories about COVID-19, reaction to communication from experts and virologists, mistrust in medicine, and mistrust in policymakers. Then, the inventory was revised by the co-authors and a group of six external experts (clinical psychologists and psychiatrists), who proposed removing three items as replication of other items or for unclear contents, leading to a final set of 12 items. Thus, the final version of the inventory included four items (numbers 1, 2, 3, and 4) investigating beliefs about conspiracy theories regarding COVID-19, three items (numbers 6, 7, and 11) investigating problems and misunderstandings in communication from experts and virologists, three items (numbers 5, 8, and 9) investigating mistrust in scientific research and medical science, and two items (numbers 10 and 12) investigating mistrust in policymakers and health systems. Each item consisted of a statement (e.g., "The new coronavirus responsible for COVID-19 was created artificially") that participants had to rate on a 5-point Likert scale ranging from 1 (completely disagree) to 5 (completely agree). Together with these items, we administered a vaccine propensity item ("If a vaccine were available for COVID-19, I would get vaccinated") measured on the same 5-point Likert scale.

Data Analysis

First, we computed the scores from the raw scale values. For each score, we computed descriptive statistics such as mean, standard deviation, and reliability as Cronbach's α. Before running the main analysis, we checked for multivariate outliers on the measured psychological scales by means of Cook's distance (Fox, 2016) and in this way excluded 24 participants as outliers. We also checked for the presence of a common method bias through Harman's one-factor test (Podsakoff et al., 2003) and the correlation matrix procedure (Bagozzi et al., 1991).

We then conducted the EFA on the BOC-19 inventory in order to assess the structure of the scale in our sample. For this analysis, we used the method of ordinary least squares (OLS) to find the minimum residual solution, and we applied an oblique rotation (oblimin) that assumes factors are correlated. We estimated the number of factors to be extracted with both scree analysis and BIC values testing solutions including 1–5 factors. We evaluated the suggested solutions by means of their factor structure together with their goodness of fit (Preacher et al., 2013). In particular, the model-fitting indexes include $\chi 2$ statistics, Tucker–Lewis index (TLI), root mean square of the residuals (RMSA), and root mean square error of approximation

(RMSEA) with related 90% confidence intervals. Model fit was considered as adequate with the following values: non-significant $\chi 2$, RMSEA of 0.06 or less, SRMR of 0.08 or less, CFI and TLI above 0.95 (Hu and Bentler, 1999).

We then moved on to the mediation model and to the related diagnostic regression analyses. Psychological variables of stress, anxiety, death anxiety, general distress, psychoticism, paranoia, hostility/anger, and somatization were predictors, while the outcome was the propensity to get vaccinated. The BOC-19 factors were mediators; thus, they were considered as dependent variables (predicted by psychological factors) or as predictors (of the vaccine propensity) in the diagnostic regression analyses. We considered our demographic variables as possible covariates in our regression models.

We tested the hypothesized mediational pathways through structural equation modeling (Kline, 2011) as it is considered a better method for assessing mediation with respect to regression methods (Iacobucci et al., 2007). We conducted model analysis by means of maximum-likelihood estimation, and we reported both unstandardized (with its relative confidence intervals) and standardized coefficients. Parameters of both regressions and SEM were estimated by means of bootstrapping over 1,000 samples, because it is considered the best method to make a model fitting robust to non-normal data (Mooney and Duval, 1993; Lai, 2018). We also tested the model using the Huber–White robust standard errors estimator in order to exclude bias due to heteroscedasticity. We used bias-corrected bootstrapped confidence intervals to test the indirect effects of psychological variables on vaccine propensity through BOC-19 factors. Confidence intervals were reported with each estimated coefficient and its related test of significance.

As we obtained a consistent number of candidate predictors, we proceed with variable selection prior to fitting the mediation model. Then, in the final model, we only included the variables that correlated with the predictors, the dependent variables, or both (VanderWeele, 2019). In order to assess if the exclusion of some variables might affect the model statistics, we compared a complete model (including all the considered variables) with a set of candidate nested models in which one or more variables or paths were removed. Model comparison was conducted by means of Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) values, and the final model selection relied on their weight (Burnham and Anderson, 2002), i.e., the relative difference in criterion between the better model and the worst one.

All our analyses were conducted with R statistical software (R Core Team, 2014). In particular, we evaluated our regression and mediation models by means of the Lavaan package (Rosseel, 2012).

RESULTS

We checked for the presence of a common method bias with the Harman's one-factor test (Podsakoff et al., 2003). Thus, we computed the variance explained by a single-factor exploratory model including all the items administered. The proportion of variance explained by this single-factor model was only 22.17%, suggesting the absence of a bias (test critical threshold = 50%). We also conducted the correlation matrix test that confirmed the absence of response bias, as all the correlation coefficients between our variables were smaller than the critical threshold value of 0.90.

Factor Structure of the Belief on COVID-19 Scale

First, we conducted the EFA on the Beliefs of COVID-19 (BOC-19) scale. The parallel analysis suggested the presence of three factors and the scree plot showed that only two factors had an eigenvalue higher than 1. Thus, we tested both a 2-factor and a 3-factor solution via a minimum residual algorithm and an oblimin rotation. **Table 2** reports the factor loadings for the two solutions, with their relative fit indices. As shown, both models explained about half of the total variance, respectively, 0.46 and 0.51 for the 2-factor and the 3-factor model. However, only the 3-factor model showed satisfactory fit indices, $\chi^2(43) = 67.08$, $p < 0.05$, TLI = 0.97, RMSA = 0.03, RMSEA = 0.05, $CI_{RMSE} = [0.03, 0.07]$, while the 2-factor model did not, $\chi^2(33) = 384.90$, $p < 0.05$, TLI = 0.76, RMSA = 0.06, RMSEA = 0.15, $CI_{RMSE} = [0.13, 0.16]$, whit RMSEA > 0.06 and TLI < 0.95. The two solutions differed in the factor that included two items about information confusion (i.e., items 6 and 7), whereas the other items loaded in the very same factors, and with the item 12 did not load significantly in any factor for both models. Thus, we decided to use the 3-factor model for the successive analysis.

The first factor included items 1, 2, 3, and 4, which investigated the beliefs on conspiracy theories of COVID-19. The second factor included items 6 and 7, which investigated the confusion about the information given about COVID-19 by virologists and medical doctors. The third and last factor included items 5, 8, 9, 10, and 11, which investigated the two topics of the mistrust in science reaction to COVID-19 and the inability of the healthcare system to manage the situation. Therefore, we called the first factor "belief in conspiracy theories" (BCT), the second factor "mistrust in medical information" (MMI), and the third factor "mistrust in medicine and science" (MMS). We then computed the values for the three scales for all the participants. As expected, the three scales were highly and positively correlated, with BCT correlated with MMI, $r = 0.40$, and MMS, $r = 0.45$, and MMI correlated with MMS, $r = 0.52$.

Correlation Analysis With Demographic and Psychological Variables

We then computed the Pearson bivariate correlations between the three BOC-19 scales and the demographic variables. The results of the analysis in terms of correlation coefficients are reported in **Table 3**. As reported, female sex was correlated with higher scores on both BCT and MMS scales, age was weakly correlated with a higher score on MMS scale, education was highly and negatively correlated with all the BOC-19 scales, religious belief was positively correlated with BCT and MMS scores, and reporting a psychic condition was positively correlated with BCT score. Working in the healthcare system,

TABLE 2 | Exploratory factor analysis results: oblimin-rotated factor loadings and explained variance for the two alternative models.

	2-factor model		3-factor model		
Item	**F1**	**F2**	**F1**	**F2**	**F3**
1. The new coronavirus responsible for COVID-19 was created artificially.		0.84	0.84		
2. The new coronavirus responsible for COVID-19 was spread voluntarily by some entity or person.		0.94	0.94		
3. The spread of COVID-19 is due to the use of innovative technologies without proper verification of their effects on health.		0.79	0.79		
4. There are effective treatments that the population does not know.		0.49	0.53		
5. I think that research and medical science are not capable of giving us adequate measures to deal with COVID-19.	0.49				0.32
6. Information on COVID-19 provided by virologists and official sources changes constantly and is unclear.	0.80			1.01	
7. Virologists and other experts have very different opinions on COVID-19; thus, it is difficult to understand which one is the best strategy to adopt.	0.75			0.84	
8. I do not trust the international scientific community and in medical research.	0.61				0.54
9. Healthcare system is dealing too much with the COVID-19 emergency to the detriment of the needs of care of other patients.	0.62				0.78
10. Important public health decisions should be made with greater collaboration between the experts and the general population.	0.48				0.39
11. Doctors and healthcare professionals should pay more attention to the emotional impact of their communications.	0.64				0.56
12. Experts and policy makers are forced to impose their decisions on the population as they are unable to regulate themselves.					
Proportion of variance explained	0.25	0.22	0.22	0.16	0.13
Cumulative variance explained	0.25	0.46	0.22	0.38	0.51

Loadings below.30 are not shown. F1, F2, and F3 refer to the different factors in each model.

being in a relationship, and having one or more medical pathologies increasing risk in the event of COVID-19 infection did not correlate significantly with any of the scores. Thus, we considered only the variables significantly related to at least one of the BOC-19 scales as covariates in the successive regression models.

We also computed the correlation coefficients between the three BOC-19 scales and the psychological variables measured. The results of this analysis are reported in **Table 3**. As shown, all the reported psychological variables had at least one positive correlation with a BOC-19 scale. In particular, death anxiety, somatization, psychoticism, and paranoia showed high correlations with all the BOC-19 scales, whereas anxiety (STAI) and anger/hostility showed low or nonsignificant correlations with BCT and MMS scales.

Vaccine Propensity: Mediation Effect of BOC-19 Scales

After the factor and correlation analysis, we assessed the pattern of the relationship between psychological variables, beliefs about COVID-19, and propensity to get vaccinated against SARS-COV-2. First, we conducted a descriptive analysis of vaccine propensity (VP) and its correlation with demographic and psychological variables. As reported in the panel A of **Figure 1**, about half of the participants declared they fully agreed with getting vaccinated against COVID-19. The mean value was 3.82, significantly higher than the midpoint of the scale, $t_{(349)} = 10.68$, $p < 0.01$. Vaccine propensity positively correlated with education level, working in the healthcare system, and the presence of a medical condition, whereas it negatively correlated with the presence of a psychological condition, paranoid ideation, female sex, MMI, MMS, and BCT. The other variables were not significantly related to vaccine propensity.

Before testing the mediation model, we conducted diagnostic regression analyses testing the relationship between demographic and psychological variables as predictors, the three BOC-19 scales as mediators, and vaccine propensity, as the outcome. We included in the regression models the covariates that showed at least one significant correlation with any of the BOC-19 scales, i.e., sex, age, education, religion, and presence of a psychological condition. We also included all the psychological scales measured, i.e., PSS, STAI, ECQ death anxiety, GHQ, somatization, anger/hostility, psychoticism, and paranoid ideation (reported as paranoia). In the model with vaccine propensity as a dependent variable, we also included the three BOC-19 factors as regressors, i.e., BCT, MMI, and MMS. We aimed at identifying the significant relationships between the variables in order to select the ones to be included in the

final mediation model. The results of this analysis are reported in **Table 4**, which included for each regressor the unstandardized coefficient (b) with its bootstrapped 95% confidence intervals and the semi-partial correlation (*sr*) as interpretable measures of effect size. We also reported the same coefficients in **Figure 2**, which compares all the four models for each predictor.

TABLE 3 | Correlation coefficients of BOC-19 factors with sociodemographic and psychological variables.

	BOC-19 factors		
Variable	**BCT**	**MMI**	**MMS**
Sex	0.20**	0.10	0.14*
Age	−0.02	0.05	0.14**
Education	−0.48**	−0.27**	−0.24**
Healthcare worker	−0.10	−0.08	0.01
In a relationship	0.02	0.01	−0.04
Religious belief	0.21**	0.09	0.15**
Psyc. condition	0.16**	0.10	0.08
Med. condition	−0.01	−0.04	0.03
PSS	0.20**	0.23**	0.16**
STAI	0.14**	0.22**	0.11*
ECQ Death anxiety	0.26**	0.27**	0.22**
GHQ	0.19**	0.26**	0.27**
SCL90 Somatization	0.28**	0.24**	0.20**
SCL90 Anger/hostility	0.10	0.20**	0.09
SCL90 Psychoticism	0.29**	0.24**	0.25**
SCL90 Paranoid ideation	0.25**	0.25**	0.24**

*Sex is coded as 0 = male, 1 = female; Healthcare worker is coded as 0 = no, 1 = yes; In a relationship is coded as 0 = no, 1 = yes; Religious belief is coded as 0 = atheist/agnostic, 1 = non–practicing, 2 = practicing; Psych. condition is coded as 0 = no, 1 = yes; Med. condition is coded from 0 to 8. BCT, Belief in conspiracy theories; MMI, Mistrust in medical information; MMS, Mistrust in medicine and science. Significant levels are reported as follows *p < 0.05, **p < 0.01.*

With regard to the covariates, education showed an effect on all the BOC-19 scales (positive) as well as vaccine propensity (negative). In addition, sex increased BCT and reduced vaccine propensity, age increased MMS, religion increased BCT, and the presence of a psychological condition decreased the propensity to get vaccinated. Thus, all the covariates showed at least one significant effect on the dependent variables tested. With regard to the psychological factors, the ECQ death anxiety was a significant positive predictor for all the models tested. The GHQ significantly increased MMI and MMS, while the STAI decreased MMS. Paranoia increased MMS and decreased the propensity to get vaccinated. The other factors, i.e., PSS, somatization, anger, and psychoticism, did not significantly relate to any dependent variables.

Our last analysis was the multiple mediation model. We tested all the direct and indirect paths considered by means of a structured equation model with parameters estimated on 1,000 bootstrapped samples. Before conducting the final analysis, we compared nested models including a different set of variables (and relative paths). First, we fitted a "complete model" including all the measured psychological variables and the three BOC-19 factors as mediators, with vaccine propensity as an outcome variable. Then, we fitted a "minimal model" including only the variables that should be retained based on our diagnostic regression analyses, i.e., ECQ, GHQ, STAI, and paranoia as psychological factors, and BCT and MMS as mediators (MMI did not affect vaccine propension; see **Table 4**). As we were particularly interested in the measures we developed, we also

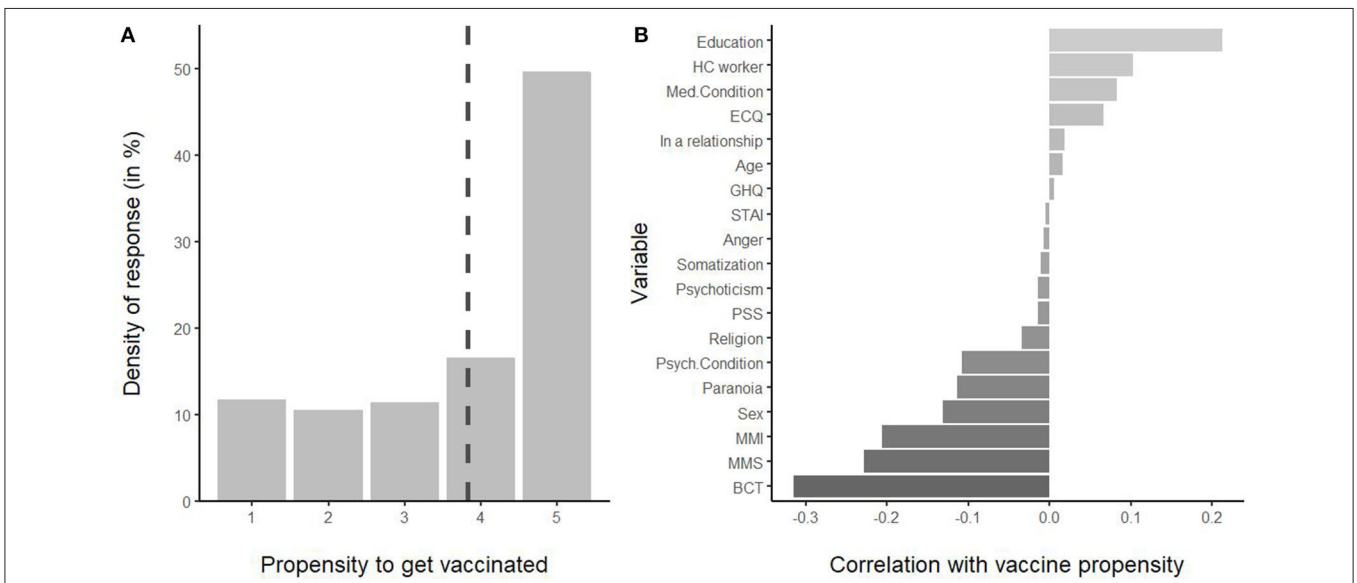

FIGURE 1 | (A) Distribution of responses for the vaccine propensity. The dashed line indicates the mean. **(B)** Correlation coefficients of vaccine propensity with demographic and psychological variables, ordered by coefficient. HC worker, healthcare worker; BCT, belief in conspiracy theories; MMI, mistrust in medical information; MMS, mistrust in medicine and science.

TABLE 4 | Regression results for the three BOC-19 scales and vaccine propensity.

	BCT				MMI				MMS				Vaccine propensity			
	b	95% CI		*sr*	*b*	95% CI		*sr*	*b*	95% CI		*sr*	*b*	95% CI		*sr*
Regressor		LL	UL			LL	UL			LL	UL			LL	UL	
(Intercept)	14.02**	11.00	16.79		5.13**	2.83	7.85		8.22**	5.11	11.28		2.59**	1.60	3.65	
Sex	1.36*	0.47	2.30	0.10	0.17	−0.49	0.77	0.02	1.08	−0.35	2.44	0.09	−0.44*	−0.70	−0.03	−0.11
Age	−0.02	−0.05	0.02	−0.04	0.02	−0.01	0.05	0.08	0.06**	0.02	0.09	0.13	0.01	−0.01	0.02	0.05
Education	−0.45**	−0.53	−0.36	−0.36	−0.12**	−0.20	−0.06	−0.17	−0.14*	−0.24	−0.02	−0.12	0.07**	0.04	0.12	0.19
Religion	0.81**	0.24	1.39	0.12	0.16	−0.23	0.57	0.04	0.52	−0.03	1.04	0.08	−0.03	−0.22	0.18	−0.01
Psych. Cond.	1.47	−0.29	3.67	0.08	0.26	−0.46	1.09	0.03	0.29	−1.18	2.31	0.02	−0.62*	−1.04	−0.06	−0.12
PSS	0.01	−0.08	0.10	0.01	−0.01	−0.07	0.04	−0.01	−0.01	−0.09	0.09	−0.01	0.01	−0.01	0.06	0.03
STAI	−0.15	−0.32	−0.01	−0.08	−0.01	−0.10	0.11	−0.01	−0.20*	−0.35	−0.02	−0.12	−0.01	−0.06	0.06	−0.01
ECQ	0.10*	0.01	0.21	0.10	0.08**	0.03	0.14	0.14	0.09*	0.03	0.17	0.10	0.04*	0.01	0.07	0.09
GHQ	0.09	0.00	0.19	0.08	0.08*	0.01	0.15	0.12	0.22**	0.12	0.31	0.21	−0.00	−0.03	0.03	−0.01
Anger	−0.08	−0.18	0.05	−0.06	0.03	−0.03	0.12	0.04	−0.06	−0.19	0.05	−0.05	0.02	−0.03	0.06	0.03
Psychoticism	0.09	−0.03	0.24	0.07	−0.04	−0.11	0.03	−0.05	0.04	−0.08	0.13	0.03	0.02	−0.01	0.05	0.05
Paranoia	0.05	−0.05	0.18	0.03	0.07	−0.02	0.15	0.08	0.13*	0.02	0.27	0.09	−0.06*	−0.10	−0.02	−0.12
Somatization	0.01	−0.03	0.07	0.02	0.01	−0.02	0.05	0.02	0.01	−0.06	0.07	0.01	0.01	−0.00	0.03	0.06
BCT	–				–				–				−0.07**	−0.11	−0.04	−0.19
MMI	–				–				–				−0.04	−0.10	0.03	−0.06
MMS	–				–				–				−0.04*	−0.08	0.00	−0.09
Model fit	$R^2 = 0.33$**				$R^2 = 0.17$**				$R^2 = 0.21$**				$R^2 = 0.18$**			

*Boldface predictors indicate variables with at least a significant effect. A significant b-weight indicates the semi-partial correlations are also significant. b represents unstandardized regression weight, with 95% CIs. LL and UL indicate the lower and upper limits of a confidence interval, respectively. sr represents the semi-partial correlation. BCT, Belief in conspiracy theories; MMI, Mistrust in medical information; MMS, Mistrust in medicine and science. Significant levels are reported as follows *p < 0.05, **p < 0.01.*

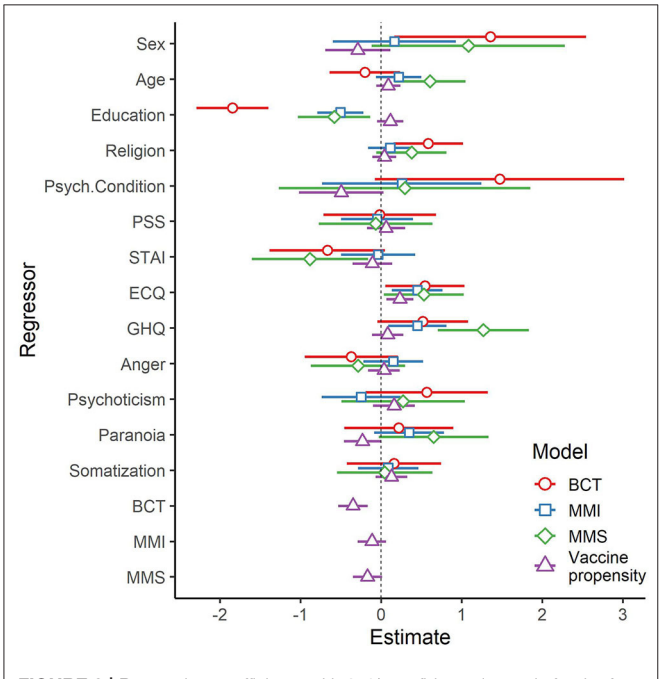

FIGURE 2 | Regression coefficients with 95% confidence intervals for the four models tested. BCT, belief in conspiracy theories; MMI, mistrust in medical information; MMS, mistrust in medicine and science.

fitted a third model ("full BOC-19 model") including the same psychological factors of the minimal model but all the three BOC-19 factors as mediators. All the three models were fully saturated, so model fit could not be assessed. We then compared the models' AIC and BIC values, considering their likelihood while penalizing unnecessarily complex models. The models AIC were 6679.52, 6662.93, and 5099.47, respectively, for the complete, the full BOC-19, and the minimal model; the models BIC were 6918.71, 6840.39, and 5226.78, respectively, for the complete, the full BOC-19, and the minimal model. As shown, the minimal model outperformed both the complete and the full BOC-19 models, with $\Delta_{AIC} > 1{,}563$ and $\Delta_{BIC} > 1{,}613$, and thus AIC weights <0.01 for both non-minimal models. This analysis suggested that removing the psychological variables of PSS, somatization, anger, and psychoticism (complete model) and the BOC-19 factor of MMI (full BOC-19 model) led to a model that was both simpler and closer to the true model.

Following all these preliminary analyses, we tested a final model (see **Figure 3**) that included four covariates, i.e., sex, age, education, and religious belief; four psychological predictors, i.e., death anxiety (ECQ), GHQ, STAI, and paranoia; two BOC-19 mediators, i.e., BCT and MMS factors; and vaccine propensity as a dependent variable. The analysis revealed that BCT was significantly increased by ECQ ($b = 0.12$, $CI = [0.04, 0.20]$, $\beta = 0.14$), and GHQ ($b = 0.10$, $CI = [0.01, 0.18]$, $\beta = 0.12$), while it was significantly decreased by STAI ($b = -0.16$, $CI = [-0.28, -0.02]$, $\beta = -0.14$). MMS was significantly increased by ECQ ($b = 0.10$, $CI = [0.01, 0.19]$, $\beta = 0.13$), GHQ ($b = 0.22$, $CI = [0.13, 0.31]$, $\beta = 0.29$), and paranoia ($b = 0.14$, $CI = [0.03, 0.23]$, $\beta = 0.16$), while it was significantly decreased by STAI ($b = -0.22$, $CI = [-0.36, -0.08]$, $\beta = -0.22$). Negative effect on the propensity to get vaccinated was significant for the path from both BCT ($b = -0.07\,6$, $CI = [-0.12, -0.03]$, $\beta = -0.24$) and MMS ($b = -0.05$,

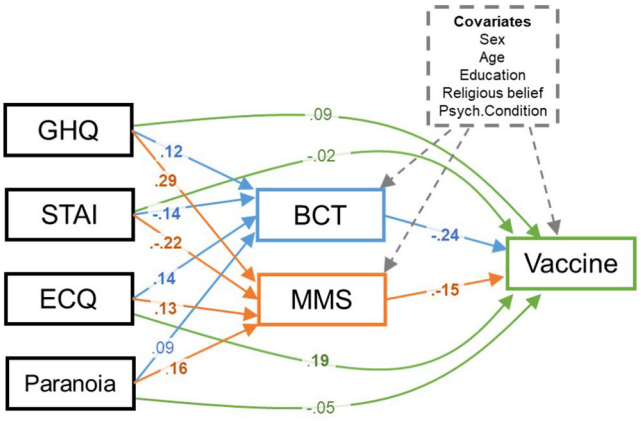

FIGURE 3 | The structured equation model tested. Standardized coefficients are reported only for direct paths. Coefficients for significant paths were reported in the boldface. Indirect effects are reported in text. BCT, belief in conspiracy theories; MMS, mistrust in medicine and science; Vaccine, propensity to get vaccinated.

$CI = [-0.09, -0.01]$, $\beta = -0.15$), whereas it was significantly and directly increased by ECQ ($b = 0.05$, $CI = [0.02, 0.08]$, $\beta = 0.19$).

The test of indirect effect through bias-corrected bootstrapped CI showed that STAI had a mediated positive effect on vaccine propensity through a reduction in BCT ($b = 0.01$, $CI = [0.01, 0.03]$, $\beta = 0.03$) and that ECQ had a mediated negative path through an increase in BCT ($b = -0.01$, $CI = [-0.02, -0.01]$, $\beta = -0.04$). Instead, both GHQ ($b = -0.01$, $CI = [-0.02, -0.01]$, $\beta = -0.04$) and paranoia ($b = -0.01$, $CI = [-0.02, -0.01]$, $\beta = -0.02$) decreased the propensity to get vaccinated by increasing the MMS factor.

The covariates showed a similar pattern of results as revealed by the previous regression analyses for their effect on mediators. In fact, BCT was increased by female sex ($b = 1.23$, $CI = [0.31, 2.21]$, $\beta = 0.10$) and religious belief ($b = 0.87$, $CI = [0.31, 1.45]$, $\beta = 0.13$), while it was reduced by higher education level ($b = -0.46$, $CI = [-0.55, -0.35]$, $\beta = -0.40$); MMS increased with age ($b = 0.06$, $CI = [0.02, 0.10]$, $\beta = 0.15$) and decreased with education level ($b = -0.15$, $CI = [-0.25, -0.03]$, $\beta = -0.14$). However, none of the covariates significantly related to vaccine propensity in this model.

We also fitted this model through a robust model estimator, i.e., the maximum-likelihood estimation with robust (Huber–White) standard errors. The result from this control analysis showed no difference with our main analysis using the bootstrapped samples; thus, we could conclude that no bias from non-normal or outlier data affected the results.

DISCUSSION

In this paper, we designed and tested an inventory for measuring beliefs about COVID-19 and their relationships with the propensity to get vaccinated. We collected data from a convenience sample of the general population, together with data on psychological symptoms and distress. We showed that three main areas emerged from the factorial analysis of the proposed inventory, i.e., believing in conspiracy theories about COVID-19, mistrust in medicine and scientific research, and mistrust in medical information about COVID-19 from experts and virologists. While these factors were all positively correlated with each other, they should be considered as distinct dimensions. The three scores were higher in female participants and in the presence of religious beliefs, whereas they decreased with an increased level of education. As female sex was positively correlated with religious belief and negatively correlated with education level, these effects could be explained by a common factor not included in the present model. Moreover, they were all positively related to the presence of psychological symptoms, in particular to death anxiety and paranoid ideation. We then conducted a mediation model, in which we included all the factors that survived the diagnostic regression models, i.e., psychological distress, anxiety, death anxiety, and paranoia, with covariance factors of age, sex, education level, religious belief, and presence of a psychological condition. We tested this model by means of structural equation modeling, and we found that death anxiety reduced the propensity to get vaccinated through a mediated path in believing in conspiracy theories, whereas paranoia was linked to a reduction in vaccination adherence with the mediation effect of mistrust in medical science. On the contrary, anxiety increased the propensity to get vaccinated through a decrease in both belief in conspiracy theories and mistrust in science. Lastly, death anxiety also had a direct positive effect on the propensity to get vaccinated. Thus, our study showed how psychological dimensions differentially relate to the belief in conspiracy theories, to mistrust in science, and to the propensity to get vaccinated. In particular, our data suggested a predominant effect of death anxiety on believing in conspiracy theories, while paranoia was the principal determinant of mistrust.

Mistrust and Conspiracy Beliefs Are Correlated but Distinct Factors

As shown, the three factors were strongly correlated with each other, suggesting that people who believe in conspiracy theories also tend not to trust science or medicine. In fact, a recent study on COVID-19 conspiracy theories showed that they are linked to denialism toward official sources of information, such as medical doctors or experts (Uscinski et al., 2020). This could be also explained by the tendency for conspiracy theories believers to self-feed, so that the more people are involved with those theories, the more they stick to them (van Prooijen, 2020). This reveals a typical echo chambers dynamics, where ignoring information from experts or official channels is a strategy to protect or maintain a core of beliefs that are functional for the individual (Uscinski et al., 2020). Skepticism toward science and policymakers could also lead to conspiracy beliefs acceptance, in particular when a group credited as "responsible" can clearly be identified (van Prooijen, 2020), e.g., the Chinese government or Big Pharma, or if one is involved in a conspiracy online group, in

which the sense of isolation and trust in conspiracy theories tends to increase during time (Del Vicario et al., 2016).

Thus, each one of these attitudes or beliefs about COVID-19 is correlated with psychological ill-being and is interconnected to the other beliefs in a complex and dynamic way. In fact, BCT seems more related to religious belief and existential anxiety, while mistrust (MMI and MMS) seems more related to distress and anxiety, with a special role for paranoia. In light of this result, BCT may be more linked to fear of death and disease, i.e., to deep existential concern (as suggested also in van Prooijen, 2020) or to a sense-making motivation (Park, 2010), whereas MMS seems to be more linked to psychological ill-being and negative emotional state. Having a paranoid or suspicious stance was a predictor of MMS, but not of BCT.

Based on our results, we can propose a new hypothesis in the interrelation between these constructs. First, an individual with a paranoid attitude, in the presence of an important stressful event, starts to lose trust in agencies and organizations that are considered to be incapable or incompetent, e.g., a person gets fired during the pandemic spread because the government proposed containment measures. Then, the same person finds information against the distrusted agencies and eventually gets involved in an online group of skeptics. In the presence of existential concerns, this person starts to search for a sense of what is happening, that is, experienced as uncertain or out of control. Moreover, the judgment on the same agencies and organizations would change from incompetent to hostile. This feeling grows as the person is even more isolated in a conspiracy echo chamber and overwhelmed by his or her negative emotional state. In this way, mistrust and misinformation interact with stress, paranoid ideation, and existential anxiety in determining the formation and the defense of conspiracy theories.

Direct and Indirect Effects of Psychological Factors on Vaccine Propensity

In our sample, we found a moderate propensity to get vaccinated for COVID-19 that is in line with a recent global survey (Mannan and Farhana, 2020). In the regression models, vaccine propensity decreased for females with respect to males and increased with education levels, according to previous studies on this topic (Lazarus et al., 2020; Malik et al., 2020). Moreover, existential anxiety and general anxiety increased vaccine propensity, while it was reduced in the presence of paranoid ideation. Again, these results are in line with previous literature showing that anxiety and fear may be associated with higher trust in COVID-19 vaccination (Mannan and Farhana, 2020; Patelarou et al., 2021).

Interestingly, we found no direct effect of anger, somatization, and perceived stress on vaccine acceptance in the regression model. About anger, we should consider that hostility tends to increase over time as distress increased and lockdown measures persisted (Duan et al., 2020). As we conducted this survey in the very first period of pandemic spread, it is possible that at that time anger was not a prominent factor for influencing vaccine intention. The absence of effect for somatization was also unexpected, but it could be explained as people with high psychosomatic symptoms could be equally scared by both COVID-19 (Grönros et al., 2020), thus propending for vaccination, but also by the vaccine's side effects, thus refusing to take the vaccine (as suggested also in Mannan and Farhana, 2020). Lastly, stress was also not related to COVID-19 vaccine intention. A previous study suggested a link between these two factors, but it tested a sample of nurses, a population at high risk of infection (Kwok et al., 2020). Thus, while stress could have a role, vaccine propensity seems more related to fear of disease and death, or to health worries (as also shown in Pastorino et al., 2021).

Out of the three factors of BOC-19, only BCT and MMS were related to vaccine propensity, whereas MMI was not. While misinformation was usually related to vaccine-related behavior (see Murphy et al., 2021), our results suggest that misinformation may be a factor that could increase mistrust and conspiracy beliefs more than directly influencing vaccine propensity. This point should be investigated in future studies on vaccine propensity addressing the role of mistrust in official information sources in forming paranoid and conspiracy beliefs about such sources.

In the mediation model on vaccine propensity, we showed how MMS mediated the negative effect of distress and paranoia, while BCT mediated the positive effect of anxiety. Again, this result revealed a completely different pattern for conspiracy beliefs and mistrust in connecting psychological variables with vaccine propensity. In particular, the absence of the effect of paranoia on BCT seems to be in contrast to the previous literature, which highlighted a prominent role for paranoia in determining conspiracy beliefs (see Goreis and Voracek, 2019). Instead, our result originally showed how paranoia seems to be implicated with a more general mistrust and suspicious stance on which conspiracy beliefs could eventually be based, but only under certain conditions (as discussed below). In fact, mistrust could be considered a more stable and central symptom of paranoia with respect to ideas of persecution (Bell and O'Driscoll, 2018). Our result originally showed how paranoia seems to be implicated with a more general mistrust and suspicious stance on which conspiracy beliefs could eventually be based, but only under certain conditions (as discussed below).

Death anxiety was the only psychological variable to show both a direct effect on vaccine propensity and an indirect effect through BCT. However, such effects had different signs, that is, the direct sign was positive, i.e., it increased the propensity to get vaccinated, and the mediated one was negative, i.e., it reduced the vaccine propensity by increasing BCT. These dissociated effects seemed to contrast each other, but they can be reconciled. Death anxiety could increase trust in the vaccine as a defense against anguish: In a mortality salience experiment, Farias et al. (2013) showed that thoughts and feelings aroused by thinking about their own death could increase belief in science. However, they reported that such belief in science elicited by mortality salience seems more similar to a form of secular "faith" or religious belief, i.e., it serves to cope with a stressful event such as thinking about death. In this vein, people with high ECQ could see the vaccine as a salvific remediation against COVID-19 without showing a paired, real trust in medicine or science. This is in line with our results, in which death anxiety actually

increased mistrust in science. Thus, death anxiety could increase vaccination adherence as a form of mitigation of existential fears and concerns (Pastorino et al., 2021), but also increase belief in conspiracy theories for the very same reasons (van Prooijen, 2020). In fact, these theories could have a protective role against death anxiety (Hornsey et al., 2021). Conspiracy theories, while imaginative, could help in explaining a threat event and thus give a greater sensitivity to a difficult situation than the official explanation (Jutzi et al., 2020). This hypothesis should be tested in further experimental research on the topic, e.g., by comparing the presence of conspiracy beliefs or mentality in two groups of participants, the former exposed to a mortality salience induction and the latter to a control condition.

Clinical Implications: Relationships Between Conspiracy Theories and Paranoia

From a clinical standpoint, our data suggest that the presence of paranoid ideation is more closely linked to a general attitude of mistrust than to belief in conspiracy theories. Mistrust, however, could be a base on which belief in conspiracy theories can grow, ignited by existential threats (van Prooijen, 2020). In fact, an exaggerated response to threats may be triggered in anxious individuals, who adopt conspiracy theories for their psychological need to feel secure (Green and Douglas, 2018). This suggests that a stable disposition resulting from early childhood experience could lead to belief in conspiracy theories. The stability of such a disposition is further supported by the usual structuring of a monological system of beliefs, i.e., belief in one conspiracy theory leads to beliefs in other conspiracy theories (as reported in Darwin et al., 2011). Thus, in order to treat pathological beliefs in patients, a therapist should first deal with their existential anxiety and with their response to that anxiety. Once such anxiety is relieved, the beliefs in conspiracy theories lose strength and then the pathological paranoid nucleus can be treated. We could conceptualize belief in conspiracy theories as a secondary delirium (Jaspers, 1997), in which the pathological and manifest ideas of reference are based on profound and latent, but explainable, existential causes.

Limitations and Future Directions

Our study is not free of limitations. First, it implied a cross-sectional design in which causal relations can be only interpreted with caution. In our model, we considered the psychological variables as predictors of the BOC-19 factors, while it is possible that also BCT or MMS affects the level of psychological symptoms circularly (as suggested by Del Vicario et al., 2016). In this respect, future longitudinal and experimental studies will provide a better methodological framework in which to test our hypothesis. We would like to point out that a second data collection is already planned on the same BOC-19 and psychological factors in order to assess how the actual presence and availability of the COVID-19 vaccine has changed the trust in vaccination with respect to the first period of the pandemic spread.

A second important limitation of our study was the use of self-report instruments. In fact, they are more prone to bias with respect to experimental methods. To overcome this limitation, in the future, it would be useful to test our hypotheses by means of experimental manipulation such as mortality salience and mood induction (for a review, see Westermann et al., 1996).

Third, we enrolled our sample through an online form using a convenience sample method. This method implied that our participants were all volunteers and thus motivated to participate, with the possibility of introducing a bias when applying our results to the general population. However, this method was the only one feasible at the time of data collection, when most of the Italian population was in quarantine during the first lockdown period. This method also allowed us to collect data from a more variegated pool rather than just the typical pool of students.

CONCLUSIONS

In conclusion, our work sheds a new light on the complex relationship pattern that links psychological distress and paranoia to mistrust and then to the endorsement of conspiracy theories, by highlighting the role of such factors in predicting vaccine propensity. In our model, we disentangled mistrust from conspiracy factors, by reporting how they relate to specific psychological dimensions. This could help in understanding how to successfully fight such distrust stances, reducing the stigma and the isolation of conspiracy believers while increasing trust in scientific organizations and policymakers during such difficult times. If effective strategies are not identified to help reduce attitudes that undermine the effectiveness of vaccination campaigns, this could have a huge negative impact on the global health situation.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

This study was reviewed and approved by Research Ethics and Integrity Committee of CNR, Rome. The participants provided their informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

LS designed and executed the study, analyzed the data, and wrote the paper. MV contributed to data analysis and wrote the paper. CG designed and executed the study and revised the paper. GB collaborated to study the design and revised the paper. DP contributed to data analysis and wrote the paper. All authors contributed to the article and approved the submitted version.

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The Impact of Pandemic Perception, National Feeling, and Media Use on the Evaluation of the Performance of Different Countries in Controlling COVID-19 by Chinese Residents

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Different nations responded to the global spread of COVID-19 differently. How do people view the governance practices and effects of various countries? What factors affect their views? Starting from the three-dimensional model of cognitive-affective-media, this study examines how pandemic perception, the national feeling, which is the emotional preference of public for different countries, and media use affect the Chinese public views on the performance of other countries in controlling COVID-19. After performing regression analysis on the data of 619 Chinese public samples collected by an online survey, it reveals the following: (1) pandemic perception is negatively correlated with the evaluation of controlling-pandemic performance in different countries by Chinese residents, whereas national feeling is positively correlated with the evaluation of controlling-pandemic performance. (2) The use of media has different characteristics in the evaluation of controlling-pandemic performance in different countries by Chinese residents. Television has a significant influence on the evaluation of controlling-pandemic performance in the United States, China, and Germany by Chinese residents. (3) Collectivist cultural orientation has no significant impact on the evaluation of the anti-pandemic performance of different countries by Chinese residents, whereas virus perception only has a significant impact on the evaluation of the controlling-pandemic performance of the United States and Italy. Research has confirmed the existence of the cognitive-affective-media model in the evaluations by public on the governance of other countries, and prospects for the superimposed role of media in the cognitive-affective model.

Keywords: COVID-19, pandemic perception, national feeling temperature, media use, nation evaluation, governance

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INTRODUCTION

After the outbreak of COVID-19 pandemic at the end of 2019, it has spread across the world. National governments are actively handling the virus to protect public health and social safety (Hopman et al., 2020; Kandel et al., 2020). Both traditional mainstream media and social media report dynamics about the pandemic and government responses to them. They also contain general

public concerns about these controlling-pandemic measures and their effects; however, it must be noted that, while public understanding of the spread of the pandemic and the governance measures of various countries mainly comes from news media, they made their evaluation of them through social media fermentation and personal perception. In fact, the source of perception is the result of the processing of the human brain of objective reality, symbolic reality, and subjective reality, and various media has become an important medium or platform for reality construction (Adoni and Mane, 1984; Gamson et al., 1992). This role is more extensive in the era of widespread social media today. So it must be noted that there is a "mediating" or even a "filtering" effect between the formation of personal perception and real events (Feezell, 2018; Goyanes et al., 2021). In the end, this perception will become the basis of judging ability of people in face of future public health emergencies. Regarding the COVID-19 pandemic, evaluation of government ability by people in handling the pandemic is affected by the spread of the pandemic in each country, which has become the basis of scientific perception and judgment of people. At the same time, it is also affected by national feeling when it is situated in the international relations. In other words, the judgment of governance performance by people is based on the actual performance of various national governments, and they are also closely related to a national feeling and media use.

This research is trying to construct a cognitive-affective-media analysis model based on the cognitive-affective framework (Baloglu and McCleary, 1999; Goldgeier and Tetlock, 2001; Mossberg and Kleppe, 2005; Yuksel et al., 2010; Maher and Carter, 2011; Li et al., 2014), and to explore how China public evaluates the effectiveness of governance practices of other countries in social and cultural background and media environment of China. Among them, pandemic perception and national feeling are used as the main explanatory variables to examine their influence on the evaluation of governments of other countries by Chinese public. At the same time, it further analyzes how different types of media play a role in the evaluation of controlling-pandemics by other countries. Eventually, it examines the feasibility of the cognitive-affective-media analysis framework and prospects the role of the media in the formation of cognition and emotion.

LITERATURE REVIEW

Influencing Factors of Controlling-Pandemic Evaluation Under the Cognitive-Affective Model

A cognitive-affective model is common in destination image research and brand research in tourism. For example, Baloglu and McCleary (1999) pointed out that the image of a tourist destination can include three types: cognitive images, emotional images, and overall images related to them, among which cognition and emotion become the main variables that affect the destination image. To cultivate the stickiness of the destination or brand, people also put research energy into changing the cognition, emotion, and behavior of the audience (Mossberg and Kleppe, 2005; Yuksel et al., 2010). In the study of country image, people also think that there are two aspects of cognition and affection (Maher and Carter, 2011; Li et al., 2014). For the image of the country in a special (epidemic) period, we believe that the cognitive-affective model is still a very basic explanatory analysis framework. Indeed, plenty of information also shows that the perception of the pandemic and national feeling has affected the evaluation of the governance capabilities of the government by public.

Since December 2019, COVID-19 has become the global focus. The WHO regularly releases reports on the global spread of the virus, which is as important source of information for the formation of perception of the pandemic. In the meantime, however, the risk perception of residents is affected by national background. For example, the survey of Dryhurst et al. (2020) of public risk perception in 10 countries in Europe, Asia, and the America finds that individualistic worldviews, personal experience, pro-social values, and social amplification through friends and family influence public risk perception. In other words, different people have different perceptions of the spread of the pandemic in different countries based on different personal experiences and information sources. This will cause their perception of the pandemic in various countries to fluctuate based on the information released by the WHO. In summary, it is the cognitive factors of individual that will affect his evaluation of controlling-pandemic.

Since COVID-19 is an infectious virus, its spread in various countries is also closely related to the management methods of each country. From the reverse deduction of the "New Public Management" (NPM) theory (Hood, 1991) by the government, it can be directly predicted that the risk perception of COVID-19 pandemic in various countries will inevitably affect the public evaluation of the effectiveness of risk management in different countries. Indeed, many studies have objectively confirmed this result. Bodrud-Doza et al. (2020) found that the outbreak of COVID-19 created psychosocial and socio-economic insecurity in Bangladeshi citizens, which reduced trust and evaluation of the government. At the same time, some of the measures taken by governments in response to the pandemic will also affect the public evaluation of the government (Shammi et al., 2020; Sibley et al., 2020). In short, combining the perspective of personal cognition formation and the new public management theory of the government, we have reason to speculate:

H1. Public perception of the severity of the pandemic in different countries will affect their evaluation of the governance effectiveness of each country.

As early as 1964, the feeling temperature was introduced for the study of public attitudes toward prominent political groups and figures (Winter and Berinsky, 1999). Later, this term was introduced to the field of international relations studies. For example, Page et al. (2008) asked Americans to use a 0–100 scoring system to evaluate Asian countries and used an indicator system composed of personal and social characteristics, information, internationalism and domestic, antipoverty, and capitalist foreign policy goals to analyze public feeling temperature toward different countries. The emotional perception of different countries by the public will further affect

their evaluation of the subsequent performance of each country. At present, most of the existing research focuses on the feeling temperature of public toward different countries and uses it as a dependent variable. However, indeed, feeling temperature can also be used as a predictive variable to influence the evaluation of government and international relations. The foundation of this influence lies in the influence of political sentiment on government evaluation. For example, as early as 1986, Lambert et al. (1986) discovered that party identity has a significant impact on the political trust by the public in the government. In recent years, further research on affective polarization has also shown the possible role of feeling temperature in political evaluation (Druckman and Levendusky, 2019). More and more people are also incorporating feeling temperature into various political prediction models (Shikano and Käppner, 2014). Combining this change with the new public management theory of the government (Hood, 1991) and the cognitive-affective model of tourism destination image (Baloglu and McCleary, 1999), we have reason to speculate:

H2. The feeling temperature of Chinese residents toward different countries will affect their evaluation of the performance of governments in managing the pandemic.

Influencing Factor of Controlling-Pandemic Evaluation From the Perspective of Media Effects

The influence of the Chinese public on the controlling-pandemic evaluation of the governments of various countries in terms of media use mainly comes from three aspects: first, media have a priming function, i.e., the ability to isolate specific issues, events, or topics in the news so that the public pay special attention (Iyengar and Kinder, 1987). This priming effect also plays a role in the evaluation of political performance. For example, Miller and Krosnick (2000) found that when evaluating political performance of the president, media played a role in urging the public to pay attention to specific aspects of the work of the president. The "priming" function of media can even change government evaluation standards by people (Iyengar and Kinder, 1987). By drawing attention of people to certain issues, media can create, strengthen, and eliminate political judgment standards by people (McGraw and Ling, 2003). This priming effect of media also occurs in the evaluation of attitudes toward other countries. For example, Brewer et al. (2003) surveyed 199 students on the East Coast of the United States to investigate how priming effect of the media affects their attitudes about four different countries. Willnat et al. (2000) also pointed out the reports that initiated terrorism or drugs significantly affected the attitudes of the participants toward Mexico and Colombia. Matthes and Beyer (2017) used a theoretical cognitive-affective process model of the hostile media effect (HME) to prove that the perception of media of people itself may also affect their attitudes toward a certain issue. In other words, media not only have the effect of initiating the attention of people to a certain topic but also have the possibility of inspiring people to have positive or negative effects on a certain topic due to cognitive tendency of people to media and may even cause adverse effects. It fully indicates the complicated mechanism of influence of media on attitudes of individuals on other countries.

The second function of the media is the framing function, which is closely related to the agenda-setting function of the media (Moy et al., 2016). Price et al. (1997) pointed out that frames can affect cognitive and affective perceptions of readers of a story. Based on reviewing the research on the role of media in the framework, Dell'Orto et al. (2004) examined how the democratic and non-democratic frameworks of the country in American newspapers affect perceptions and images of foreign countries in readers. Ospina Estupinan (2017) confirms that countries in Latin America do have a typical framework for international image of China. In government evaluation, this kind of framing function of news media still exists. For example, Shen and Guo (2013) indicate that the information frame in reports tend to activate the relevant psychology of the public in political evaluation. Zhao et al. (1994) found that the use of news media is positively related to government policy support. In other words, in response to the evaluation of government of China, the media frame that the Chinese public is exposed to may strengthen their positive attitude toward the government. What about other countries? Will the reporting frame distributed in different media affect Chinese perception of controlling-pandemic evaluations of other countries?

Indeed, the influence of media on government evaluation is reflected in the most basic level of information acquisition. For example, Wanta et al. (2004) confirmed that the more media reports focus on one country, the more the public thinks the country is important. If they receive more negative information about a country, they are more likely to have a bad impression of the country. Lee and Hong (2012) also confirmed this view with data from 27 countries. Furthermore, we should also pay attention to the influence of the own frame of the media on the perception of government evaluation. For example, Shen and Guo (2013) proved that the internet is strongly negatively correlated with political trust through world values data, whereas TV news and political trust are significantly and positively correlated. On the other hand, the influence of newspapers is not significant. Shen et al. research is rooted in his assumption that many Chinese media are propaganda. So when reporting frame of media or political attributes are linked to the evaluation of foreign governments, what will happen?

Under the premise that media may have an impact on controlling-pandemic evaluations by foreign governments, we also need to consider the influence of bias of different media toward controlling-pandemic reports on other countries. For example, Shen and Guo (2013) indicated that television and political trust of Chinese citizens on the government is significantly and positively correlated, while the internet is the opposite. A large number of studies also indicated the negative correlation that the rise of the internet may have on the evaluation of the Chinese government (Yang, 2003). So when the internet gradually becomes old-fashioned, will newer forms of media, such as social media, have more influence on government evaluations and evaluations of other countries? In China during the pandemic, social media functioned as an intermediary and filtered other media information releases. It has become a

comprehensive information exposure method facilitating media contact and interpersonal contact. Then, whether does the information circulated on different social media has a differential impact on evaluation of different countries by people? Han and Xu (2020) have shown that social media has played a more important role than traditional media in improving public health. In the evaluation of governments of other countries, we have reason to speculate that the use of different media will have different effects, so we propose the following:

H3. The exposure of Chinese public to different media types will affect their evaluation of the performance of governments in controlling the pandemic.

The factors that are generally influencing are as follows: socio-demographic variables, virus perception, and cultural value orientation; in addition to the above three main factors, we will also consider the possible impact of general demographic variables, virus perception, and cultural value orientation on government evaluation. Demographic variables are the basic variables when we examine various government evaluations, and the current government performance evaluation from the citizen perspective further magnifies the significance of demographic variables (Alshawi and Alalwany, 2009). Among them, we pay special attention to the influence of political parties on the evaluation of the government. Bian et al. (2001) confirmed that the attributes of party members are closely related to the dynamics of the system, and the attributes of individual party affiliations are very likely to affect their perception of other countries. Cultural values have a similar influence. Collectivist cultural values are considered to be east Asian and are also considered as an important variable when analyzing various political phenomena in China (Shi, 2001; Yang et al., 2014). Dahler-Larsen and Schwandt (2012) pointed out that understanding government evaluation must be based on the political culture of the country, so we incorporate collectivist cultural values as a factor. In addition, the impact of the evaluation of the fight of the government against the pandemic will also be related to perception of the virus itself by people. If a higher awareness of the danger of the virus is held, will it reduce the strict judgments of the public on the governments of various countries? Or is it that the higher the awareness of the danger of the virus, the more we hope that countries can control it and increase expectations? Therefore, we incorporate the above three types of variables into the overall analysis framework and finally form a three-dimensional model based on cognition-emotion-media communication.

Aim

This research aims to examine the explanatory power of the cognitive-affective model for the evaluation of the performance of other countries in controlling COVID-19 by the Chinese public, and to analyze the role of media use in it, and to construct a three-dimensional model of cognitive-affective-media.

METHODS

Participants

The data of this study comes from a random sampling survey conducted on the Chinese large-scale questionnaire survey platform (https://www.wjx.cn/) from June 3–7, 2020. The survey took 2.6 million registered users as the sample pool. A total of 1,358 questionnaires were distributed through continuous rolling random questionnaires, of which 619 were valid (the rate of valid was 45.58%). Because the survey was continuously distributed randomly, so the questionnaire obtained still meets the requirements. The survey also uses IP address and logic problem design to ensure that each participant only participates in the survey one time. The population covered by the survey involved a total of 30 provinces, municipalities, and autonomous regions across the country (the Tibet autonomous region did not collect samples).

The demographic characteristics of the sample are distributed as shown in **Table 1**:

Measures

The Evaluation of COVID-19 Control by Different National Governments

The dependent variable of this study is the evaluation of the controlling-pandemic performance of the governments of different countries by the Chinese public. Although the government evaluation itself has many dimensions, according to research needs we mainly adopt the 0–10 points scoring system (Sanderson, 2001). The specific questions are as follows: "Please rate the controlling-pandemic situation of the following countries (0 is very poor, 10 is very good)." The matrix is scored for 12 countries. Refer to **Table 2** for the mean and SD of scores by the countries.

Pandemic Perception of Different Countries

Regarding the public perception of the epidemic situation in different countries, similar to Jose's seven-point ranking scale (Jose et al., 2021) on the epidemic perception, we used the following five-degree Likert scale to measure according to the actual measurement purpose. It is "How do you perceive the seriousness of the spread of COVID-19 in the following countries?" The answers are 1 = very serious, 2 = relatively serious, 3 = fair, 4 = relatively slight, and 5 = slight. After the reverse assignment, the average and SD of the scores on this indicator of the Chinese public are shown in **Table 2**.

Feeling Temperature of Different Countries

There are various ways to measure feeling temperature (Liu and Wang, 2015). The most common one is a 0–100 scoring system (Greene, 2004). To facilitate respondents to answer questions more quickly, the following question is used to measure: "How do you like or dislike the following countries," countries include the 12 countries shown in **Table 2**, and the answers are 1 = like it very much, 2 = like it more, 3 = fair, 4 = I do not like it, and 5 = I do not like it very much. After the reverse assignment, the average and SD of the feeling temperature of the Chinese public for each country are shown in **Table 2**. This item is used to measure national feeling, and, sometimes, it is directly replaced with the feeling thermometer (refer to **Table 2** and **Figure 1**).

Media Exposure for COVID-19

The third influencing variable examined in this study is the media exposure of Chinese residents to pandemic information in

TABLE 1 | Distribution of sample socio-demographics.

	Categories	Frequency	Percentage (%)		Categories	Frequency	Percentage (%)
Gender	Male	359	58.0	Province or municipality	Hebei	56	9.0
	Female	260	42.0		Hubei	53	8.6
Education	Junior high school and below High school	11	1.8		Guangdong	46	7.4
		25	4.0				
	College/University	514	83.0		Shanghai	46	7.4
	Master and above	69	11.2		Liaoning	35	5.7
Family income per	<4,999	65	10.5		Shanxi	32	5.2
Month (Rmb)	5,000–9,999	166	26.8		Zhejiang	32	5.2
	10,000–14,999	161	26.0		Hunan	30	4.8
	15,000–19,999	127	20.5				
	20,000–24,999	58	9.4		Henan	29	4.7
	>25,000	42	6.8		Jiangsu	27	4.4
	City	464	75.0		Fujian	25	4.0
	Town	97	15.8		Beijing	22	3.6
	Rural	58	9.2		Tianjin	20	3.2
Party member	CCP	125	20.2		Chongqing	19	3.1
	Non-CCP	494	79.8		Sichuan	18	2.9
Age	Mean	30.5			Others	129	20.8

TABLE 2 | Evaluation of controlling-pandemic, pandemic perception, and feeling thermometer of the Chinese public in different countries ($N = 619$).

	Evaluation of controlling-pandemic (0–10)		Pandemic perception (1–5)		Feeling thermometer (1–5)	
	Mean	Std.	Mean	Std.	Mean	Std.
US	**1.42**	1.78	**4.94**	0.28	**1.69**	0.90
Japan	5.57	2.08	3.53	0.70	**2.40**	1.01
UK	3.97	1.92	**4.14**	0.71	2.67	0.83
S.Korea	6.02	2.02	3.46	0.79	2.79	0.90
Italy	4.76	2.11	**4.44**	0.71	2.97	0.92
Germany	5.39	1.99	3.74	0.78	3.26	0.86
France	4.95	1.87	3.83	0.79	3.17	0.90
Iran	4.84	1.89	3.87	0.85	2.91	0.85
Brazil	**3.84**	2.16	4.10	0.84	2.82	0.84
India	**3.55**	2.16	4.07	0.92	**2.07**	0.89
Russia	5.48	2.12	3.86	0.94	3.68	0.87
China	9.10	1.35	3.27	0.93	4.84	0.59

The bold values are the values of the top three countries in each index.

various countries. Considering the history of media development and actual media exposure of residents in China, media exposure is mainly divided into two categories: exposure to pandemic information through traditional media and exposure to pandemic information through social media. Traditional media include newspapers, magazines, broadcast, television, and the internet. Social media include WeChat, Weibo, Tiktok, Kuaishou, QQ, BaiduTieba, Zhihu, Douban, Facebook, Twitter, and Instagram (Han and Xu, 2020). The specific measurement question is "How do you receive various pandemic information (including the number of infections, global spread, prevention methods, discussion of different viewpoints, etc.) from the following media," the answers are 1 = very more, 2 = more, 3 = general, 4 = less, and 5=less or no, and the score is reversed. After re-assignment, the minimum value is 1, and the maximum value is five, the average value of each media and SDs are given for newspapers (M = 1.82 and SD = 0.98), magazines (M = 1.69 and SD = 0.88), broadcast (M = 4.21 and SD =0.77), Weibo (M = 3.50 and SD = 1.24), Tiktok (M = 3.28 and SD = 1.28), Kuaishou (M = 2.63 and SD = 1.34), QQ (M = 2.95 and SD = 1.12), BaiduTieba (M = 2.53 and SD = 1.14), Zhihu (M = 2.64 and SD = 1.20), Douban (M = 1.98 and

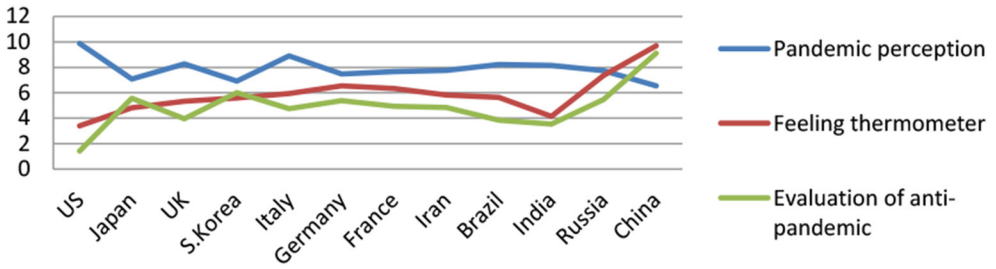

FIGURE 1 | Evaluation of controlling-pandemic, feeling thermometer and pandemic perception of Chinese public on different countries ($N = 619$).

SD = 1.02), Facebook (M = 1.45 and SD = 0.81), Twitter (M = 1.44 and SD = 0.82), and Instagram (M = 1.39 and SD = 0.78).

Measurement of Other General Variables That Affect Government Evaluation

COVID-19 Perception

Since there is no mature scale on COVID-19 Perception to be adopted, we have conducted multiple rounds of question screening through consulting experts and official science information of WHO to determine the following measurement question. It is "Please express your attitude toward the following statements about COVID-19." The measurement items include eight statements: (1) the new coronavirus is more harmful than the SARS virus; (2) at present, we have a deeper understanding ofCOVID-19; (3) people infected with COVID-19 can be cured; (4) the death rate among patients infected by COVID-19 is very high; (5) the latent impact of COVID-19 is very large; (6) the COVID-19 pandemic can be completely controlled in our country after 6 months; (7) the COVID-19 pandemic can be controlled globally in the next year; and (8) there will be repeated outbreaks of COVID-19 in the future. The options are: 1 = strongly agree; 2 = more agree; 3 = general, 4 = more disagree, and 5 = strongly disagree, where 1.4.5.8 reverse scoring is used. After the weighted summary, the copy range of this item is 1–5. The average value of the variable is 3.16, the SD is 0.44, and Cronbach's Alpha is 0.735. The KMO value is 0.715, and the Bartlett sphere test result is significant (0.00).

Collectivist Cultural Value

With reference to the measurement method of the Asian Barometer Survey (Han et al., 2011), the measurement issues of this study include the following: (1) the state is like a big machine, and the individual is but a small cog, with no independent status. (2) Personal interests give way to collective interests, in general. (3) Personal interests should be sacrificed for national interests. (4) For the benefit of the family, individuals should put their interests second. (5) Even if request of a parent is unreasonable, children should still obey. (6) If a conflict occurs, one should ask senior people to uphold justice. The options are as follows: 1 = strongly agree; 2 = more agree; 3 = general, 4 = more disagree, and 5 = strongly disagree, and the indicators of collectivist cultural value are obtained after reverse scoring and total average. The average value of this variable is 3.12, the SD is 0.56, and Cronbach's Alpha is 0.705. The KMO value is 0.694, and the Bartlett sphere test result is significant (0.00).

Demographic Characteristics

The demographic variables used in this study mainly include gender, age, education, income, and party affiliation. The operational measurement of each indicator is as follows: gender, 1 = male; 0 = female and the female was the control group. Age: calculated using 2020 minus the year of birth. Education level: 1 = junior high school and below; 2 = high school/secondary school, technical school; 3 = college, university; 4 = Master; and 5 = PhD and above. The family income per month: 1 = 4,999 Yuan or less, 2 = 5,000–9,999 Yuan, 3 = 10,000–14,999 Yuan, 4 = 15,000–19,999 Yuan, 5 = 20,000–24,999 Yuan, 6 = 25,000 Yuan or more. Party: 1 = CCP and 2 = Non-CCP.

Data Analysis Methods and Procedures

According to the research hypothesis, we used the evaluation of the controlling-pandemic performance of the governments of different countries by the Chinese public as the dependent variable, and the relevant influencing variable as the independent variable, and processed the data through multiple regressions (OLS regression in SPSS19.0 software). Independent variables in the model are mainly composed of four categories: demographic variables, traditional media information exposure, social media information exposure, and perception of different countries (pandemic perception and feeling temperature). We believe that in this way, we can observe the distribution of the influence of different variables in the evaluation of pandemic governance in various countries, and from this, we can also discover which factors are the most important and have common effects.

RESULTS

Descriptive Results of Controlling-Pandemic Evaluation, Pandemic Perception, and Feeling Temperature in Different Countries by Chinese Public

Based on the 619 data samples, the top three perception of the pandemic by the Chinese citizens are the United States, Italy, and the United Kingdom, and the bottom three in the emotional

TABLE 3 | Regression analysis for evaluation of controlling-pandemic of the Chinese public in different countries.

		M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
		US	Japan	UK	S.Korea	Italy	Germany	France	Iran	Brazil	India	Russia	China
		B(β)	B(β)	B(β)	B(β)	B(β)	B(β)	B(β)	B(β)	B(β)	B(β)	B(β)	B(β)
Demography variables	Gender	−0.115 (0.032)	0.095 (0.022)	0.202 (0.052)	0.244 (0.060)	0.254 (0.059)	**0.353* (0.087)**	0.155 (0.041)	0.018 (0.005)	−0.072 (−0.016)	**0.375* (0.086)**	0.169 (0.039)	−0.097 (−0.035)
	Age	0.015 (0.072)	0.019 (0.075)	0.007 (0.032)	0.039 (0.163)	0.012 (0.047)	0.019 (0.080)	0.018 (0.080)	0.004 (0.018)	0.005 (0.018)	0.009 (0.035)	−0.013 (−0.053)	**−0.016* (−0.103)**
	Education	**−0.318* (−0.085)**	−0.051 (−0.012)	−0.232 (−0.057)	**0.263**** **(0.062)**	−0.197 (−0.044)	0.183 (0.044)	**−0.057* (−0.015)**	−0.173 (−0.044)	−0.044 (−0.010)	−0.035 (−0.008)	−0.044 (−0.010)	−0.230 (−0.081)
	Income	−0.071 (−0.054)	**0.200*** (0.131)**	−0.108 (−0.076)	0.104 (0.070)	−0.085 (−0.055)	−0.032 (−0.022)	−0.114 (−0.084)	0.047 (0.034)	−0.109 (−0.069)	−0.079 (−0.050)	−0.029 (−0.019)	0.073 (0.073)
	MCP	0.287 (0.064)	−0.044 (−0.009)	−0.049 (−0.010)	−0.090 (−0.018)	−0.397 (−0.075)	−0.144 (−0.029)	−0.167 (−0.036)	0.223 (0.047)	**0.476* (0.088)**	0.212 (0.039)	−0.062 (−0.012)	−0.168 (−0.050)
Control variables	Culture Collectivism	−0.059 (−0.018)	−0.138 (−0.037)	−0.050 (−0.014)	−0.264 (−0.073)	0.081 (0.021)	−0.164 (−0.046)	−0.184 (−0.055)	−0.157 (−0.047)	−0.155 (−0.040)	−0.126 (−0.033)	−0.159 (−0.042)	0.069 (0.028)
	COVID−19 Perception	**−0.323* (−0.079)**	0.017 (0.003)	−0.215 (−0.049)	−0.182 (−0.040)	**−0.382* (−0.079)**	0.039 (0.009)	−0.098 (−0.023)	0.059 (0.014)	−0.225 (−0.045)	−0.102 (−0.021)	0.098 (0.020)	−0.043 –(0.014)
Traditional media	newspaper	−0.017 (−0.009)	**−0.269** (−0.126)**	−0.177 (−0.090)	−0.052 (−0.025)	0.059 (0.027)	−0.023 (−0.011)	0.040 (0.021)	0.116 (0.060)	−0.166 (−0.075)	−0.062 (−0.028)	0.026 (0.012)	−0.093 (−0.068)
	Magazine	0.131 (0.064)	0.014 (0.006)	0.200 (0.091)	−0.150 (−0.065)	0.116 (0.048)	−0.019 (−0.008)	0.031 (0.014)	−0.137 (−0.064)	**0.264* (0.107)**	0.097 (0.040)	0.088 (0.037)	0.165 (0.107)
	broadcast	0.002 (0.002)	0.049 (0.028)	0.022 (0.013)	−0.016 (−0.010)	−0.152 (−0.083)	−0.100 (−0.058)	−0.018 (−0.011)	−0.034 (−0.021)	0.023 (0.013)	−0.072 (−0.039)	−0.041 (−0.023)	0.028 (0.024)
	TV	**−0.211* (−0.110)**	0.108 (0.048)	−0.034 (−0.017)	0.159 (0.073)	0.004 (0.002)	**0.226* (0.105**)	0.005 (0.002)	0.160 (0.078)	−0.072 (−0.031)	0.109 (0.047)	0.083 (0.036)	**0.151* (0.103)**
	Internet	−0.055 (−0.019)	0.226 (0.067)	0.070 (0.022)	0.282 (0.086)	−0.041 (−0.012)	0.009 (0.003)	0.025 (0.008)	0.175 (0.057)	0.205 (0.059)	−0.022 (−0.006)	0.037 (0.011)	−0.054 (−0.025)
Social media	WeChat	0.022 (0.010)	−0.096 (−0.036)	−0.106 (−0.043)	**−0.291** (−0.113)**	0.038 (0.014)	−0.143 (−0.056)	−0.179 (−0.075)	−0.217* (−0.090)	−0.061 (−0.022)	−0.057 (−0.021)	−0.108 (−0.040)	−0.060 (−0.035)
	Weibo	−0.033 (−0.023)	−0.072 (−0.043)	0.028 (0.018)	0.065 (0.040)	0.055 (0.032)	−0.033 (−0.021)	0.004 (0.003)	−0.038 (−0.025)	0.028 (0.016)	0.092 (0.053)	**−0.191* (−0.111)**	−0.033 (−0.030)
	Tiktok	0.003 (0.002)	−0.107 (−0.066)	0.077 (0.051)	−0.124 (−0.079)	0.096 (0.058)	0.061 (0.039)	0.089 (0.061)	0.008 (0.005)	0.064 (0.038)	0.142* (0.084)	**0.148* (0.089)**	−0.014 (−0.013)
	Kuaishou	0.106 (0.079)	0.075 (0.048)	−0.044 (−0.031)	0.042 (0.028)	**−0.157* (−0.099)**	−0.116 (−0.078)	−0.085 (−0.061)	−0.064 (−0.045)	−0.042 (−0.026)	−0.092 (−0.057)	−0.094 (−0.059)	−0.050 (−0.049)
	QQ	0.016 (0.010)	0.086 (0.046)	0.080 (0.046)	0.140 (0.078)	0.159 (0.084)	0.011 (0.006)	0.030 (0.018)	0.128 (0.076)	0.033 (0.017)	0.143 (0.074)	0.064 (0.034)	0.033 (0.027)
	BaiduTieba	0.083 (0.053)	−0.019 (−0.010)	−0.032 (−0.019)	−0.044 (−0.025)	−0.078 (−0.042)	0.055 (0.031)	0.080 (0.049)	−0.060 (−0.036)	−0.011 (−0.006)	−0.034 (−0.018)	−0.028 (−0.015)	0.063 (0.053)

(Continued)

TABLE 3 | Continued

		M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
		US	**Japan**	**UK**	**S.Korea**	**Italy**	**Germany**	**France**	**Iran**	**Brazil**	**India**	**Russia**	**China**
		B(β)	**B(β)**	**B(β)**	**B(β)**	**B(β)**	**B(β)**	**B(β)**	**B(β)**	**B(β)**	**B(β)**	**B(β)**	**B(β)**
	Zhihu	**0.141*** **(0.095)**	0.086 (0.049)	0.101 (0.063)	0.149 (0.089)	0.070 (0.040)	0.127 (0.077)	0.118 (0.076)	0.023 (0.015)	0.076 (0.042)	−0.079 (−0.044)	0.034 (0.019)	−0.039 (−0.035)
	Douban	−0.051 (−0.029)	0.014 (0.007)	0.020 (0.011)	−0.081 (−0.041)	0.189 (0.090)	−0.011 (−0.005)	−0.025 (−0.014)	−0.052 (−0.028)	−0.146 (−0.068)	0.038 (0.018)	0.022 (0.010)	0.039 (0.029)
	Facebook	0.127 (0.058)	−0.116 (−0.045)	−0.016 (−0.007)	0.022 (0.009)	0.097 (0.037)	−0.064 (−0.026)	−0.018 (−0.008)	−0.003 (−0.001)	0.286 (0.107)	0.162 (0.061)	0.092 (0.035)	**−0.244* (−0.146)**
	Twitter	0.040 (0.018)	0.083 (0.032)	0.118 (0.050)	−0.120 (−0.049)	0.039 (0.015)	0.159 (0.065)	0.243* (0.107)	0.238 (0.103)	−0.013 (−0.005)	0.207 (0.079)	0.256 (0.099)	0.014 (0.009)
	Instagram.	−0.209 (−0.091)	−0.025 (−0.009)	0.112 (0.045)	0.053 (0.020)	−0.039 (−0.014)	−0.038 (−0.015)	−0.088 (−0.037)	0.007 (0.003)	−0.032 (−0.012)	−0.153 (−0.055)	−0.140 (−0.051)	−0.038 (−0.022)
Perception on different country	Pandemic perception	**−1.056**** **(−0.171)**	**−0.782**** **(−0.265)**	**−0.698**** **(−0.258)**	**−0.613**** **(−0.240)**	**−0.385**** **(−0.129)**	**−0.511**** **(−0.202)**	**−0.449**** **(−0.192)**	−0.143 (−0.065)	**−0.975**** **(−0.382)**	**−0.692**** **(−0.297)**	**−0.665**** **(−0.297)**	**−0.161** **(−0.111)**
	Feeling temperature	**0.383**** **(0.194)**	**0.477**** **(0.232)**	**0.337**** **(0.146)**	**0.331**** **(0.149)**	**0.377**** **(0.164)**	**0.592**** **(0.256)**	**0.352**** **(0.171)**	**0.641**** **(0.290)**	**0.347**** **(0.135)**	**0.591**** **(0.244)**	**0.531**** **(0.219)**	**0.494**** **(0.217)**
	F	4.538****	5.783****	4.764****	4.373****	2.981****	4.865****	3.414****	3.249****	7.888****	6.434****	5.848****	3.178****
	Adjusted R^2	0125	0.162	0.132	0.120	0.074	0.135	0.089	0.083	0.218	0.180	0.164	0.081
	R^2	0.161	0.192	0.167	0.156	0.122	0.170	0.126	0.120	0.250	0.213	0.198	0.118

*$p \leqq 0.05$, **$p81 \leqq 0.01$, ***$p81 \leqq 0.001$, ****$p = 0.000$.

score are the United States, India, and Japan, the last three in controlling-pandemic performance are the United States, India, and Brazil. The results of pairwise *t*-test and Bootstrap analysis show that the evaluation of different countries by the Chinese public in various categories differs significantly ($p < 0.05$). Refer to **Table 2** for details.

To better show the performance of the Chinese citizens in handling the pandemic in different countries, the severity of the pandemic and the feeling temperature, after the perception of the pandemic and the feeling temperature performance are all converted into a 0–10 measurement (original value *2), **Figure 1** is obtained as follows.

It can be seen from **Figure 1** that the controlling-pandemic evaluation and the trend of feeling temperature changes are the same, showing a positive correlation; while it is opposite to the trend of pandemic perception, showing a negative correlation. Chinese people have the lowest feeling temperature toward the United States, the highest perception of the pandemic, and the lowest controlling-pandemic evaluation, whereas they have the highest feeling temperature toward China, lower perception of the pandemic, and the highest controlling-pandemic evaluation.

Analysis of Regression Results

It can be seen from **Table 3** that variables selected by this study can explain the changes in evaluation of the Chinese citizens of the fight among different countries against the pandemic. All regression equations are significant. The lowest adjusted R^2 coefficient is the French regression model (Adjusted $R^2 = 0.089$), the highest is the Brazil regression model (Adjusted $R^2 = 0.218$), and the significance of each regression model is 0.000. By further observing the explanatory power of different influencing variables in each equation, it can be found that feeling temperature and pandemic perception, in general, have influence, with a significant degree of 0.00 (only in the Iran regression equation model, pandemic perception has no significant influence) and the explanatory coefficients in each equation are far higher than other influencing factors. Pandemic perception is negatively correlated with controlling-pandemic evaluation, whereas national feeling temperature is positively correlated with controlling-pandemic evaluation. These results support H1 and H2.

In terms of media exposure and national performance evaluation, different countries show different distribution characteristics. Specifically, the forms of media that has a significant impact on the evaluation of the United States controlling-pandemic are TV ($\beta = -0.110$, $p < 0.05$) and Zhihu ($\beta = 0.095$, $p < 0.05$); the form of media that has a significant impact on the evaluation of Japan is newspapers ($\beta = 0.126$, $p < 0.01$); the form of media that has a significant impact on the evaluation of South Korea is WeChat ($\beta = -0.113$, $p < 0.01$); the form of media that has a significant impact on Italy is Kuaishou ($\beta = 0.099$, $p < 0.05$); for Germany, TV has a significant effect ($\beta = 0.105$, $p < 0.05$); magazine has a significant effect on Brazil ($\beta = 0.1079$, $p < 0.05$); the form of media that has a significant effect on India is Tiktok ($\beta = 0.084$, $p < 0.05$); the forms of media that have a significant impact on Russa are Weibo ($\beta = -0.111$, $p < 0.05$) and Tiktok ($\beta = 0.148$, $p < 0.05$); the forms of media that have a significant impact on China are TV ($\beta = 0.103$, $p < 0.05$) and Facebook ($\beta = -0.146$, $p < 0.05$). These partially support H3. It also explains the difference in the evaluation of controlling-pandemic effects in various countries by the media.

In terms of the impact of general variables on the evaluation of the national controlling-pandemic performance, we found that COVID-19 perception has a significant impact on the evaluation of government controlling-pandemic performance in the United States ($\beta = -0.079$, $p < 0.05$) and Italy ($\beta = 0.079$, $p < 0.05$). Collectivist cultural value, in general, has no significant influence. Among them, CCP members rated the ($\beta = 0.088$, $p < 0.05$) controlling-pandemic performance of Brazil government more positively, people with high incomes rated Japan more positively ($\beta = 0.131$, $p < 0.001$), and people with high education rated South Korea ($\beta = 0.062$, $p < 0.05$) more positively, while rated the United States ($\beta = -0.085$, $p < 0.05$) and France ($\beta = -0.015$, $p < 0.05$) more negatively. Older people are negatively correlated with the performance evaluation of China ($\beta = -0.103$, $p < 0.05$), while men have more positive evaluations of controlling-pandemic in Germany ($\beta = 0.087$, $p < 0.05$) and India ($\beta = 0.086$, $p < 0.05$).

CONCLUSION AND DISCUSSION

This study mainly discusses the impact of pandemic perception, national feeling, and media use on evaluation of controlling-pandemic performance in different countries from the three-dimensional perspective of cognitive-affective-media by Chinese residents. The results show the following: (1) pandemic perception and feeling temperature are important factors that affect the evaluation of controlling-pandemic performance in different countries by Chinese public. Pandemic perception is negatively correlated with controlling-pandemic performance evaluation, while feeling temperature is positively correlated with controlling-pandemic performance evaluation. (2) The use of media has different characteristics in the evaluation of the controlling-pandemic performance of different countries by Chinese public. Among them, television has played a significant role in the evaluation of the controlling-pandemic performance by Chinese public in the United States, China, and Germany. This is likely because television reports have a special focus on these countries. (3) Cultural orientation has no significant impact on the evaluation of controlling-pandemic performance in different countries by Chinese public, and COVID-19 perception only has a significant impact on the evaluation of controlling-pandemic performance in some countries (the United States and Italy). Demographic variables have different characteristics for the public to evaluate the controlling-pandemic performance of different countries.

As a descriptive study of a small sample, the above findings provide basic information to understand the evaluation

of controlling-pandemic evaluations by Chinese public and influencing factors in different countries during this pandemic, but what is the significance of these findings? Is the three-dimensional model sufficient for the evaluation by the Chinese public of the government of another country? The three, namely the cognitive-affective-media factors we propose, are there more complex relationships among each other? Regarding the existing research, what tentative exploration did this research make? Reviewing the reasons for the research, research design and previous research literature, this article mainly hopes to make verification and contributions in the following two theoretical construction directions.

In the Evaluation of Other Governments, There Is a Cognitive-Affective Model, That Is, Cognition and Emotion Play a Dual Role

The cognitive-affective model is widely used in tourism destination management and national and local image research; however, on the issue of government evaluation, people have always focused on the influencing factors of a country's people's evaluation of their own government, especially after the rise of government performance evaluation and NPM (Hood, 1991)Attention is often focused on structural factors in national governance, such as elections and bureaucracy, process factors, such as citizen participation, and result factors, such as corruption governance and citizen satisfaction (Xiao and Xiao, 2016). These factors are not enough for people in other countries to measure the effectiveness of a government. In other words, from the perspective of the "other," some deep-seated factors that initiate cognition are playing a role. Dryhurst et al. (2020) pointed out that individualistic worldviews, personal experience, and prosocial values will all play a role in the formation of risk perception of people on COVID-19 in various countries. In addition to factors, which play a role, whether there is a basic cognition formation structure determines attitudes and views of people. Indeed, in recent years, the research background of affective factors entering the field of government evaluation has provided an inspiration. Different researchers have paid enough attention to affection in government research from the micro, meso, and macro levels. For example, Ennis et al. (2018) examined the role of emotional and normative commitments in turnover intentions of government employees at the micro-level. Wilson (2015) and Miller et al. (2004) examined intergroup emotions as an important mediator between intergroup contact and general political predispositions. At the macro level, a study of Twitter information about China shows that when non-negative emotional information about pandemic control decreases in China, discussions about Chinese politics, diplomacy, and racist ideology arise. It indicates that emotional comments on political information may have a greater influence than the long-term impact of cognitive information (Chen et al., 2020). These research cases provide an opportunity to use the "cognitive-affective" two-factor model to analyze evaluation of the performance of governments of other countries by the Chinese public during the COVID-19 pandemic. This research also shows a strong correlation between the two factors and country evaluation.

The Media Plays a Differentiated Role in the Evaluation of Governments of Other Countries, Which Can Verify the Cognitive-Affective-Media Attitude Formation Mechanism, but the Enhancement or Amplification Effect of the Media on Cognition and Affection Needs Further Research

Existing studies have shown that the priming function (Iyengar and Kinder, 1987; Miller and Krosnick, 2000; Willnat et al., 2000; Brewer et al., 2003; McGraw and Ling, 2003; Matthes and Beyer, 2017), framing function (Zhao et al., 1994; Price et al., 1997; Dell'Orto et al., 2004; Shen and Guo, 2013; Moy et al., 2016; Ospina Estupinan, 2017), information function (Wanta et al., 2004; Lee and Hong, 2012; Shen and Guo, 2013) of the media are used in government evaluation. At the same time, the media itself also has a bias (Yang, 2003; Shen and Guo, 2013) and substitution effects (Kaye and Johnson, 2003; Han and Xu, 2020). This research further demonstrates how the potential attributes of different media influence the evaluation of the governance of different countries by the Chinese public in the control and management of the COVID-19 pandemic. In the end, we saw that TV, as a mainstream media, under the enhanced effect of home isolation measures during the pandemic, the strengthening of the positive evaluation of the Chinese government, and the strengthening of the negative evaluation of the United States government occurred. Meanwhile, whether it is traditional media or social media, the influence of different media on the evaluation of governments of different countries is different, which means that there is a media map in the evaluation of governments of other countries. Understanding the reporting bias, coverage, and audience distribution of various media in a country is very useful for predicting the national evaluation of the public. It should be noted that, when social media information is easy to offset each other and polarization exists at the same time, Chinese TV still plays a leading role in public opinion.

Regarding the superimposing effect of media in public cognition and affection, Ball-Rokeach and DeFleur (1976) analyzed the possible influence of media on public cognition, affection, and behavior. It is called the dependency model of media effects. Further, Kepplinger et al. (1991) proposed cognitive-affective media effects, and also developed a theoretical cognitive-affective process model of the HME. These studies show that the media influence the emotions and cognition of audience. In this research, affection and cognition are variables that have been extracted separately, so is there a superimposed effect of media on cognition and affection, that is, in specific events, the media will further exert its influence on cognition and affection, forming a superimposed effect model of cognition-emotion + media? This becomes the direction of the subsequent expansibility research.

Limitations

This study is an analysis of the general factors that affect evaluation of Chinese citizens of the anti-pandemic performance of different countries, with a particular focus on the impact of pandemic perception, national feeling, and media use. Although this framework attempts to integrate the cognitive and affective perspectives that affect the formation of national attitudes and highlights the role of media, there is no further analysis of impact of media on the perception of the pandemic and national feeling, so the results of the regression analysis appear to be relatively flat. It is worthwhile to investigate the strengthening/weakening influence of media in the formation of cognitive and emotional functions through structural equation analysis. We also examine other factors including gender, age, education, income, political party, cultural collectivism, and COVID-19 perception. Among them, cultural collectivism is related to affection, and COVID-19 perception is related to cognition. The selection of these variables may appear relatively arbitrary, and there is no in-depth analysis of the research results, such as why cultural collectivism does not work in general, and COVID-19 perception only plays a role in the evaluation of the United States and Italy. However, this uncontrolled regression analysis method is helpful to show the true status of evaluation of Chinese residents on the pandemic control in different countries. We also hypothesize that it is more of a propensity analysis than rigorous causal analysis (Rubin and Waterman, 2006). In addition, in the measurement of media use, traditional media includes the internet based on portal website use, and the specific classification of social media into 11 categories is likely to cause doubts about the levels of measurement; however, this categorization is carried out under the guidance of previous research (Ho et al., 2015; Han and Xu, 2020) and the intention to examine the comparative effects of social media and traditional media. The research conducted a dialogue on the classification of media use. This research presents the main influencing factors of the evaluation of the anti-pandemic by the Chinese public in different countries during the COVID-19 pandemic. The perception of the pandemic and national feeling plays a dual role, and media exposure has a differentiated and diverse influence on this kind of evaluation. In China, TV still exerts an important influence on the evaluation of major countries. These study results also provide reflections on how to eliminate barriers between different countries and face human disasters together in the context of the global public health crisis.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by ethics committee of School of Media and Communication, Shanghai Jiao Tong University. Written informed consent to participate in this study was provided by the participants in Wenjuanxing survey platform (https://www.wjx.cn/).

AUTHOR CONTRIBUTIONS

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

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Prosocial Orientation of Russians During the COVID-19 Pandemic: Caring for Others and Yourself

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To mitigate the potentially devastating effects of the COVID-19 pandemic, it is vital to identify psychosocial and moral resources. The care, preservation, protection, and well-being of social communities are attributes of prosocial behavior that can be such a resource. The purpose of the study is to identify the features of prosocial orientation of Russian youth during the COVID-19 pandemic, as well as to identify strategies for prosocial behavior during the COVID-19 pandemic. The sample consisted of 447 people. The study was conducted in May 2020 in the form of an online survey of subjects using Google Forms ("Moral Foundations Questionnaire method" and "Portrait Values Questionnaire"). The research made it possible to establish that Russians were dominated by norms of care, fairness, purity; values of benevolence-universalism, security, and self-direction. During the COVID-19 pandemic, the prosocial orientation of Russians may manifest itself in the following behavioral strategies: proactive prosocial strategy of "caring for others" (true altruism, expressed in forms of volunteering, helping a stranger, and charity despite the risk of contracting a coronavirus infection); egoistic strategy of prosocial behavior "self-care through caring for others" (volunteering based on self-development; helping a stranger to improve your own psychological well-being); conventional prosocial strategy "self-care" (self-isolation and preventive behavior). In the long run, it is necessary to identify personal and environmental resources that allowed people to effectively implement a prosocial self-isolation strategy during the COVID-19 pandemic, as well as various forms of volunteerism.

Keywords: prosocial orientation, prosocial behavior, self-care, care for others, COVID-19 pandemic, psychological safety

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INTRODUCTION

Changing of our collective behavior is crucial to saving lives in the face of a new infectious disease. To mitigate the potentially devastating effects of the COVID-19 pandemic, it is vital to identify psychosocial and moral resources (Wolf et al., 2020). The care, preservation, protection, and well-being of social communities (another person, team, social organization, etc.) are attributes of prosocial behavior that can be such a resource. Addressing the altruistic and prosocial orientation of an individual can be an important aspect of response to social dilemmas during the pandemic (Van Bavel et al., 2020).

Psychologists, sociologists, anthropologists, biologists have noted that prosocial behavior is a central aspect of human life and the focus of research in the natural and social sciences (Zaki and Mitchell, 2013). Prosocial behavior refers to a broad category of acts that are generally beneficial to

other people or society and includes such behaviors as cooperating, resource sharing, and helping (Penner et al., 2005; Twenge et al., 2007). Prosocial orientation of an individual is characterized by a system of motivations associated with activities for the benefit of others and society as a whole, with a sense of duty, responsibility to the group or society. In case of prosocial orientation, the individual is identified with the group. The constant threat of natural disasters and related shocks has probably shaped our prosocial motives throughout human evolution (Vardy and Atkinson, 2019).

Genetic characteristics determine prosocial behavior at the biological level and its focus is to preserve the human race. Empathy is the emotional basis for prosocial behavior. At the social level, prosocial behavior is supported by such norms (motives) as a social responsibility norm (encourages a person to help those who need it), a social reciprocity norm (people should help those who help them), a social fairness norm (rules on fair and just distribution of resources) (Aronson et al., 2010). Based on an interdisciplinary approach and anthropological research results, the intentionality of morality in the relationship between self-caring and caring for others has been established, revealing the paradox of self-caring: "the self-care ability develops when we care for others" (Bénabou and Tirole, 2005; Harbaugh et al., 2007; Barile et al., 2015; Kozlova and Kosheleva, 2015).

Human values and moral norms are essential in creating the possibility that people obey behavioral demands and display prosocial behavior. There is evidence that values of self-transcendence and security (Bardi and Schwartz, 2003; Fischer and Smith, 2006; Sagiv et al., 2017; Schwartz et al., 2017; Wolf et al., 2020), as well as moral identity (including moral norms, thinking, and emotions) (Hardy et al., 2015; Ding et al., 2018; Patrick et al., 2018; Gotowiec and Mastrigt, 2019; Lebedeva, 2019) predict the prosocial behaviors (charity, voluntary assistance, cooperation, empathy).

According to the theory of moral grounds, the prosocial orientation can be defined using the following moral grounds: "care" (care for the surrounding people and environment, developed ability for empathy and interpersonal interaction), "fairness" ("honesty") (values of equality of all people, honesty and fairness in relations with others), "loyalty" ("collectivism") (loyalty of a person to a social group, with which he identifies himself), "respect for authority" ("power") (tendency to worship and subordinate to authority, observance of traditions, rules of conduct, public order), "purity" ("holiness") (value of religious beliefs, loyalty to ideals of moral, and physical purity) (Graham et al., 2013).

Thus, the values and moral norms shared by society may be a key binding factor in promoting the collective prosocial orientation necessary during the COVID-19 pandemic. It is the value-semantic component of the prosocial orientation that determines the main relations of a person to the world and to himself. In this intention, the conditionality of prosocial behavior manifests itself. This relationship is the basis for the study of moral norms and value orientations, as well as preferred strategies of prosocial behavior during the transformation of social interactions caused by COVID-19 (Asmolov et al., 2020).

LITERATURE REVIEW

In response to COVID-19, self-help groups and medical volunteers have become widespread in many countries (Booth, 2020; Holt, 2020; Unitus Europe European Philanthropy Social Investing Impact Hub, 2020; Yuan, 2020). In order to support people in terms of the pandemic, Russia has launched the "We Are Together" mutual assistance campaign, which includes medical, psychological, legal assistance, collection of donations to support the elderly, provision of healthcare facilities, and volunteer headquarters (My Vmeste, 2020).

The online magazine "BRICS Business Magazine" in April 2020 launched a media project "COVID-19-the Correct Answer" (https://covid.bricsmagazine.com/). The goal of the media project is to draw attention to professionalism, altruism, caring, and empathy, which in all its forms helped individuals, cities, countries, and the whole of humanity to win the fight against the pandemic. The site contains stories about the helping behavior, heroism and self-sacrifice of doctors, patients, scientists, teachers, politicians, civil servants, businessmen, law enforcement, military, civil activists, volunteers, journalists, and ordinary people (Press-Release.ru, 2020).

Sociological studies conducted in Russia reveal some contradictory data. On the one hand, Russians demonstrate their attraction to prosocial orientation and to a selfish one, on the other hand. Thus, according to the results of the Levada Center sociological survey, half of those polled, replying the question "What will happen to relationships between people in our country in the epidemic situation?," chose the following answer: "People will take more care only about themselves and 'their own'"; one-third replied "Nothing will change between people"; and only 17% supported the version "People will become more supportive of each other" (Levada-Centre, 2020).

In March–April 2020, the Institute of Psychology of the Russian Academy of Sciences conducted research on the attitude of Russians to the COVID-19 pandemic. The results of the research show that one-third to half of the respondents demonstrated a prosocial orientation («I forward information to my friends and acquaintance that can help them during the epidemic»–50%; «I'm willing to donate money to help the elderly who fell ill during the epidemic»–31%, etc.) or prosocial perception («If my family gets sick, I am sure they will get the required help from other people»–30%, etc.) of others for a number of indicators (Institute of Psychology RAS, 2020).

In March–April 2020, The Russian Center for Public Opinion Research conducted a study on Russians' awareness of volunteer activities during the spread of coronavirus infection and their readiness to provide volunteer assistance themselves. More than half of the Russians (61%) declared their readiness to provide volunteer assistance to people under quarantine, including single people. Every sixth Russian (15%) has already had to provide gratuitous help to elderly people or those who are under home quarantine due to the coronavirus («Inform surrounding people about the ways of coronavirus transmission and methods of its prevention»–19%; «Убирать подъезды, жилые помещения общего пользования» –13%; «Buy or produce your own protection and hygiene products»—11%; «Provide assistance in

solving everyday problems»–8%; «Provide psychological help, support, psychological counseling»–7%, etc.).

In the face of a pandemic, a proactive strategy of prosocial behavior shall be a strategy of "caring for another person," which can exist in the form of volunteering, charity, and situational help to a stranger. The proactive strategy bases on the ethics of "love for a distant" and "duty motives," and is related to the ability to accumulate and use economically any kind of resources necessary to achieve time-distant life goals (Slabinskii and Voishcheva, 2016).

Sociological research data has generally reflected a tendency for volunteerism and charity in Russia in recent years. Thus, according to WCIOM sociological survey conducted in September 2019, 19% of Russians are regularly engaged in charity or volunteering, and 68% are ready to engage in charity or volunteering in future (WCIOM, 2019). We may assume in this regard that the motives for providing assistance during the COVID-19 pandemic are also primarily selfish and related to self-actualization, social skills development, and increase of social contacts, etc., despite the risk of contracting coronavirus infection (Kislyakov et al., 2019). Thus, the second strategy of prosocial behavior during the COVID-19 pandemic is the selfish strategy of "self-care through caring for others." At the same time, mechanism of prosocial behavior realization can be mechanism of psychological protection (coping) and development.

Raposa et al. showed that participation in prosocial behavior could be an effective strategy for reducing the impact of stress on psycho-emotional status (Raposa et al., 2016). Dawans et al. proved in laboratory conditions that people who experienced acute social stress showed more prosocial behavior (trust, reliability, and sharing) (Dawans et al., 2012). Thus, the authors arrived at the conclusion that participation in prosocial behavior in response to stress can be a protective pattern. Krysko notes that prosocial behavior leads to good social well-being of a human through reflexing (Krysko, 2016). Luria et al. showed that the avoidance of uncertainty was a predictor of volunteering and donations at the individual level (Luria et al., 2019).

Finally, the third strategy for prosocial behavior in a pandemic is the "self-care strategy," which manifests itself in the form of preventive or health-saving behavior (Wilson, 2018). The inextricable link between caring for others and self-care is evidenced by research on health-saving behaviors that consider self-care as an activity of individuals, families, and communities undertaken to promote health, prevent disease and restore health. Research of processes in which self-care acts as a strategy for preserving an individual's identity indicates a deep, value, and moral motivation for health-saving behavior (Kozlova and Kosheleva, 2015). For example, a study of the health-saving behavior of older people shows that individuals interpret self-care practices as a moral obligation to society (Roberto et al., 2005). Caring for one's own health, a person retains his independence as well as the ability to take care of others (Clarke and Bennett, 2013).

Kappes et al. found that in hypothetical scenarios for deciding whether to go to work when sick, the American and British participants in the experiment reported that they would be less willing to stay home when it was doubtful that they would infect a colleague. However, when going to work, at the risk of infecting an older colleague who has a serious illness, the participants reported that they would be more willing to stay home. Thus, focusing on the worst-case scenarios, even if they are unsure, may encourage people to make sacrifices for others (Kappes et al., 2018).

Preventive behavior during the COVID-19 pandemic should be linked to self-isolation and should aim to exclude or reduce their contact with others who may pose a threat to themselves or, conversely, to others, "to practice caring for their own being and that of others, to perform the work of the individual for their well-being—physical, mental, and spiritual—and to eliminate their own and others' disadvantage" (Magomed-Eminov, 2020; Wolf et al., 2020). Pfattheicher et al., conducting research in the UK, USA, and Germany, found that empathy (as the emotional basis for prosocial behavior) predicted and even increased motivation to observe the rules of physical distancing and wearing medical masks (Pfattheicher et al., 2020).

Most of the negative effects on the human psyche relate to forced restriction of liberty. The "self-care strategy" adoption through voluntary self-isolation helps to reduce stress. Therefore, authorities and social institutions should emphasize altruism in their choice of self-isolation (Kudryavceva, 2020). Awareness of prosocial behavior associated with observing the rules of social distance and hygiene forms a sense of collectivity and helps preventing mental disorders caused by self-isolation (Guo et al., 2020).

A research by psychologists at the Institute of Psychology of the Russian Academy of Sciences showed that 70% of respondents believed that salvation from the COVID-19 pandemic was the moral consciousness and responsibility of each person. About 70% of respondents are also aware of the importance of preventive behavior during the COVID-19 pandemic (self-isolation and wearing masks) (Institute of Psychology RAS, 2020). At the same time, as noted by Nestik, one of the reasons for observing the precautionary rules during the COVID-19 pandemic, along with fear of infection, is compassion for others (empathy) and solidarity with others (Nestik, 2020).

Dryhurst and colleagues completed a study aimed at measuring the COVID-19 risk perception index in 10 countries in Europe, America, and Asia. The index reflected people's perceptions of danger of the COVID-19 pandemic, the perceived likelihood that they themselves, their family members and friends would become infected with the virus, and the level of concern about the virus. The study found that prosocialism, expressed in recognition of the importance of doing something for the benefit of others and society, even to the detriment of personal interests, was more or less a predictor of awareness of the COVID-19 pandemic risks for people in all countries (from different cultures) (Dryhurst et al., 2020).

According to the Russian Public Opinion Research Center, four out of five Russians (81%) who participated in a sociological poll are self-isolating. Moreover, 76% have limited their contacts, stay at home or have gone to a faraway location (WCIOM, 2020).

As Leontiev notes, sociological researches allow to fix the change of attitude to many realities being on the surface of

consciousness (Leontiev, 2020). Psychological research, on the other hand, deals with more stable mechanisms. In this regard, psychological research is required to study changes in prosocial orientation and to implement behavioral strategies based thereon during the COVID-19 pandemic. Our research is devoted to this problem solution.

Existing theoretical and empirical studies show, albeit indirectly, that first, people are shifting toward prosocialism during the COVID-19 pandemic, and secondly, different strategies of prosocial behavior based on caring for others and/or self-concern are possible (Pfattheicher et al., 2020; Wolf et al., 2020). In addition, we have formulated the following hypotheses based on the evidence that values define forms of prosocial behavior (Sagiv et al., 2017; Kislyakov et al., 2020; Wolf et al., 2020): (1) during the COVID-19 pandemic the Russians have shifts in values and morality toward prosocial orientation; (2) prosocial behavior during the COVID-19 pandemic could be characterized by three strategies: proactive "caring for others" strategy, selfish "self-care through caring for others" strategy, and conventional preventive "self-care" strategy.

MATERIALS AND METHODS

The sample consisted of 447 people (41% men, 59% women) aged 17 to 25 years ($M = 20$), university students in Moscow, Ivanovo, Kostroma, Yaroslavl; 57.7%—had experience in volunteer activities. A sampling is formed from young persons, because they are the most active and mobile part of society, involved in various social processes (including volunteering—as a form of prosocial behavior), and are faster to respond to the changes and adapt to them, including those related to the moral and value orientations.

In each city, one state university was selected, which implements various programs (sciences and humanities). All universities taught using distance learning, and students were studying at home. Anti-epidemic restrictions were in effect in the cities (cancellation of mass events, wearing of medical masks, etc.). The procedure of "convenience" sampling was used; the students voluntarily took part in the research for additional points in the academic ranking. The study was conducted in May 2020 in the form of an online survey of subjects using Google Forms. Students were sent an email to their personal e-learning accounts.

The prosocial orientation was assessed based on indicators of the moral norms development and value orientations.

The initial stimulus used for the survey was "*During the COVID-19 pandemic, it is important that people take care of the health and well-being of others. Care can be expressed in donations, participation in volunteer actions, psychological support, observance of social distance and rules of behavior, etc. Answer the questions given the COVID-19 pandemic situation.*"

The evaluation of the level of moral norms development was carried out with the help of Moral Foundations Questionnaire method (MFQ) (Heidt et al., adapted in Russian by Sychev et al., 2018). This methodology is based on the moral grounds classification developed by J. Heidt: "care," "fairness," "loyalty," "respect for authority," "purity." A subject consented with 32 statements on a 6-point scale—measured from "1—not at all important/absolutely disagree" to "6—extremely important/absolutely agree," embodying one or another moral value.

Value orientations were investigated using a shortened version of the "Portrait Values Questionnaire" methodology (PVQ-21) (Sh. Schwartz, adapted in Russian by Davidov et al., 2008). This methodology is based on the value classification developed by Schwartz and assesses seven typological value indices (scales): "security" (safety and stability of society, relations and oneself), "conformance-tradition" (containing actions and motives that may harm others and do not meet social norms), "self-direction," "stimulation," "hedonism," "achievement-power" (social status, domination over people and resources), "care for people and nature" (benevolence, universalism). The subject evaluates 21 descriptions of people characterized by certain values on a 6-point scale—from "1—not at all like me" to "6—very similar to me."

The resulting empirical data were processed using Friedman's two-factor dispersion analysis for related samples, hierarchical cluster analysis (intergroup bonding method), Mann-Whitney *U*-test, linear regression analysis (step method), Pearson's correlation analysis. Calculations were made based on the SPPS 23 statistical software package.

The study was conducted in accordance with the ethical code of The Russian psychological society, and the Protocol was approved by the Academic Council of the faculty of psychology of the Russian State Social University (Protocol No. 4 of 28.04.2020) and with the ethical standards of the World Medical Association Declaration of Helsinki. The questionnaire included the item "I confirm that I have read and understood the purposes, procedure, method, and possible inconveniences of participation in the research. I give my consent to participation in the research. I can give up or end the questionnaire at any time."

RESULTS

The research revealed that for all scales of MFQ technique, the average values correspond to the average level of moral norms development (from 17 to 27 points). Quite high indicators of internal consistency of the questionnaire scales were confirmed (Cronbach's alpha > 0.7) (see **Table 1**). Friedman's two-factor rank dispersion analysis was used to identify the dominant moral norms in the sample under study.

To identify the value orientations (indices) of Russians using the PVQ-21 method, an arithmetic mean (from 1 to 6) was calculated for each scale since the scales were measured in different ranges. The research made it possible to establish that for all scales of the PVQ-21 method, the average values correspond to the average level of formation of value indices (from 3 to 4 points). Quite high indicators of internal consistency of the questionnaire scales were confirmed (Cronbach's alpha > 0.7). Friedman's two-factor dispersion analysis was used to identify dominant value orientations in the sample under study (see **Table 2**).

TABLE 1 | Comparative analysis of the moral norms dominance among Russians during the COVID-19 pandemic (MFQ).

MFQ scales	*M*	Cronbach's alpha	Mean rank	Friedman test
Care	26.06	0.755	3.86	$\chi^2 = 500.52$ $p \leq 0.001$
Fairness	25.89	0.723	3.67	
Purity	23.85	0.719	3.01	
Loyalty	22.30	0.812	2.57	
Respect	20.46	0.764	1.89	

TABLE 2 | Comparative analysis of the value orientation dominance among Russians during the COVID-19 pandemic (PVQ-21).

PVQ-21 scales	*M*	Cronbach's alpha	Mean rank	Friedman test
Benevolence-universalism	4.39	0.801	4.95	$\chi^2 = 388.39$ $p \leq 0.001$
Security	4.13	0.747	4.34	
Self-Direction	4.22	0.723	4.54	
Hedonism	4.12	0.784	4.31	
Stimulation	3.94	0.856	3.90	
Achievement-power	3.69	0.809	3.35	
Conformity-tradition	3.27	0.774	2.61	

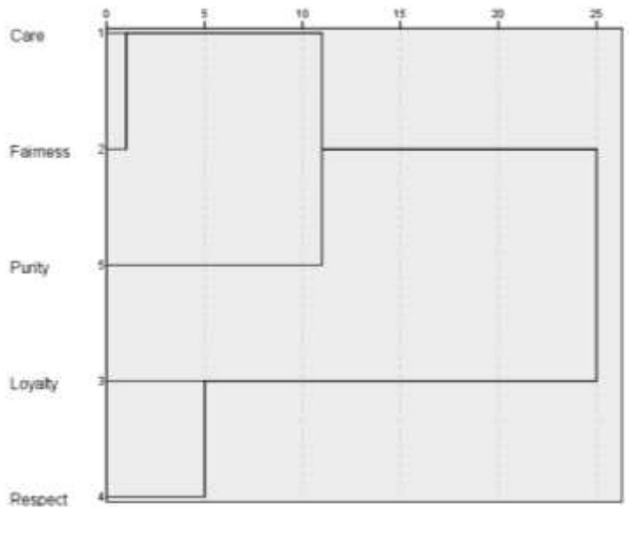

FIGURE 1 | Classification of Russians' moral norms during the COVID-19 pandemic (MFQ). Dendrogram of hierarchical cluster analysis (intergroup communication method).

To test the second hypothesis of three prosocial behavioral strategies ("caring for others," "self-care through caring for others," and "self-care") for Russians during the COVID-19 pandemic, a hierarchical cluster analysis (intergroup communication method) was conducted (see **Figures 1**, **2**).

To study the impact of the "volunteer experience" on the prosocial orientation of Russians during the COVID-19 pandemic (according to indicators of moral norms and values orientation), we compared two groups using Mann-Whitney *U*-test (see **Table 3**).

A linear regression analysis (step method) was performed to identify Russians' prosocial orientation predictors during the COVID-19 pandemic (see **Table 4**).

Pearson's correlation analysis also revealed the existence of correlation relationships between the value indices of benevolence-universalism (care), conformism, security, stimulation, self-direction (PVQ-21) (see **Figure 3**).

DISCUSSION

The data in **Tables 1**, **2** show that Russians were dominated by norms of care, fairness, purity; values of benevolence-universalism, security, and self-direction.

The cluster analysis allowed to distinguish three classes (types) of social orientation of Russians during the COVID-19 pandemic (see **Figures 1**, **2**).

The first type of social orientation can be characterized as "caring for others" proactive prosocial strategy. This type is defined by the moral norms of care, fairness and purity (MFQ) or the values of benevolence (universalism, fairness), self-discretion and stimulation (PVQ-21). Harvey and Erdos note that the psychological factors of risk-assisted behavior in an emergency area are altruism, heroism, and prosocial orientation of the individual (Harvey and Erdos, 2003). Studies conducted in Spain (Serrano-Montilla et al., 2021), Serbia (Dinić and BodroŽa, 2021), Canada, and the United States (Sin et al., 2021) showed that the health threat of COVID-19 predicted a tendency to express altruistic prosocial actions: anonymous helping behavior (Dinić and BodroŽa, 2021), volunteering and providing support (Sin et al., 2021), empathic care (Serrano-Montilla et al., 2021).

The second type of social orientation, defined by the norms of respect for power and loyalty (collectivism) (MFQ) or the values of security and conformism (PVQ-21), can be described as a conventional strategy. Conventional norms directly relate to the "self-care" prosocial strategy through respect for sanitary standards and norms of social distance. Campos-Mercade et al., 2021; Petrocchi et al., 2021 found that the motivation for self-isolating behavior can be altruistic. Ceylan and Hayran (2021) also note that compliance with restrictive measures is considered as prosocial behavior based on social responsibility. Kejselman calls introjection as a way to implement a prosocial behavior. The introjection mechanism helps to suppress conflict with the dominant worldview, and adapts a person to reality (Kejselman, 2016). One of the factors of prosocial behavior and caring for others in a crisis is the emerging sense of common identity and collectivism, which stem from a common experience of being in straitened circumstances (Drury et al., 2009; Cruwys et al., 2020; McKinley, 2020). Di Napoli et al. (2021) and Politi et al. (2021) found that prosocial attitudes during the COVID-2019 pandemic are driven by collective values and solidarity. Developing a sense of loyalty can help coordinate threat management efforts (Haslam and Reicher, 2006) and promote group commitment and social norms

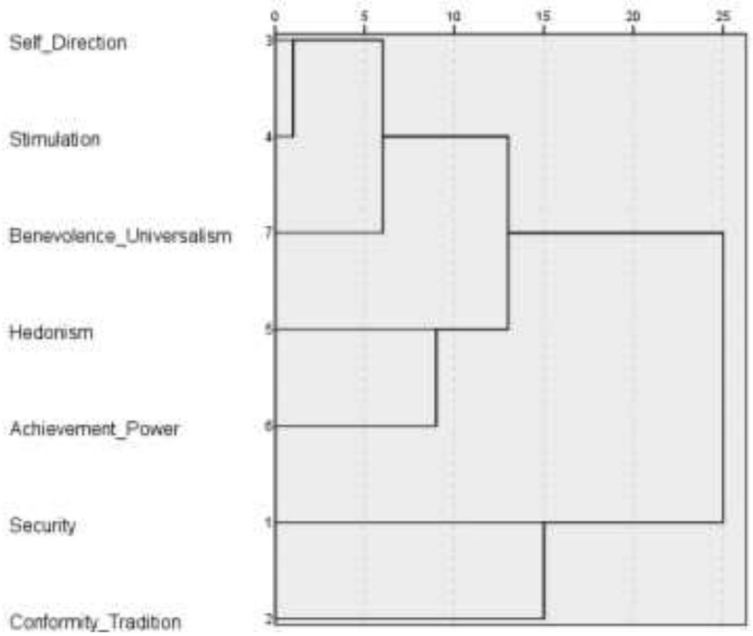

FIGURE 2 | Classification of Russians' value orientation during the COVID-19 pandemic (PVQ-21). Dendrogram of hierarchical cluster analysis (intergroup communication method).

TABLE 3 | Comparison of Russians in terms of moral norms (MFQ) and value indices (PVQ-21), taking into account volunteer experience.

Indicators	Mean rank		Mann-Whitney *U*-test	*p*
	Experienced in volunteering (*n* = 258)	Having no experience in volunteering (*n* = 189)		
MFQ scales				
Care	239.37	203.02	20,416	0.003
Fairness	238.95	203.59	20,523.5	0.004
Loyalty	238.05	204.82	20,756	0.007
Purity	228.38	218.03	23,252	0.402
Respect	223.14	225.18	24,158	0.869
PVQ-21 scales				
Benevolence-universalism (Care)	236.63	206.76	21,123.5	0.015
Self-Direction	238.75	203.87	20,576	0.004
Stimulation	246.29	193.57	18,630	<0.001
Achievement-power	235.50	208.30	21,414.5	0.028
Hedonism	230.13	215.63	22,799.5	0.238
Conformity-tradition	214.82	236.54	22,011.5	0.078
Security	222.27	226.37	23,934	0.738

TABLE 4 | Predictors of Russians' prosocial orientation during the COVID-19 pandemic.

Predictors	*β*	*p*	Summary for the model
MFQ scales ("care" dependent variable)			
Fairness	0.595	<0.001	$R^2 = 0.676$; $F = 463.223$. $p < 0.001$
Purity	0.310	<0.001	
PVQ-21 scales ("benevolence-universalism" dependent Variable)			
Self-direction	0.355	<0.001	$R^2 = 0.45$; $F = 90.304$. $p < 0.001$
Conformity-tradition	0.275	<0.001	
Stimulation	0.179	<0.001	
Security	0.191	<0.001	

(Ellemers et al., 2002; Neighbors et al., 2010; Stevens et al., 2019). In doing so, the authorities (leaders) can have a significant impact on prosocial behavior by acting as role models (Schnall and Roper, 2012; Yang et al., 2018).

The third type of social orientation can be described as a selfish strategy "self-caring through caring for others," defined by the values of hedonism and achievement-power (PVQ-21). Studies conducted in China have shown that prosocial coping with psychological pressures and stresses caused by the COVID-19 pandemic contributed to reducing mental health problems (Guo et al., 2020; Chong et al., 2021). Banerjee and Nair indicate that mutual help is an element of psychosocial intervention during the COVID-19 pandemic (Banerjee and Nair, 2020). However, there are studies showing that people with prosocial tendencies do not feel safe during the COVID-19 pandemic (Niemi et al., 2021).

Yamamoto psychologist of the Tokyo Mental Health, among the measures to minimize the psychological consequences of the pandemic, points out the importance of altruism, empathy, and Prosocial behavior not only about those who are important, but

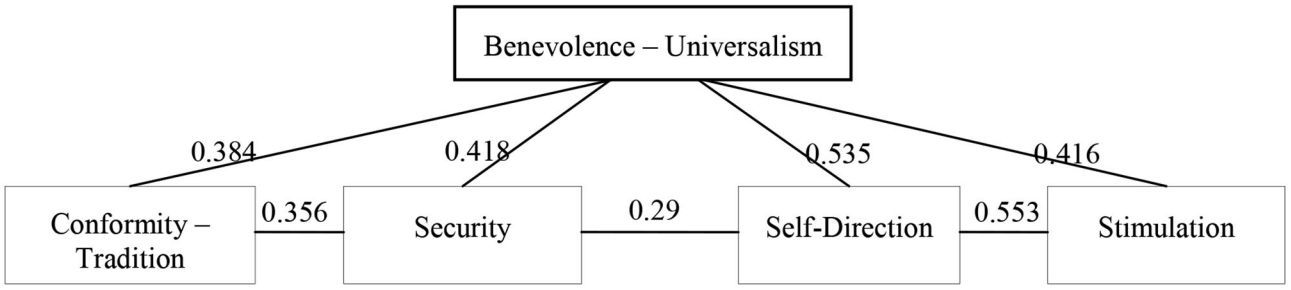

FIGURE 3 | Value indices correlation Pleiades. Pearson correlation, Significance level $p < 0.001$.

also about those who are in a difficult situation (it can be one short phone call and one email). Yamamoto notes that as social animals, we humans strive for contact, compassion, and concern for nature and others (Yamamoto, 2020).

Mahovskaya, replying to the question "How to behave in self-isolation due to the COVID-19 pandemic?" notes that those who help others survive in difficult periods live long generally (Mahovskaya, 2020). Magomed-Eminov in his recommendations on human behavior and activities in the COVID-19 pandemic contingency also notes the need to take care of loved ones, because taking care of others maintains a positive attitude in the person and enhances the meaning of life (Magomed-Eminov, 2020).

Leahy developed a scheme "What do I want to be during the COVID-19 pandemic?" which includes the position "I think about others and how I can help them" in the growth zone. Leahy offers the following recommendations during the COVID-19 pandemic: "Be supportive, ask for help and offer help! There is nothing more satisfying than to help a lonely person who is struggling or to help your loved ones, especially the elderly and the weak. Our feelings of belonging, gratitude, mutual support, and the substances that the body produces when we help others are the best immune assistants we have now" (Leahy, 2020). Thus, the strategy "I am for the World" becomes a resource for human development and psychological security (Fedosenko, 2020).

The conducted research has shown that people experienced in volunteering have more developed moral norms of care, fairness, loyalty as well as values of benevolence-universalism, self-direction, stimulation, and achievement-power (see **Table 3**).

Our correlation analysis and linear regression analysis (see **Table 4**, **Figure 3**) showed that the values of self-direction, stimulation, conformism, and security are the predictors of the value of benevolence-universalism (PVQ-21) (prosocial). Thus, the regression equation includes two behavioral strategies. The first proactive prosocial strategy relates to caring for others (autonomy and risk). Volunteers assisting those in need during the COVID-19 pandemic are ready to risk their health and well-being, and independently organize assistance and charity projects. The second conventional prosocial strategy is to take care of oneself and to observe sanitary and social norms of distance (conformism and security). Predictors of the moral norm of care (MFQ) are norms of fairness and purity. This prosocial strategy also relates to caring for others.

CONCLUSION

One can expect prosocial behavior to manifest itself in different ways depending on individuals' group identity, psychological well-being, altruistic norms, and volunteer experience to the extent that different emergencies affect the human psyche.

Despite any cross-cultural differences, the global data convincingly show that it is useful to activate values of self-transcendence and security in order to motivate people's behavior to support the mitigation of the pandemic. To reduce any negative social and psychological consequences of the COVID-19 pandemic, the society and authorities should not rely on fear but on collective control, compassion, support, and solidarity. Studies show that cultures that are accustomed to prefer security to freedom are easier to coordinate in the face of a pandemic.

The results of numerous studies in social psychology, clinical psychology, personality psychology, and neuropsychology have shown that "Self" maturity becomes the basis for compassion and caring for the Other. The self-care ability develops when one cares for others. The Other becomes a necessary participant in the process of self-consciousness and the formation of one's own identity. In emergencies, prosocial behavior can be a coping strategy.

Values of self-direction, stimulation, conformism, and security were the prosocial predictors of Russian youth during the COVID-19 pandemic. Norms of fairness and purity define the moral norm of caring for others.

Based on the obtained data analysis, it has been established that during the COVID-19 pandemic, the prosocial orientation of Russians may manifest itself in the following behavioral strategies: proactive prosocial strategy of "caring for others" (true altruism, expressed in forms of volunteering, helping a stranger, and charity despite the risk of contracting a coronavirus infection); egoistic strategy of prosocial behavior "self-care through caring for others" (volunteering based on self-development; helping a stranger to improve your own psychological well-being); conventional prosocial strategy "self-care" (self-isolation and preventive behavior).

In the long run, it is necessary to identify personal and environmental resources that allowed people to effectively implement a prosocial self-isolation strategy during the COVID-19 pandemic, as well as various forms of volunteerism.

LIMITATIONS

The resulting empirical results should be interpreted in light of several important limitations. First, it was a "convenience sampling." Thus, temporal order and causality cannot be verified. Future studies should use some longitudinal structures for further examination of the regularities we have found. The sampling is not necessarily representative for the entire Russian society. Replication with the use of different sampling methods (gender, age, ethnicity, profession, etc.) is necessary. Future studies can confirm the reliability of the obtained results by analyzing various forms of prosocial behavior directly during the COVID-19 pandemic (volunteering, charity, membership in charity organizations, experience in helping a stranger, etc.) and personal characteristics (empathy, social identity, trust in the world, etc.).

DATA AVAILABILITY STATEMENT

Publicly available datasets were analyzed in this study. This data can be found here: https://www.europeansocialsurvey.org/about/country/russian_federation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Academic Council of the faculty of psychology of the Russian State Social University (Protocol No. 4 of 28.04.2020). Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

PK conducted a comprehensive analysis of the state of research on the problem of prosocial behavior. ES justified the methodological basis of the study. Both authors conducted analytical work on the processing and analysis of the results of empirical research.

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Subjective Impact of the COVID-19 Pandemic on Schizotypy and General Mental Health in Germany and the United Kingdom, for Independent Samples in May and in October 2020

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Studies reported a strong impact on mental health during the first wave of the COVID-19 pandemic in March–June, 2020. In this study, we assessed the impact of the pandemic on mental health in general and on schizotypal traits in two independent general population samples of the United Kingdom (May sample N: 239, October sample N: 126; participation at both timepoints: 21) and in two independent general population samples of Germany (May sample N: 543, October sample N: 401; participation at both timepoints: 100) using online surveys. Whereas general psychological symptoms (global symptom index, GSI) and percentage of responders above clinical cut-off for further psychological investigation were higher in the May sample compared to the October sample, schizotypy scores (Schizotypal Personality Questionnaire) were higher in the October sample. We investigated potential associations, using general linear regression models (GLM). For schizotypy scores, we found that loneliness, use of drugs, and financial burden were more strongly corrected with schizotypy in the October compared to the May sample. We identified similar associations for GSI, as for schizotypy scores, in the May and October samples. We furthermore found that living in the United Kingdom was related to higher schizotypal scores or GSI. However, individual estimates of the GLM are highly comparable between the two countries. In conclusion, this study shows that while the general psychological impact is lower in the October than the May sample, potentially showing a normative response to an exceptional situation; schizotypy scores are higher at the second timepoint, which may be due to a stronger impact of estimates of loneliness, drug use, and financial burden. The ongoing, exceptional circumstances within this pandemic might increase the risk for developing psychosis in some individuals. The development of general psychological symptoms and schizotypy scores over time requires further attention and investigation.

Keywords: COVID – 19, schizotypy, SPQ, depression, anxiety, SCL-27, mental health, psychosis

INTRODUCTION

The highly infectious severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) had developed into an ongoing worldwide pandemic by March 2020 precipitating a global health crisis with nearly 150 million cases and over 3 million deaths by the end of April 2021 (Daly and Robinson, 2021; JHU, 2021). Due to the high risk of infection and the rapid spread of the virus, governments across the world were compelled to implement restrictions and social distancing measures to keep the number of cases and hospitalizations as low as possible. The main aim of this strategy was to prevent the health care system from being overburdened and gain time to develop treatments and vaccines (Han et al., 2020; Kissler et al., 2020). This led to unpreceded changes to everyday life for the people all around the world. In many countries, people were forced to withdraw from usual face-to-face social activities on a large scale, and schools, nurseries, and retailers as well as workplaces were closed at least for some weeks, with workers being required to work at home. The number of permitted social contacts was limited (Kissler et al., 2020). In many countries, restrictions and lock-down measures are still in place in April 2021. The exact measures taken by countries differed vastly, and even countries within Europe with similar developments throughout the pandemic used different strategies in order to deal with the hitherto unknown situation. According to Plümper and Neumayer (2020) government-strategies can be differentiated based on two dimensions: the time to response and the level of stringency of the lockdown policy. Germany, for example, went into lockdown rapidly in Spring 2020 and managed to control the increase of infections efficiently, whereas the United Kingdom delayed lockdown and faced a much higher plateau (Balmford et al., 2020). At the beginning of the pandemic, in March 2020, the government in the United Kingdom pondered with the idea of implementing what has since become known as the Swedish strategy, which avoids a lockdown and allows a relatively high number of infections, in order to reach herd immunity (Plümper and Neumayer, 2020). These strategies might have substantially contributed to the variation in numbers of cases and deaths in each country.

From the start of the pandemic, the World Health Organization, many researchers and clinicians communicated warnings about the consequences of mitigation and suppression measures on mental well-being and mental health (Pfefferbaum and North, 2020; WHO, 2020; Xiong et al., 2020). As expected, the severe restriction of social contacts as well as the fear of the virus or the impact on living conditions had a measurable impact on the mental health of general populations all over the world (Bu et al., 2020; Smith et al., 2020; Xiong et al., 2020). During the first lockdown increased levels of perceived stress and mental distress, COVID-19 related fear, general anxiety and depression and a general decline in mental wellbeing were measured in many countries including, Germany and the United Kingdom (Bäuerle et al., 2020; Smith et al., 2020; Proto and Quintana-Domeque, 2021). Female gender, younger age, being part of an ethnic minority and a low socioeconomic status were associated with a high risk for experiencing mental distress (Bäuerle et al., 2020; Fancourt et al., 2020; Simha et al., 2021). However, also living in a specific country was associated with lower stress: for example Adamson et al. (2020) found higher perceived stress levels in the United Kingdom than in Germany.

The results of our own study from April–May 2020, confirmed these findings revealing a higher psychological and socioeconomic impact of the pandemic on people resident in the United Kingdom vs. Germany (Knolle et al., 2021). However, both countries reported similarly strong subjective ratings of symptom worsening, with 25% of all responders reported increased levels of anxiety and depressive symptoms [Symptom Check List, SCL-27 (Hardt and Gerbershagen, 2001)], and nearly 10% reported worsening of schizotypy traits measured with Schizotypal Personality Questionnaire [SPQ (Raine, 1991)]. Especially, the findings on the subjective worsening of schizotypy measured with the SPQ are interesting, as to our knowledge no other study has investigated schizotypy traits in the general population within the scope of the current pandemic.

Schizotypy describes a latent personality trait, thought to reflect an underlying vulnerability of developing psychosis or schizophrenia-spectrum disorders (Chapman et al., 1994; Debbané and Barrantes-Vidal, 2015; Schultze-Lutter et al., 2019), though we note that different scholars have conceptualized it in differing ways (Grant et al., 2018). Although the SPQ is commonly used as a measure of schizotypy in the general population, its design was based on diagnostic symptoms of schizotypal personality disorder (Oezgen and Grant, 2018). It can, therefore, be considered as measuring related but not identical traits to other schizotypal questionnaires. Based on a recent review by Preti et al. (2020) the current pandemic poses an especially large risk for people suffering from paranoid or high schizotypal traits, as the measures taken to prevent the spread of the virus might ultimately lead to increased anxiety and depressive symptoms, increased avoidance behaviors, stronger disruption of social contacts, and delayed return to normality in these individuals. Furthermore, studies show links between recent adverse life events (Beards et al., 2013; Betz et al., 2020) or isolation and loneliness (Chau et al., 2019; Le et al., 2019) and schizotypy or psychosis-like experiences. Both these aspects, loneliness and adverse life events, are present in the current pandemic, which might have a worsening effect on schizotypal trait expression in people with pre-existing high schizotypy scores, perhaps leading to increased distress or disability. Additionally, the ongoing uncertainty and the impact on social routines might lengthen the time it takes schizotypal high-scores to return to baseline levels. Preliminary evidence and case reports show an increase in the development of first-episode psychosis linked to the pandemic (Huarcaya-Victoria et al., 2020; Valdés-Florido et al., 2020) and reactive psychotic disorders in previously healthy individuals (Valdés-Florido et al., 2020) following the months after start of the pandemic.

When incidence levels of infections decreased during the summer and, as a result, relaxations of the restrictions were initiated (Han et al., 2020; Hetkamp et al., 2020), this also positively impacted the reported mental health status in the general population across both countries. Some studies found a reduction of these scores to a level comparable before the pandemic (Hetkamp et al., 2020; Wang et al., 2020) while others

measured elevated, but no longer worsening, levels (Fancourt et al., 2020; O'Connor et al., 2020; Daly and Robinson, 2021). *Post hoc* comparisons between countries can be challenging due to the use of different questionnaires by different research groups, or different overall developments of the progression of the pandemic and governmental responses. In this study we therefore, investigated the association of the COVID-19 pandemic and the accompanying lockdown with mental health comparing independent samples of the general population of United Kingdom and Germany at two timepoints – the first one during the first lockdown (April/May 2020) and the second after the summer (September/October 2020) when a majority of restrictions had been lifted. Specifically, we examined whether reported levels of depressive symptoms and anxiety, and, in particular, schizotypal scores would change over the summer following the reduction of the restrictions, using the same questionnaire as in the first timepoint. Consistent with other studies, and due to the easing of the restrictions over the summer in Germany and the United Kingdom, we hypothesized to detect lower levels of anxiety and depression in the October compared to the May sample. In contrast, we predicted that SPQ-scores would be similar across the first and the second timepoints, as we expected that the return to baseline levels would take longer for schizotypal traits. In addition, all mental health scores were compared between the Germany and the United Kingdom to provide insight into the impact of political action on the well-being of the population. For clarity, we wish to emphasize that the design of this study is not longitudinal, rather we assess the impact of the pandemic at two different timepoints in highly comparable but different, only partially overlapping samples.

MATERIALS AND METHODS

Study Design and Procedure

The questionnaire used in this study assessing mental and psychological health and COVID-19 exposure was designed as an online survey using EvaSys[1](Electric Paper Evaluationssysteme GmbH, Luneburg, Germany). The questionnaire was available in German and English. For participant recruitment we used a snowball sampling strategy to reach the general public. For the first timepoint, data collection took place from 27/04/2020 to 31/05/2020 and completion of the survey took approximately 35 min; for the second timepoint, data collection took place from 10/09/2020–18/10/2020, and the completion of the survey took approximately 15 min. For each psychological item, the first timepoint survey included a "before the pandemic" or an evaluation of whether or not item strength had changed, which approximately double the time it took to complete the survey. Participation was voluntary. Participants did not receive any compensation.

Ethical approval was obtained from the Ethical Commission Board of the Technical University Munich (250/20 S). All participants provided informed consent.

[1]https://www.evasys.de

Outcome Variables

As described in Knolle et al. (2021) in detail, the survey consisted of three parts. The first part, partially comprised of the Coronavirus Health Impact Survey (CRISIS[2], which assessed demographics (age, gender (not biological sex), education and parental education, living conditions), COVID-19 exposure [infection status, symptoms, contact), mental and physical health questions. In the second part, we assessed the general mental health status (global severity of symptom index (GSI)] using the Symptom Check List (SCL) with 27 items (Hardt and Gerbershagen, 2001; Hardt et al., 2011). The GSI score describes the total expression of symptom strength over all SCL-27 items, combining measures of anxiety, depression, mistrust and vegetative symptoms. Furthermore, we assessed the specific sub-scores verified by Hardt et al. (2011); the sub-scores were dysthymic symptoms, depressive symptoms, symptoms of social phobia, symptoms of mistrust, agoraphobic symptoms, and vegetative symptoms. In the third part, using the dichotomous version of the Schizotypy Personality Questionnaire [SPQ, (Raine, 1991)] we evaluated total schizotypy trait (SPQ-total). We also assessed the subdimensions, using a six-factor model abnormal experiences and beliefs, social anhedonia, paranoid ideation, social anxiety, eccentricity, and disorganized speech (Davies, 2017), as well as the original nine-factor model (Raine, 1991), the three-factor model (Raine et al., 1994) and the four-factor model (Stefanis et al., 2004). During the first timepoint of data collection, we also assessed subjective measures of change for questions on life circumstances, mental health and psychological traits, asking participants to either report on that particular question before the pandemic or report whether the evaluation of the item had increased, decrease or stayed the same.

Statistical Analysis

Statistical analysis and visualizations were computed using R and R Studio (R Core Team, 2016; R Studio Team, 2020). We first describe demographics and COVID-19 exposure variables, using frequency analysis. For the country comparison we used Wilcoxon rank sum tests or Chi-square test of independence to explore differences between the countries (United Kingdom, Germany) and timepoints (April/May and September/October 2020) on the demographics and the COVID-19 exposure variables.

To further explore the differences between the countries and timepoints in CRISIS variables we conducted robust ANOVAS (Mair and Wilcox, 2020) with country (United Kingdom, Germany) and timepoint [before pandemic (i.e., subjective rating acquired during the first timepoint), April/May, September/October] as between-subjects factor.

In order to identify possible negative associations for experiencing increased general strain and mental distress, we applied Gaussian regression models to assess the connection between the outcome and predictor variables. Our outcome variable was GSI, the total expression of psychological symptoms. In the first basic model, we explored the relationship of

[2]http://www.crisissurvey.org/

demographic variables (age, gender, education, country of residence, living area, and parenthood) and prior physical and mental health problems with GSI scores. The second model – the harmful and healthy behavior model – was used to investigate the link between healthy and harmful behaviors and the outcome variable. For this purpose, we added sleeping hours per night, days with physical exercise per week, drug, alcohol, media consumption and the degree of perceived loneliness to the basic model conducted previously as predictor variables. In the third model – the COVID-19 context model – we examined the coherence of COVID 19 pandemic and associated restrictions using the following variables: perception of the burden of restrictions, stressful relationship changes, financial impact of the Pandemic, hope for a soon end and suspicion of COVID-19 disease. In addition, we also included the degree of trust in government in the October survey.

We investigated possible associations for expression of schizotypy using Poisson regression models. The dependent variable was the total SPQ-score. We used the same three models as for the investigation of the SPQ as for the GSI. We correct for multiple comparisons in all six models, using an adjusted p-value of 0.0083 as the threshold for significance. Models were run for samples separately, using different only partially overlapping samples.

In order to investigate stressful changes in social and family relationships, we used the sum of the degrees of stress experienced in the deterioration in social and family relationships. Excessive media consumption received a positive expression if at least one of the categories of media consumption (television, social media or videogames) was used for more than 4 h per day. The drug score was calculated on the basis of at least one use of marijuana, tranquilizers or other drugs like heroin or other opiates.

RESULTS

Whole Sample Description

The first survey (May 2020) was completed by 860 participants. Two participants did not provide consent and were excluded. 6 participants did not consent to sharing the data publicly, and are included in the analysis but will be removed from the open-access data set. In this paper we focused on the comparison of responders living in the United Kingdom (N = 239) and in Germany (N = 543). In the first survey the majority of respondents were female (72%), 25% were male, 3% diverse or did not provide the information. The age ranged from 18 to 92 years, with a mean 43 (SD 15.5) years and a median of 41 years. The majority of participants were well educated, 60% had a master's degree or higher, and 25% had completed a professional college or a bachelor degree. 48% reported to live in large cities, 12% in suburbs of large cities, 19% in small cities, and 21% in rural areas (see **Table 1**).

The second survey (October 2020) was completed by 550 participants. 22 were excluded from the analysis as they gave not consent to the participation and one he or she did not provide information about the current residency. 69% of the participants were female, 25% male and 6% did not provide the information. The age ranged from 18 to 93 years (M = 42, SD = 16.1). Most of the participants had their current residency in Germany (76%, N = 401) and 24% in the United Kingdom (N = 126). The majority of the sample were well educated, with 45% reporting to have a master's degree or higher and 39% to have completed a professional college or bachelor's degree. 39% lived in a city, 13% in suburbs, 18% in towns and 28% in villages or rural areas (see **Table 1**).

Since participation at the first survey was not required for taking part in the second survey, the two samples are partially overlapping. 121 responders participated in both surveys. The samples did not differ significantly in terms of age (X^2 = 100.8, p = 0.989) and gender (W = 192786, p = 0.635) between the timepoints, but in the second survey significantly more participants came from Germany (X^2 = 8.55, p = 0.014), their living area was more rural (W = 182331, p = 0.002) and the sample was less educated (W = 218690, p = 0.018).

COVID 19 Infection

At the first timepoint, 0.2% of the German sample reported a positive COVID-19 test result, 0.7% reported a diagnosis made by a health care professional without using a test, but based on symptoms and contact to COVID-19 positive individuals, and 14.4% possible symptoms of a COVID-19 infection. 83,8% stated that they had not suspected COVID-19. In the United Kingdom sample, 2.5% reported a medical diagnosis of COVID-19 made by a health care professional without using a test, but based on symptoms and contact to COVID-19 positive individuals, and 18.8% of possible symptoms. None of the respondents reported having received a positive test result. 78.7% reported that they had not previously suspected COVID-19.

At the second timepoint, 0.8% of the German sample reported being positively tested for COVID-19, 0.5% reported receiving a positive diagnosis, without a test, and 16% reported symptoms that could indicate a COVID-19 infection. 82.0% reported not having suspected COVID-19. In the United Kingdom sample, 0.8% reported having received a positive diagnosis, without a test, of COVID-19 and 20.6% had recently experienced symptoms of COVID-19 infection. None of the United Kingdom respondents reported having received a positive test result. 77.0% reported no signs of possible COVID-19 infection (see **Table 1**).

Results of Robust ANOVAs

Global symptom index scores differed significantly between the two countries ($p < 0.001$) and samples (p = 0.04) with higher GSI scores in the May sample and higher scores in the United Kingdom sample compared to the German sample (see **Figure 1**). There was no interaction effect. The results of the robust ANOVAS are shown in **Table 2**. Furthermore, we investigated the development in the small sample of those responders who took part in the survey at both timepoints. The results are similar and are presented in the **Supplementary Materials**.

TABLE 1 | Demographics and suspected infection among the samples divides by country.

		April – May sample		September – October sample		Difference between GER/United Kingdom		Difference between samples	
		United Kingdom	GER	United Kingdom	GER	W/X^2	*p*	W/X^2	*p*
N		239	543	126	401			192346	0.008**
Prozent		30.6%	69.4%	23.91%	76.09%				
Age	Mean	39	45.4	40.90	42.67	237.2	<0.001***	100.9	0.989
	SD	16	14.9	16.17	1.14				
Gender	Female	73.6%	71.3%	65.87%	70.32%	159158	0.865	190794	0.786
	Male	24.3%	25.8%	28.57%	24.19%				
	other/NA	2.1%	3%	5.56%	5.49%				
Education	School leavers	0.4%	-	-	-	162346	0.207	218690	0.017*
	8-years	19.3%	13.1%	15.87%	14.46%				
	Prof. college/Bachelor	31.8%	21.6%	38.89%	30.42%				
	Master or higher	47.3%	65%	44.44%	54.61%				
	Missing	1.3%	0.4%	0.79%	0.50%				
Children	Yes	21.3%	30.8%	28.57%	30.17%	155440	0.013*	196510	0.540
	Missing	1.3%	2.6%	0.79%	1.00%				
Living Area	City	20.5%	60.2%	26.19%	42.89%	227803	<0.001***	182331	0.002**
	Suburb	8%	13.1%	11.90%	13.97%				
	Town	36.4%	10.9%	27.78%	14.71%				
	Village or rural Area	34.7%	15.7%	33.33%	25.94%				
	Missing	0.4%	18%	79.00%	2.49%				
Suspected infection	Positive Test	-	0.2%	-	0.75%	160840	0.024*	205006	0.614
	Diagnosis	2.5%	0.7%	0.79%	0.50%				
	Symptoms	18.8%	14.4%	20.63%	15.96%				
	No infection	78.7%	83.8%	76.98%	82.04%				
	Missing	-	0.9%	1.59%	0.75%				

*p < 0.100,*p < 0.050,**p < 0.010, ***p < 0.001.*

In a norm sample (Hardt et al., 2004), 10–15% of the screened population reach the clinical cut-off on the different sub-dimensions, and require additional psychological investigation. As shown in **Figure 2**, there are significant differences between the countries [$F(1, 7464 = 237.96, p < 0.001)$] and samples [$F(1, 7464 = 12.58, p < 0.001)$]. For the sub-dimension of dysthymic symptoms (DYS), the rate fell from 68.38 to 58.82% in the United Kingdom responders and from 37 to 30% in the German responders who lay above the clinical cut-off; for depressive symptoms (DEP) from 51 to 50% in the United Kingdom and from 39 to 27% in the German responders; for symptoms of social phobia (SOP) from 37 to 34% in the United Kingdom and from 24 to 19% in German responders; for symptoms of mistrust (MIS) from 29 to 26% in the United Kingdom and from 26 to 22% in the German sample; and for agoraphobic symptoms (AGO) from 52 to 32% in the United Kingdom and from 23 to 12% in the German responders. Interestingly, the vegetative symptoms (VEG) increased from 26 to 35% in the United Kingdom and from 14 to 16% in the German responders. The reduced rates were measured in a comparable but different only partially overlapping sample.

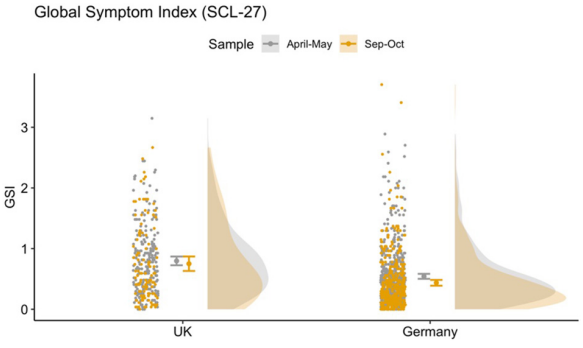

FIGURE 1 | Raincloud plot for GSI across country and timepoint, showing data distribution (the "cloud"), jittered raw data (the "rain"), mean and standard error.

SPQ scores (**Figure 3**) also differed significantly between countries with higher scores in the United Kingdom sample ($p = 0.01$). We found a trend toward higher SPQ-scores in the October compared to the May sample ($p = 0.06$). The results of the robust ANOVAS are shown in **Table 2**. Furthermore, we investigated the development of the total SPQ score in the small sample of those responders who took part in the survey at both timepoints. The results are similar and are presented in the **Supplementary Materials**.

Additionally, we investigated the different SPQ subdimensions in an explorative analysis. For completion, we present four

TABLE 2 | Overview of means and robust ANOVAS of GSI and SPQ scores, all CRISIS variables and questions concerning life changes due to COVID.

	Mean						Robust ANOVA/M-estimator			*Post hoc*						
	Before		April - May		September - October		significance			Country (sample comparison)	Before (country comparison)	April – May (country comparison)	Sept. – Oct. (country comparison)	Country x Before	Country x April - May	Country x - Oct. Sept. -
	United Kingdom	GER	United Kingdom	GER	United Kingdom	GER	ME C	ME TP	Country x sample	Psi	Psi	Psi	Psi	Psi	Psi	Psi
GSI			0.8	0.54	0.75	0.44	0.000 ***	0.043 *	0.973	0.6***		0.2*			0.0	
SPQ			13.6	12.25	17.36	13.20	0.011**	0.061 *	0.240	5.7**		−3.8*			−2.5.	
Behavior																
Sleep week	2.06	2.06	2.1	2.07	1.86	2.02	i									
Sleep weekend	2.41	2.36	2.3	2.33	2.15	2.33	0.118	0.197	0.232	0.3	−0.3.	0.0.	0.3	−0.3	0.0.	0.3
Exercise	2.84	2.46	3.0	2.55	2.48	2.29	0.000 ***	0.000 ***	0.312	1.0***	−0.2.	0.5***	0.8***	0.0	0.2.	0.2.
Outside	3.89	3.88	3.6	3.00	3.64	3.90	0.121	0.258	0.534	−0.5	0.4**	0.2.	−0.2	0.2*	0.3 *	0.0
Cognition																
Happy content	3.48	3.48	2.8	2.75	2.90	3.11	0.183	0.000 ***	0.250	−0.2.	1.5***	1.0***	−0.5**	0.0	0.2.	0.2.
Concerned	2.23	2.28	2.9	3.10	2.59	2,59	0.098	0.000 ***	0.161	−0.3 *	−1.5***	−0.7***	0.8**	0.2	−0.0	−0.2.
Enjoy activities	3.65	3.86	2.6	3.02	2.79	3.45	0.000 ***	0.000 ***	0.028	−1.3**	1.9**	1.3***	−0.6**	0.2.	0.5***	0.3*
Relaxed	2.91	2.43	3.4	2.89	3.29	2.67	0.001 **	0.000 ***	0.794	1.6**	−0.9**	−0.6***	0.3	0.0	−0.2	−0.2
Restless	1.95	1.89	2.3	2.20	2.25	2.02	0.015 **	0.001 **	0.490	0.4**	−0.7**	−0.4**	0.3*	−0.1	−0.2	−0.1
Tired	2.57	2.62	2.8	2.78	2.74	2.83	0.400	0.006 *	0.858	−0.2	−0.4**	−0.4**	0.0	0.0	0.0	0.1
Focused	2.43	2.29	3.3	2.72	2.97	2.55	0.000 **	0.000 **	0.016	1.1**	−1.3**	−0.8**	0.5*	−0.4**	−0.3*	0.1
Irritated	2.02	2.37	2.5	2.72	2.37	2.49	0.000 **	0.000 **	0.140	−0.66	−0.9**	−0.5**	0.4**	−0.2.	−0.2.	−0.1
Lonely	1,64	1,73	2.2	2,30	2,43	2,04	0.607	0.000 **	0.559	−0,1	−2.5**	−2.1**	0.4*	0.1	0.0	−0.1
Negative Thoughts	2.65	2.55	2.9	2.94	2.82	2.70	0.177	0.000 **	0.607	0.23	−0.7**	−0.3**	0.4*	0.1	0.0	−0.1
Media consumption																
TV digital Media	2.8	2.8	3.26	3.10	3.18	2.94	0.384	0.384	0.384	0.0	0.0**	0.0*	0.0.	0.0**	0.0*	0.0
Social Media	2.5	2.1	2.81	2.42	2.73	2.46	0.000 **	0.026 *	0.554	1.1**	−0.7**	−0.6.	0.0	0.0	0.1.	0.1
Videogame	1.3	1.2	1.55	1.28	1.53	1.26	i									
Print media	2.0	2.4	2.13	2.57	2.20	2.42	0.000 **	0.010 *	0.041 *	−1.5*	−0.8*	−0.3*	0.5	0.4	−0.2*	−0.7*
Substance use																
Alcohol	4.3	3.9	4.36	4.16	4.24	3.84	0.000 **	0.517	0.878	3.4**	−0.6	0.1	0.7.	−0.2	−0.1	0.07
Tobacco	1.5	1.8	1.39	1.93	1.93	186	i									
Marihuana	1.2	1.2	1.21	1.19	1.47	1.13	i					0.1				
Opiate Heroin	1.0	1.0	1.01	1.02	1.09	1.05	i									
Life changes																
Time Outside			3.47	3.83	3.71	4.11	0.111	0.151	0.811	−0.8**	−0.5*				0.1	
Restrictions stressful			2.92	2.86	2.78	2.59	0.071.	0.008*	0.340	0.3*	0.4**				−0.1	
Quality of family relationships			3.23	3.04	3.14	2.96	0.043 *	0.415	0.739	0.3*					0.1	

(Continued)

TABLE 2 | Continued

	Mean			Robust ANOVA/M-estimator					Post hoc						
	Before	April - May	September - October	significance					Country (sample comparison)	Before (country comparison)	April – May (country comparison)	Sept. – Oct. (country comparison)	Country x Before	Country x April - May	Country x Sept. - - Oct.
	United Kingdom	GER	United Kingdom	GER	ME C	ME TP	Country x sample		Psi	Psi	Psi	Psi	Psi	Psi	Psi
Change of family (stressful)		2.84	2.47	2.16	2.11	0.038 *	0.020 *	0.080	0.4**	1.0**				0.3.	
Quality social of Relationships		2.79	2.71	2.43	2.52	0.280	0.000 **	0.045	0.2	0.8**				0.4.	
Change of social relations (stressful)		3.05	2.57	2.28	2.23	0.008 *	0.000 **	0.025	0.5**	1.1**				0.4**	
Financial impact		2.05	1.86	1.82	1.60	0.000 **	0.457	0.457	1.9.	0.2				0.2	
Concerned life stability		2.04	2.44	1.86	2.08	0.000 **	0.011 *	0.265	−1.5**	1.4*				0.7	
No money for food		0.03	0.03	0.04	0.03										
Hopeful for a soon end		2.91	2.51	1.78	2.03	0.013 *	0.000 **	0.000	−0.6*	2.4**				1.4**	

*psi = psihat, C = Country. p < 0.10, *p < 0.05, **p < 0.01, ***p < 0.001, I = interaction, GER = Germany, UK = United Kingdom, i = could not be calculated due to insufficient dispersion or change.*

different categorizations based on the six-factor model (Davies, 2017; **Figure 4A**), the original nine factor model (Raine, 1991; **Figure 4B**), the three-factor model (Raine et al., 1994; **Figure 4C**) and the four-factor model (Stefanis et al., 2004; **Figure 4D**). Using a robust ANOVA, we analyzed differences across country of residence and samples. All results are presented in the **Supplementary Table 1**. Factors of social anhedonia and social anxiety (Raine, 1991; Davies, 2017), as well as the interpersonal factor (Raine et al., 1994; Stefanis et al., 2004) show the strongest endorsement in the two countries. The overall trend is similar across all four approaches, revealing significant differences between the two countries and showing higher scores for most subdimension scores in the United Kingdom.

General Linear Model: General Psychological Symptom Index

Effects of Demographic Variables and Prior Physical and Mental Health Problems on GSI Scores (Basic Model)

In both surveys in May and October, age (TP1: $p < 0.001$, TP2: $p = 0.001$), country of residence (TP1 $p = 0.005$, TP2 $p < 0.001$) and pre-existing physical (TP1: $p = 0.002$, TP2: $p = 0.005$) and mental health problems (TP1: $p < 0.001$, TP2: $p < 0.001$) were significantly associated with GSI. Older age and country of residence in Germany are related to lower scores, while the opposite was shown for pre-existing physical and mental health problems. Female gender was associated with lower GSI scores in the May sample (TP1: $p = 0.031$, TP2: $p = 0.779$) and higher levels of education was related to lower scores in the October sample (TP1: $p = 0.962$, $p < 0.001$). In the first survey we found that living in a town was significantly connected to higher GSI compared to living in a large city ($p = 0.045$). There was no significant association between having children at home and the outcome in both samples in May and October (TP1: $p = 0.256$, TP2: $p = 0.439$) see **Table 3**.

Based on these results, we adjusted for the predictors age, gender, education level, country of residence, having children at home, as well as physical and mental health problems in the following two models. Additionally, all models have been run separately on the small overlapping sample, see **Supplementary Materials**. Results are comparable to the full sample.

Effects of Harmful and Healthy Behaviors GSI Scores (Harmful and Healthy Behavior Model)

After adjusting for possibly confounding demographic variables from the previous basic model, in the May and October samples drug consumption was associated with higher GSI scores (TP1: $p = 0.005$, TP2: $p < 0.001$), as well as excessive media use (TP1: B = 0.12, t = 3.34, $p < 0.001$, TP2: B = 0.13, t = 2.38, $p < 0.001$). No correlation was found for alcohol consumption (TP1: $p = 0.602$, TP2: $p = 0.740$). Sleeping between 6 and 8 h (TP1: $p < 0.001$, TP2: $p < 0.001$) and more than 8 h (TP1: $p < 0.001$, TP2: $p < 0.001$) compared to sleeping less than 6 h was connected to lower GSI scores. There was no effect of physical exercise on GSI. Feeling lonely had a negative association with GSI scores both on

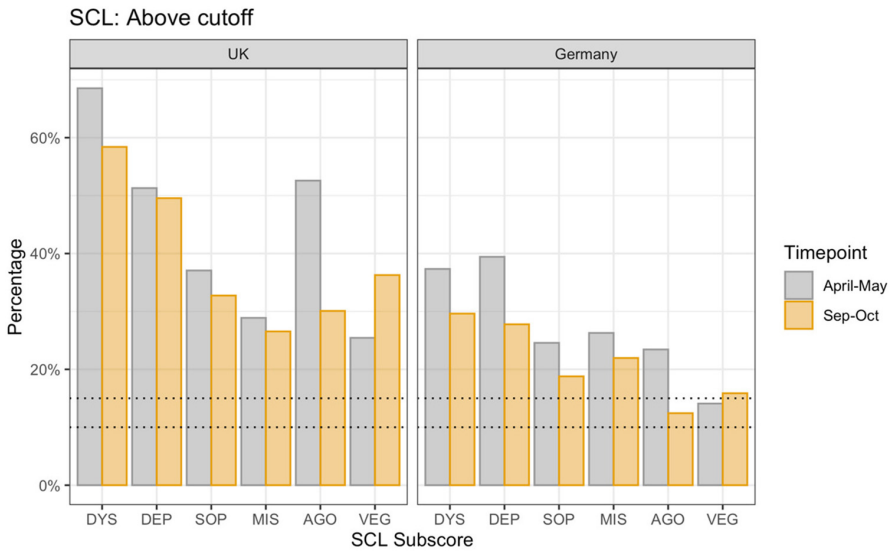

FIGURE 2 | Percentage of responders above clinical cut-off by country and sample. Dotted lines represent the percentage of the norm population above threshold (10–15%). DYS: dysthymic symptoms, DEP: depressive symptoms, SOP: symptoms of social phobia, MIS: symptoms of mistrust, AGO: agoraphobic symptoms, VEG: vegetative symptoms.

medium levels (TP1: $p = 0.046$, TP2: $p < 0.001$) and high levels (TP1: $p = 0.003$, TP2: $p < 0.001$) in the May and October samples. See **Table 3** and **Supplementary Materials** for results of the fully overlapping sample.

Effects of the COVID-19 Pandemic on GSI Scores (COVID-19 Impact Model)

In this third model, we investigated the relationship of factors related to the COVID-19 pandemic with GSI scores. The perception of the restrictions as being stressful was connected with increased GSI scores in the May and October samples (TP1: $p < 0.001$, TP2: $p = 0.013$). Financial problems due to the crisis significantly correlated with GSI scores, being higher in the May compared to the October survey. In the May samples, only major financial impact was associated with increased GSI scores ($p = 0.042$). In the October samples, both major financial impact ($p < 0.001$) and medium impact ($p < 0.001$) were negatively related to GSI. Deteriorations in relationships that were experienced as stressful had a negative connection with the outcome in both, the May and October samples, with very stressful changes having a greater association (TP1: $p < 0.001$, TP2: $p < 0.001$) on GSI than stressful changes only (TP1: $p < 0.001$, TP2: $p < 0.001$). The suspicion of COVID-19 disease or the diagnosis had a negative relationship with GSI scores in both, the May and October samples (TP1: $p = 0.009$, TP2: $p < 0.001$). Being hopeful for a soon end of the pandemic did not have a significant association with GSI scores. In the October sample, we also included the degree of trust in the government to lead the country well out of the crisis in our model. However, this predictor had no significant effect on GSI scores. See **Table 3** and **Supplementary Materials** for results of the fully overlapping sample.

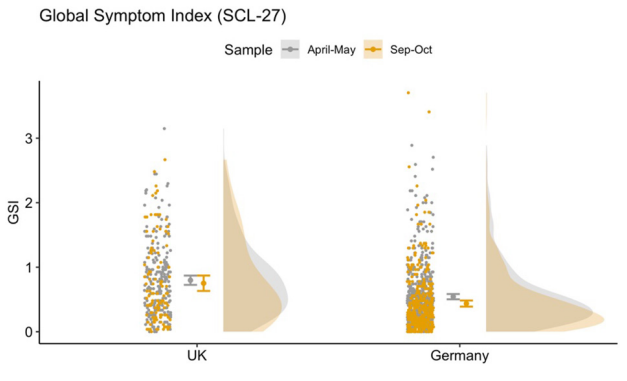

FIGURE 3 | Raincloud plot for total SPQ across country and sample, showing data distribution (the "cloud"), jittered raw data (the "rain"), mean and standard error.

General Linear Model: Schizotypy (SPQ)

Effects of Demographic Variables and Prior Physical and Mental Health Problems on SPQ Scores (Basic Model)

In both, the May and October samples, increasing age (TP1: $p < 0.001$, TP2: <0.001), higher education levels (TP1: $p < 0.001$, TP2: $p < 0.001$) and female gender (TP1: $p = 0.088$, TP2: $p < 0.001$) were connected with lower SPQ scores. The current country of residence in Germany significantly associated with lower scores only in the October sample (TP1: $p = 0.677$, TP2: $p < 0.001$). In contrast having children was related to lower outcomes only in the May sample (TP1: $p = 0.001$, TP2: $p = 0.573$). In the May samples, living in a suburban ($p = 0.035$) or rural area ($p = 0.025$) compared to a big city were connected with increased

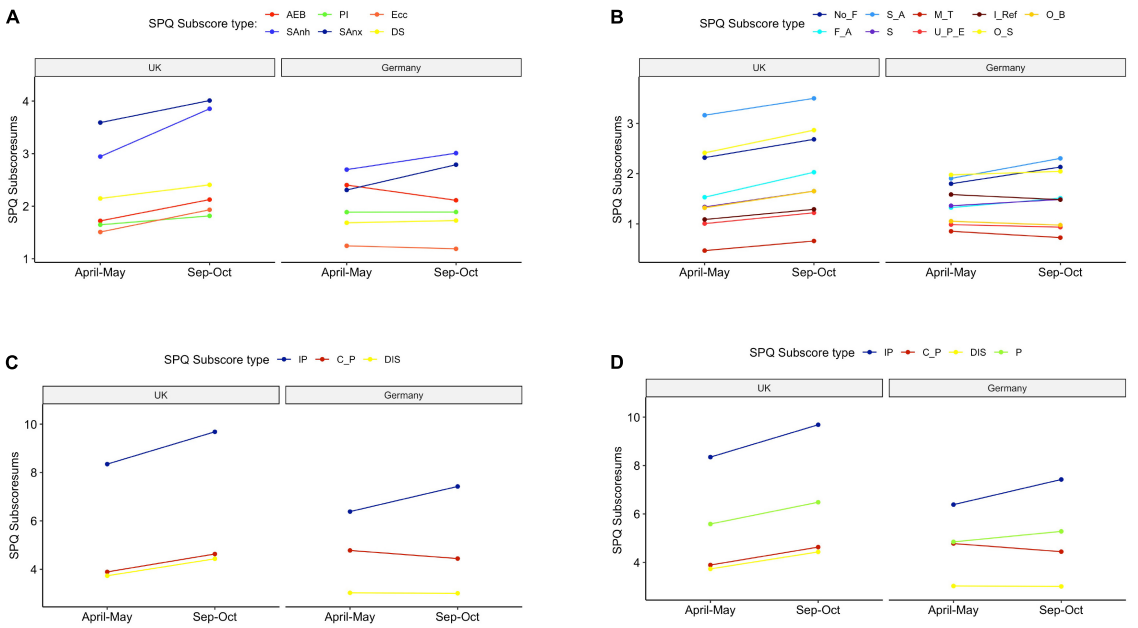

FIGURE 4 | Interaction plot shows different subdimension models across samples and countries. **(A)** Six-factor model by Davies (2017). AEB: Anomalous experiences and beliefs, SAnh: Social anhedonia, PI: Paranoid ideation, SAnx: Social anxiety, Ecc: Eccentricity, DS: Disorganized speech. **(B)** Nine-factor model by Raine (1991). No_F: No close friends, F_A: Flattened/Constricted affect, S_A: Social anxiety, S: Suspiciousness, M_T: Magical thinking, U_P_E: Unusual perceptual experience, I_Ref: Ideas of Reference, O_S: Odd speech, O_B: Odd behavior. **(C)** Three-factor model by Raine et al. (1994). IP: Interpersonal, C_P: Cognitive/Perceptual, DIS: Disorganization. **(D)** Four-factor model by Stefanis et al. (2004) with additional Paranoid (P) subdimension.

SPQ scores, while in the October sample, living in a small town (TP1: $p = 0.001$) or rural area (TP1: $p < 0.001$) compared to a big city had a decreasing effect on SPQ scores. In addition, there was a trend toward an increased SPQ score when living in a suburb compared to a large city ($p = 0.074$), see **Table 4**.

In the two subsequent models, we adjusted for age, gender, country of residence, place of residence, having pre-existing physical and mental health problems as possible confounding variables. All three models have been calculated for the fully overlapping sample, see **Supplementary Materials**, which are comparable to the full sample.

Effects of Harmful and Healthy Behavior SPQ Scores (Harmful and Healthy Behavior Model)

After adjusting for possibly confounding variables drug consumption (May samples: $p < 0.001$, October samples: $p < 0.001$) as well as excessive media use (May samples: $p < 0.001$, October samples: $p < 0.001$) were associated with higher SPQ scores in both samples, whereas alcohol consumption ($p = 0.004$) and medium physical exercise ($p = 0.036$) were connected with lower scores only in the first sample. Physical Exercise at least five times per week had a negative relationship in both, the May and October samples (May samples: $p = 0.002$, October samples: $p < 0.001$). Sleeping between 6 and 8 h (May samples: $p = 0.001$, October samples: $p < 0.001$) and more than 8 h (May samples: $p < 0.001$, October samples: $p < 0.001$) both were associated with lower SPQ-scores compared to sleeping less than 6 h. See **Table 4** and **Supplementary Materials** for results of the fully overlapping sample.

Effects of the COVID-19 Pandemic on SPQ Scores (COVID-19 Impact Model)

After adjusting for confounds, there was a positive relationship of mistrust in Government of leading the country successfully out of the crisis in the October sample ($p < 0.001$). Perceiving the restrictions as stressful ($p = 0.043$) and being hopeful for a soon end ($p = 0.022$) only had negative effects on SPQ scores in the October sample. Medium financial impact of the CRISIS only had a significant association in the second survey ($p < 0.001$), whereas major financial were positively correlated with SPQ scores in both, the May and October samples (May: $p < 0.001$, October: $p < 0.001$). Very stressful relationship changes had only a significant link with the outcome in the second survey ($p < 0.000$). The suspicion or diagnosis of being infected with COVID 19 was associated with an increase of SPQ scores in both, the May and October samples (May samples: $p < 0.001$, October samples: $p = 0.001$). See **Table 4** and **Supplementary Materials** for results of the fully overlapping sample.

DISCUSSION

The current study investigated the association of the COVID-19 pandemic with mental health generally and schizotypy specifically in different, partially overlapping general population samples from the United Kingdom and Germany assessed at two time points – the first during widespread societal restrictions aimed at curbing the spread of the virus (April/May 2020), and the second at a time when the majority of

TABLE 3 | Overview over all three conducted models (Basic Model, Harmful and Healthy Behavior, COVID-19 Impact) for both samples for GSI scores.

		April – May sample						September – October sample					
		Basic Model		Harmful and healthy behavior		COVID-19 Impact		Basic Model		Harmful and healthy behavior		COVID-19 Impact	
BIC		874.4		804.2		788.1		641.2		567.4		468.4	
		B	**t**	**B**	**t**	**B**	**t**	**B**	**t**	**B**	**t**	**B**	**t**
Intercept		0.67	5.6**	0.68	5.2**	0.45	5.0**	1.15	7.0**	0.97	5.6**	0.59	3.8**
Age		0.00	−3.8**	0.00	−2.9*	−0.00	−3.3*	0.00	−3.3*	−0.004	−2.7*	−0.004	−3.9**
Gender	Male	Reference											
	Female	0.08	2.2 ∼	0.09	2.5 ∼	0.07	1.8	0.01	0.3	0.05	1.1	004	0.9
Highest Education		0.00	0.1	0.00	0.0	0.00	0.3	−0.06	−3.3*	−0.03	−1.7	−0.03	−1.6
Country	United Kingdom	Reference											
	GER	−0.12	−2.8 *	−0.14	−3.4*	−0.11	−2.8*	−0.23	−4.3**	−0.20	−4.2**	−0.22	−3.8**
Pre-existing physical health problems		0.14	3.1 *	0.10	2.4 ∼	0.11	2.5 ∼	0.18	2.8*	0.14	2.4 ∼	0.18	3.3*
Pre-existing mental health problems		0.50	11.3**	0.38	8.9**	0.45	10.5**	0.46	7.9**	0.32	5.9**	0.37	7.1**
Children at home	No	Reference											
	Yes	−0.04	−1.1	−0.02	−0.5	−0.07	−2.0 ∼	0.04	0.8	0.05	1.2	−0.08	−2.0 ∼
Living area	City	Reference											
	Suburb	0.06	1.1	0.09	1.8.	0.12	2.3 ∼	0.06	0.9	0.04	0.7	0.05	0.8
	Town	0.10	2.0 ∼	0.12	2.6 ∼	0.14	2.8*	−0.02	−0.4	−0.01	−0.1	0.01	0.2
	Rural Area	0.03	0.8	0.06	1.3	0.10	2.4 ∼	−0.04	−0.7	−0.05	−0.0	0.06	1.2
Alcohol				0.00	0.5					0.01	0.7		
Drug consumption	Never	Reference											
	At least once			0.1	2.1 ∼					0.17	2.8*		
Excessive Media use	No	Reference											
	Yes			0.1	2.8*					0.11	2.0 ∼		
Exercise	0 days	Reference											
	1–4 days			0.00	0.0					−0.04	−0.8		
	>4 days			−0.03	−0.6					−0.12	−1.6		
Sleep	<6 h	Reference											
	6–8 h			−0.20	−4.3**					−0.24	−4.0**		
	>8 h			−0.20	−3.8**					−0.24	−3.0*		
Trust in Government	Yes	Reference											
	No											0.00	−0.1
Loneliness	Not	Reference											
	Medium			0.12	2.9*							0.13	2.21 ∼
	Yes			0.36	8.3**							0.50	8.40**
Restrictions perceived as stressful	No	Reference											
	Yes					0.02	5.4**					0.05	2.5 ∼
Financial impact	No	Reference											
	Medium					0.01	0.1					0.24	3.9**
	Major					0.09	2.0 ∼					0.59	7.0**
Hope for a soon end	No	Reference											
	yes					−0.01	−0.4					−0.03	−0.4
Stressful relationship chanes	No	Reference											
	Few					0.15	4.1**					0.17	3.7**
	Many					0.32	5.6**					0.49	7.1**
Suspected of COVID 19	No	Reference											
	Yes					0.11	2.6 ∼					0.19	3.9**

*B = Estimate, *<0.008, ** <0.001, ∼ = only significant when uncorrected.*

TABLE 4 | Overview over all three conducted models (Basic Model, Harmful and Healthy Behavior, COVID-19 Impact) for both samples for SPQ scores.

		April – May sample						September – October sample					
		Basic Model		Harmful and Healthy Behavior		COVID-19 Impact		Basic Model		Harmful and Healthy Behavior		COVID-19 Impact	
BIC		7056.5		6908.2		6833.2		5268.1		4949.3		4495.3	
		B	z	B	Z	B	z	B	z	B	z	B	z
Intercept		2.97	40.5**	2.92	33.9**	2.81	43.0**	3.78	42.9**	3.48	32.3**	3.45	32.6**
Age		−0.01	−9.2**	−0.01	−6.6**	−0.01	−9.0**	−0.01	−7.7**	−0,01	−5.9**	−0.01	−6.7**
Gender	Male												
	Female	−0.04	−1.7	−0.06	−2.3 ∼	−0.04	−1.7	−0.17	−6.1**	−0.16	−5.4**	−0.15	−5.2**
Highest Education		−0.05	−5.2**	−0.04	−4.1**	−0.07	−4.0**	−0.12	−12.4**	−0.07	−6.3**	−0.09	−8.3**
Country	United Kingdom	Reference											
	GER	0.01	0.4	0.02	0.6	0.03	1.2	−0.15	−5.2**	−0.06	−2.1 ∼	−0.12	−3.2*
Pre-existing physical health problems		0.22	8.2**	0.17	6.3**	0.23	8.2**	0.20	6.0**	0.19	5.5**	0.24	6.8**
Pre-existing mental health problems		0.44	17.0**	0.37	13.6**	0.43	16.2**	0.56	19.1**	0.43	13.5**	0.42	12.9**
Children at home	No	Reference											
	Yes	−0.08	−3.4*	−0.06	−2.3 ∼	−0.09	−3.7**	0.02	0.6	0.02	0.72	−0.13	−4.1**
Living area	City	Reference											
	Suburb	0.07	2.1 ∼	0.10	2.9 *	0.10	2.3*	0.07	1.8	0.04	0.89	−0.07	−1.6
	Town	0.00	0.3	0.02	0.6	−0.02	−0.5	−0.13	−3.4**	−0.09	−2.3 ∼	−0.11	−2.9*
	Rural Area	0.07	2.2 ∼	0.08	2.6 ∼	0.08	2.6 ∼	−0.13	−3.9**	−0.11	−3.5**	−0.09	−2.6 ∼
Alcohol				−0.01	−2.8*					0.00	−0.3		
Drug consumption	No	Reference											
	Yes			0.08	2.5*					0.16	4.5**		
Excessive Media consumption	No	Reference											
	Yes			0.22	9.0**					0.21	6.4**		
Exercise	No	Reference											
	1–4 days			−0.06	−2.1 ∼					−0.05	−1.7		
	Min. 5 days			−0.09	−2.8*					−0.21	−4.1**		
Sleep	<6 h	Reference											
	6–8 h			−0.06	−2.0 ∼					−0.27	−7.6**		
	>8 h			−0.01	−3.5**					−0.29	−6.2**		
Loneliness	Not at all	Reference											
	Medium			0.02	0.7					0.07	1.8		
	Yery			0.14	4.8**					0.26	7.6**		
Trust in Government	Yes	Reference											
	Not at all											−0.15	−4.4**
Restrictions perceived as stressful	No	Reference											
	Yes					−0.03	−1.3					0.03	2.1 ∼
Financial impact	No	Reference											
	Medium					−0.04	−0.3					0.31	7.9**
	Major					0.15	5.3**					0.45	9.2**
End hopeful	No	Reference											
	Yes					−0.04	−1.4					−0.13	−2.5 ∼
Stressful relationship chanes	No	Reference											
	Few					0.03	1.1					0.06	1.9
	Many					0.02	0.4					0.37	8.3**
Suspected of COVID 19	No	Reference											
	Yes					0.1	3.5**					0.16	4.9**

*B = estimate, *<0.008, **<0.001, ∼ = only significant when uncorrected.*

these restrictions had been lifted (September/October 2020). Although we are measuring two timepoints, it is not a longitudinal approach, as the samples at both timepoint are only partially overlapping. We are therefore assessing the impact of the pandemic on independent samples from the German and British general population collected in May 2020 and October 2020. The sample from May and October are independent, but highly comparable in terms of distribution of age, and gender. The subjective impact on mental health was quantified using an online survey including questions on the impact on life circumstances, as well as two psychological questionnaires, the Symptom Check List (SCL-27) assessing general psychological symptoms, including depressive symptoms, and symptoms of anxiety, and the Schizotypal Personality Questionnaire (SPQ), assessing schizotypy traits. Furthermore, we assessed the social and economic impact of the pandemic.

We found that the general psychological symptoms (mainly depressive and anxiety symptoms) measured using the Global Symptom Index (GSI, main measure of SCL-27) was significantly lower in the May compared to the October sample in both countries. We were able to confirm these results when running the same analyses in a small sample comparing only those individuals who had taken part at the survey at both timepoints. While during the first timepoint 25–68% of responders were laying above the clinical cut-off for further psychological investigation based on the sub-scores of the SCL-27, at the second timepoint only 12–40% of responders were above clinical threshold. In a normative sample the 10–15% of a cohort reach or exceed the clinical cut-off (Hardt et al., 2004). Schizotypy, however, was higher in the October compared to the May sample, by 4 points in United Kingdom responders, 13.6 to 17.4, and by 1 point in German responders, from 12.3 to 13.2. Furthermore, we investigated the subdimensions of the SPQ. The current literature on the SPQ does not provide a consensus on an optimal dimensional structure of the SPQ. In addition to the original nine-factor structure (Raine, 1991), studies have identified a three-factor structure (Raine et al., 1994; Badoud et al., 2011), four-factor structure (Stefanis et al., 2004; Oezgen and Grant, 2018), a bifactor structure (Preti et al., 2015) as well as a six-factor structure (Davies, 2017). This inconsistency is problematic and may arise because the items of the SPQ introduced measurement error. For completion we investigated the six-, nine-, three- and four-factor models. All models show distinct differences between the two countries, especially in overlapping domains such as social anxiety and the interpersonal scores, where the United Kingdom scores significantly higher than Germany. Interestingly, this analysis shows that while all scores for the subdimensions for the United Kingdom are stable or higher in October compared to May, there is more variation in the score patterns in the German sample.

The results displaying the differences in psychological symptom and schizotypal trait scores confirm our hypotheses. On the one hand, we found that general psychological symptoms (depressive symptoms and symptoms of anxiety) are significantly lower or stay the same comparing samples from October and May, as reported in other studies (Fancourt et al., 2020; Wang et al., 2020). Fancourt et al. (2020) report for an only United Kingdom cohort that symptoms depression and anxiety stabilized with the introduction of lockdown easing measures from July 2020, whereas we detect a clear decline in symptoms strength. This might be explained by timepoint of data collection, which was conducted in 2 months after the Fancourt study, in September/October 2020. The ability to have social contacts, to resume one's profession, to send children to child care, etc, might have a direct alleviating effect. This shows the possibility that the measured increase in symptoms of anxiety and depression at the onset of the pandemic also resembles a normative psychological response to an exceptional situation. Investigating the sub-scores of the symptom check list (SCL-27) in our study, we found the strongest decrease in agoraphobic symptoms; in the United Kingdom sample, these symptoms decrease by 20% and in the German sample by 10%. This sub-score of the SCL-27, specifically assesses phobic fears of being among others or supressing actions that could create risks for one's health, like going outside. These behaviors are expected responses during a pandemic, and are therefore likely to reduce when the risk of infection goes down. The only sub-score of the SCL-27 which increased where vegetative symptoms, like dizziness, heart racing, stomach ache, sickness, etc. These symptoms strongly relate to psychosomatic symptoms, which have been reported to have increased significantly in front-line workers (Marinaci et al., 2020; Yi et al., 2020).

On the other hand, and as predicted, we found that schizotypy scores remained the same or were higher at the later timepoint. This is highly interesting, considering that already during the first timepoint nearly 10% of the responders indicated a subjective increase of schizotypy. Recent work shows the impact of adverse life events or loneliness on developing psychotic-like experiences (Beards et al., 2013; Chau et al., 2019; Le et al., 2019; Betz et al., 2020). The social and life-changing consequences of this pandemic (i.e., general reduction of social interaction, job insecurity, experiencing health problems) might therefore provide a long-term risk of schizotypal trait exacerbation in those individuals with high schizotypy scores. Our regression models indicate that indeed loneliness, financial hardship, and drug consumption are predictors for SPQ. The estimates of those three predictors were increased in the October compared to the May sample. In keeping with prior suggestions (Preti et al., 2020), individuals with increased schizotypal traits might show stronger avoidance behaviors, stronger disruption of social contacts, and with that a delayed return to normality, and therefore take longer to reverse the habits established during the first lockdown showing a worsening of schizotypy scores and a delay to return to baseline. However, this hypothesis requires rigorous longitudinal investigations.

In order to identify associations of the impact of the pandemic on psychological symptoms and schizotypy, we ran three sets of regression models separately for the two timepoints. For GSI, we first setup a basic model: During the first survey we identified positive relations between age, being female, living in the United Kingdom, reporting lower mental and physical health prior to the pandemic and living in a town compared to a big city as risk factors, showing an in strong positive association. In the

October samples, we identified an additional positive association with lower education. These results, except for living in the United Kingdom, confirm previous findings (Adamson et al., 2020; Bu et al., 2020; Bäuerle et al., 2020; Fancourt et al., 2020; Smith et al., 2020; Proto and Quintana-Domeque, 2021; Simha et al., 2021). In the harmful and healthy behavior model adjusting for the significant factors of the basic model, we investigated harmful and healthy behavior. We identified the same lowering and increasing association with the outcome in both, the May and October samples. Excessive media consumption and drug consumption contributed to an increased GSI, while longer sleep (>6 h) was negatively associated. Interestingly the effect of drug consumption is twice as high in the second than the May samples. A recent study showed a strong association between newly initiated substance use and increased measures of COVID related fear and worry (Rogers et al., 2020). Those individuals with highest use and fear and worry scores used substances as necessary coping strategies, which might provide an explanation for the increased association between drug use with GSI in the October sample in our study. Regular sleep of more than 6 h and healthy sleep routines are usually predictive of better mental health (Milojevich and Lukowski, 2016), it is therefore not surprising that this is the same during a pandemic. Furthermore, we found that excessive media consumption predicts GSI, which confirms previous findings (Bendau et al., 2020). In the COVID-19 impact model adjusting for the significant factors of the basic model we investigated social and economic impact of the COVID-19 pandemic. We found that while the restrictions themselves and the change in social contacts posed a strong stressor during the May survey it was mainly the financial impact, the change in social contacts and the increased risk of infections which posed the greatest influence during the second timepoint. Already during the first peak in April, Witteveen and Velthorst (2020) linked economic hardship to increased levels of depression and anxiety. During the first peak the economic burden might still be compensated for, however, with the continuing pandemic this burden increases and significantly contributes to mental health decline.

We ran similar regression models to detect potential predictors for schizotypy. In the basic model, we identified similar predictors in both, the May and October samples. While higher age, higher education, and being female were associated with lower outcomes in both, the May and October samples, mental and physical health status before the pandemic were positively correlated. The connection of having children with SPQ scores changed with the continuing of the pandemic from being a negative to a positive predictor; being a United Kingdom resident also correlated with higher outcome scores in the October sample. Living in towns or rural areas was associated with lower scores compared to big cities. The link of annual income with SPQ scores was only recorded during the second survey, with increasing effects on the outcome. Gender differences and younger age have been associated with schizotypy previously (Bora and Baysan Arabaci, 2009), and urbanicity (Fett et al., 2019) as well as lower socioeconomic status (Loch et al., 2017) are often linked to psychotic-like experiences.

In the harmful and healthy behavior model we examined whether harmful and healthy behaviors predicted schizotypy. Adjusting for the significant factors of the basic model, we found the same predictor for both timepoints. While excessive media consumption and drug consumption were linked with higher schizotypy, more exercise and sleep above 6 h showed the opposite relation. Interestingly, however, the association of drug consumption doubled in the October samples and the connection of more exercise tripled in the October samples. The effect of drug use on schizotypy confirms earlier findings reporting that regular cannabis users score higher on schizotypy and psychosis ratings (Nunn et al., 2001). However, it is a critical finding as drug use is also associated with higher conversion from schizotypy to psychosis (Hjorthøj et al., 2018). Therefore, these results are clinically relevant and requires attention in the course of the pandemic. Regular exercise has been identified as an alleviating intervention for early psychosis (Firth et al., 2018), and should be promoted rigorously during a crisis like the current one.

The COVID-19 impact model investigates the relationship of COVID-19 related measures. Here, we see significant worsening comparing the first and the October samples. The association of financial hardship triples, which is independent from annual income. This might show that financial hardship creates a stressor which imposes a risk not only in people with lower socioeconomic status (Loch et al., 2017), but across a wider range of socioeconomic statuses. Furthermore, stress related the change in social contact more than doubled in the October vs. the May samples. This might have been expected that with the continuing course of the pandemic, social isolation might increase, and with that, potentially loneliness too. Loneliness significantly interacts with schizotypy, and has been clinically linked to risk-for psychosis (Chau et al., 2019; Le et al., 2019).

In all models we included country of residence as a predictor, which was significant in most of the models for the May samples and in all models of the October samples. In order to fully understand this relationship, we ran the same regression analysis without country of residence as a predictor (see **Supplementary Tables 6**, **7** for results). All main findings remain the same when excluding the country of residence from the models, suggesting that the overall associations, and especially the directionality, is comparable across both countries, but slightly increased in the United Kingdom as indicated by the robust analyses of variance. The reason why United Kingdom residents might suffer a stronger mental health burden is multifold. The delayed start of implementing restrictions and due to that the higher numbers of infections and death (Balmford et al., 2020), followed by a higher unemployment and greater loss in gross income (Bauer and Weber, 2020; Mayhew and Anand, 2020), but also general differences in the health care system might contribute (Kuhlmann et al., 2009). Independently, however, the effects are highly similar, which might be due to the comparability of the samples, and the higher proportion of well-trained and socioeconomically secure responders in both samples.

This study has potential limitations. First, we used online data collection methods, therefore, people without or with

limited access to computers, or less well-versed using these methods would be excluded from the sample. However, in order to maximally ease the accessibility of the questionnaire we provided an online version with smart-phone compatible formatting. Second, we used a snowball sampling method for both timepoint with partially overlapping responders, therefore, the sample is not fully representable of the general population. Although we contacted all participants who had completed the first timepoint and agreed to be re-contacted (71.3%), only 121 participants (14.7%) took part in both timepoints. The results of the study should therefore be interpreted considering the sample's demographics. Furthermore, the reader should be aware that this study is not using a longitudinal approach, it is not showing changes within the same sample. It is, however, comparing two very similar samples at two timepoints within the ongoing pandemic. Third, comparing two countries is problematic as the countries vary on a large number of factors that are not and cannot be accounted for in detail. Therefore, any differences between the countries presented in this study might be linked to baseline differences. However, by specifically asking for a subjective change considering a pre- verses during-pandemic time-point, we minimized this confound. Fourth, we used a self-reporting survey without clinical in-person verifications. Social distancing measures complicate such verification. However, by using a completely voluntary and anonymous format, as well as standardized questionnaires we are minimizing potential effects. Fifth, we are presenting simple regression models without testing for interactions. This approach may not present conclusive results, however, it does allow for comparison with other studies following the same approach, and to generate hypotheses for future research rather than definitive inference. Finally, the usual caveat to observational studies applies, that we are noting associations but cannot infer causality.

In conclusion, we were able to show that whereas general psychological symptoms and percentage of responders above clinical cut-off for further psychological investigation were lower in the sample measured at the second timepoint, following the first peak of the pandemic, schizotypy scores were higher in the October survey. We furthermore found that United Kingdom responders were suffering from a stronger mental health burden than responders from Germany. The financial burden, drug use, the impact of loneliness, and previous mental and physical health problems predicted schizotypy, and general psychological symptoms most strongly, but were stronger in the October samples for schizotypy compared to general psychological symptoms. The differences in the scores over time requires further attention and investigations, to understand whether the impact on schizotypy increases further, potentially creating a higher risk for developing psychosis.

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 Commission Board of the Technical University Munich (reference nr: 250/20 S). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

FK: conceptualization, methodology, data collection, formal analysis and writing (original draft, review and editing), and administration of the project. SD: data collection, formal analysis, and writing (original draft and editing). LM: statistical advice and assistance, discussion, and editing of manuscript. LR: review and editing of manuscript. GM: methodology, discussion, and review and editing of 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.2021.667848/full#supplementary-material

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COVID-19-Fear Affects Current Safety Behavior Mediated by Neuroticism—Results of a Large Cross-Sectional Study in Germany

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Objectives: Although many research studies concerning changes in personality and behavior in time of COVID-19 pandemic emerged, important questions still have not been answered. This study with a large sample aimed to give insights into the impact of personality on pandemic fear and behavior by investigating the Big Five traits, COVID-19-fear, and associated behavioral changes in a large German-speaking sample.

Methods: About 14,048 healthy respondents (65.5% female, 34.2% male, and 0.32% other gender/gender queer; range = 18–85 years, median age 35–44 years) participated in the survey during the COVID-19 pandemic. Two scales, "adherent" safety behavior (ASB, $\alpha = 0.857$) and "dysfunctional" safety behavior (DSB, $\alpha = 0.876$), three items each, measured pandemic-associated behavior. The Big Five Inventory-10 (BFI-10) tested personality traits.

Results: While ASB correlated negatively with extraversion (rho = −0.053, ≤0.001), the other four traits were positively associated, with the highest association for neuroticism (rho = 0.116, ≤0.001), whereas neuroticism showed a positive correlation (rho = 0.142, ≤0.001) with DSB, extraversion (rho = −0.042, ≤0.001), agreeableness (rho = −0.028, ≤0.001), and conscientiousness (rho = −0.025, ≤0.001) correlated negatively with it. Regression analyses showed a small extent of the effect of personality traits. Moreover, neuroticism mediated the association between COVID-19-fear and DSB (positive-directed).

Conclusions: Even though our results on correlations between personality, pandemic fear, and related behavior are in line with the existing literature studies, the analyses clearly show that the impact of personality traits, including neuroticism, on pandemic behavior is very small. Rather, pandemic fear has a much larger influence on the safety behavior mediated through neuroticism. Further studies should bear in mind that personality traits can not only have influencing effects but also mediating effects.

Keywords: COVID-19 pandemic, big five personality traits, adherent safety behavior, dysfunctional safety behavior, hoarding

INTRODUCTION

One topic has dominated not only the media but also the everyday life of each of us during the last year: the COVID-19 caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). COVID-19 was officially classified on March 11, 2020, as the first pandemic virus infection since H1N1 in 2009/2010 (WHO briefing on COVID-19, 2020). In Germany and other countries, people started to buy and hoard toilet paper, disinfectants, face masks, and basic foodstuffs (such as rice, flour, and milk), while the stocks of hygiene materials in hospitals have been exhausted due to theft. Many research studies focus on calls for solidarity and social distancing to face the massive impact of the virus on people all over the world (Raygoza, 2020; Ruijter et al., 2020). Differences in the current pandemic safety behavior could be identified: a more adherent behavior or recommended preventive behavior (Musche et al., 2020), such as social distancing and handwashing, and a dysfunctional behavior, e.g., hoarding and stockpiling (Garbe et al., 2020; Weismüller et al., 2020; Schweda et al., 2021). These differences between people can have various reasons (Flowers et al., 2014) reported that psychosocial determinants (e.g., cognitions and identity) and sociocultural determinants (e.g., social context and capacity) impact pandemic behavior in the context of an influenza pandemic.

Personality has been found to show a tight connection to health behavior in various areas (Booth-Kewley and Vickers, 1994; Smith, 2006; Raynor and Levine, 2009). By definition, personality traits within individuals are stable across time and have substantial cross-situational consistency ("person-situation" debate) (Goldberg, 1993; Faulkner et al., 2004) and the study suggests that this will impact the behavior of a person even in specific and pandemic situations. Most studies investigated the influence of personality factors on COVID-19 behavior and affectivity by correlative analyses based on the Big Five model, which describes the personality in five broad traits: neuroticism, extraversion, agreeableness, conscientiousness, and openness (Allik et al., 2013). Only few investigators used other instruments (Garbe et al., 2020; Somma et al., 2020), even concerning the Dark Triad traits (Nowak et al., 2020).

According to the Big Five model, individuals who score high in neuroticism are more likely than average to experience feelings of anxiety, anger, and depression and to respond poorly to environmental stress (Widiger and Costa, 2013). They also tend to likely interpret ordinary situations as threatening and may experience small frustrations as unbearable (Widiger and Costa, 2013). Extrovert people tend to be outgoing (Widiger, 2016), sociable, talkative, and adventurous (Rammsayer and Weber, 2016). People who score high in agreeableness often behave in a cooperative, insightful, altruistic, and generous way in interaction with other persons (see Rammsayer and Weber, 2016). Conscientiousness defines individuals who are reliable, tidy, persevering, disciplined, and hardworking (Rammsayer and Weber, 2016). People displaying high levels of openness are curious, indiscriminate, culturally interested, and seek for new experiences (Rammsayer and Weber, 2016).

Most notably, neuroticism was often found to play a significant role as a predictor of several mental and physical disorders (Lahey, 2009). Recent investigations on this personality trait and its influence on the COVID-19 pandemic behavior and affectivity support the previous findings. Qian and Yahara (2020) found that neuroticism negatively predicted underestimation, material sufficiency, medical sufficiency, information sufficiency, self-rated health status, the likelihood of surviving, evaluation to others, and confidence in doctors. Moreover, people with higher scores on neuroticism show higher levels of stress, anxiety, depression, the likelihood of infection, concerns regarding family and children, influence on life and work, and preventive behavior, such as covering mouth and nose when sneezing or washing hands. However, these results are in line with the study of Abdelrahman (2020): People with higher scores of neuroticism perform more social distancing, i.e., preventive behavior. However, it was found that even though neuroticism indeed correlates with anxiety, it does not predict it (Bayanfar, 2020). Interestingly, the association between conscientiousness and preventive behavior is similar to that of neuroticism. Conscientiousness positively predicted preventive behavior and epidemic consciousness (Qian and Yahara, 2020). Higher levels of conscientiousness were correlated with more preventive behavior, such as social distancing and handwashing (Abdelrahman, 2020; Carvalho et al., 2020). Additionally, conscientious people more frequently and intensely tend to shop and stockpile toilet paper (Garbe et al., 2020). However, even though conscientiousness resembles neuroticism regarding preventive behavior, it differs when it comes to anxiety and fear: In contrast to neuroticism, higher levels of conscientiousness were associated with decreased anxiety caused by COVID-19 (Bayanfar, 2020; Watson and Clark, 2020). Investigations on the personality factors agreeableness and openness yielded similar results regarding preventive behavior. Thus, openness positively predicted epidemic consciousness, preventive behavior, and medical sufficiency. Agreeable people presented higher levels of preventive behavior, material sufficiency, self-rated health status, the likelihood of surviving, evaluation to others, and confidence in doctors (Qian and Yahara, 2020). Yet, these findings are not consistent. Another study found higher levels of agreeableness being associated with less social distancing (Abdelrahman, 2020). Agreeable people tend to be less anxious (Bayanfar, 2020; Watson and Clark, 2020), whereas openness positively predicted stress (Qian and Yahara, 2020). The personality trait extraversion positively predicted preventive behavior, self-rated health status, concerns regarding family and children, and influence on work (Qian and Yahara, 2020). However, the results of another investigation are in contrast to the above, since higher levels of extraversion were not associated with the following governmental recommendations like social distancing and handwashing (Carvalho et al., 2020). Unfortunately, the association between extraversion and perceived anxiety has not yet been examined in this study.

On the whole, the Big Five were all found to be positively associated with preventive behavior. However, the effects of neuroticism and conscientiousness were the most distinct. Although high levels of both neuroticism and conscientiousness

were associated with preventive behavior, neurotic people perceived more anxiety, depression, and stress, whereas conscientiousness is related to decreased mental burdens and increased confidence about health (Qian and Yahara, 2020).

The existing studies concerning personality and the COVID-19 pandemic only examined correlative relations between personality, especially neuroticism, and pandemic fear and/or behavior (e.g., Weismüller et al., 2020). Even though research study indicates that higher scores of neuroticism relate to higher levels of stress, anxiety, depression, and preventive behavior, and neuroticism indeed correlates with anxiety (Bayanfar, 2020), the type of relation between neuroticism and these concepts/outcomes/constructs has not yet been investigated. Therefore, some research questions remained unanswered: How strong is the influence between personality and the way of dealing with the pandemic? In particular, how much of the variance in pandemic behavior is explained solely by personality traits? By investigating the Big Five traits, COVID-19-related fear, and associated behavioral changes in healthy people in a very large online survey, this study aimed to give insights into the impact of personality and its extent on pandemic fear and COVID-19-related behavior by using regression and mediation analyses. Since neuroticism has been shown to correlate with both COVID-19-fear and pandemic behavior, we expect personality traits to predict pandemic behavior and that individuals with higher COVID-19-related fear will perform a more pronounced safety behavior mediated by neuroticism.

MATERIALS AND METHODS

Procedure

Over the time course of almost 6 months (March 10, 2020–September 14, 2020), during the first COVID-19 phase in Germany a population-based survey was distributed *via* online channels, social media, and personal contacts. In this phase, governmental requirements became restrictive, individual freedom was curtailed (e.g., prohibition of large events, closing of public facilities, and directives to minimize social contacts), and restrictions were unstable. About 19,149 individuals completed the anonymous questionnaire reported in previous studies, e.g., (Bäuerle et al., 2020a,b; Teufel et al., 2020; Weismüller et al., 2020). For analysis, only mentally healthy individuals (aged 18–85 years) were included and respondents with unclear illness and psychiatric/psychological illness (self-report) were excluded, resulting in $N = 14{,}048$. All participants gave written informed consent (online) before participating in the online survey. This study was conducted in accordance with the Helsinki Declaration. In agreement with the respective ethics committee, no approval procedure was required as this survey was completely anonymous.

Assessment

Sociodemographic data were assessed such as age, gender, education, marital status, occupation, residential situation, and psychological health status.

The Big Five Inventory (BFI) is a psychometric short scale, based on the Big Five model of personality. The questionnaire assesses the five principle aspects of personality (*openness, conscientiousness, extraversion, agreeableness, and neuroticism*) on a 5-point scale (1 = "strongly disagree" to 5 = "strongly agree"). In this study, the 10-item short German version (BFI-10) was used. Retest reliability of the scales amounted to $r = 0.58$ for agreeableness, $r = 0.72$ for openness, $r = 0.74$ for neuroticism, $r = 0.77$ for conscientiousness, and $r = 0.84$ for extraversion (Rammstedt and John, 2007).

COVID-19-related fear was assessed by the item: "I worry about COVID-19" (see Bäuerle et al., 2020a,b; Hetkamp et al., 2020; Musche et al., 2020; Skoda et al., 2020, 2021; Weismüller et al., 2020; Schweda et al., 2021). Answers were given on a 7-point Likert scale ranging from "1 = strongly disagree" to "7 = strongly agree." Hence, higher scores indicate a higher COVID-19-fear.

Based on media reports on specific behavior during the pandemic phase and expert consensus, items were generated to cover general recommendations by the WHO (WHO briefing on COVID-19, 2020) including physical distancing, increased hand hygiene, and reported behavioral changes in media including stockpiling behavior [further questionnaire in **Supplementary Table 1**, see (Weismüller et al., 2020)]. Two scales assessing adherent safety behavior (ASB; e.g., item *"I increasingly avoid public places/events."*) ($M = 4.759$, $SD = 1.879$) with Cronbach's alpha of 0.857 and dysfunctional safety behavior (DSB; e.g., item *"I have bought larger quantities of basic food (flour, sugar, noodles, rice, and canned food) or will buy more in the near future.")* ($M = 2.526$, $SD = 1.468$) with Cronbach's alpha of.876, each with three items, have been established based on the rotated component analysis by Varimax (**Supplementary Table 2**). Answers were given on a 7-point Likert scale ranging from "1 = strongly disagree" to "7 = strongly agree." Items with a scale correlation lower than.30 were excluded. The items of the two subscales and the corrected item-scale correlations can be found in **Supplementary Table 2**. The two scales were correlated (rho = 0.356, $p \leq 0.001$).

Statistical Analyses

Statistical analyses were carried out using the *Statistical Program for Social Sciences SPSS* version 26 (IBM, New York). The level of significance for all analyses was set at $\alpha = 0.05$. In the presence of non-normal distributions, we generated *Spearman's rho* (two-sided). We constructed a multiple regression model with the Big Five traits predicting the corona-specific behavior of the subjects. For the mediator effects, the *PROCESS Procedure for SPSS version 3.4.1* by Andrew F. Hayes (The PROCESS Macro for SPSS, SAS and R, 2020) was used (Model 4). We controlled the direct and indirect mediational effects with the bootstrapping method (see Hayes, 2018). The level of confidence for all CIs was 95%, and numbers of bootstrap samples for percentile bootstrap CIs were set at 5,000.

RESULTS

Participants

In this study, 14,048 mentally healthy (no self-reported mental illness) individuals were included with ages between 18 and 85

TABLE 1 | Demographics.

	N	Percent (%)
Gender		
Female	9,203	65.5
Male	4,806	34.2
Other/gender queer	38	0.3
Age category (years)		
18–24	1,797	12.8
25–34	3,419	24.3
35–44	3,343	23.8
45–54	2,755	19.6
55–64	1,990	14.2
65–74	645	4.6
75–84	99	0.7
Marital state		
Single	3,896	27.7
Married	6,210	44.2
In a relationship	2,903	20.7
Divorced/separated	771	5.5
Widowed	189	1.3
Others	79	0.6
Education		
University degree	6,278	44.7
High school diploma	4,476	31.9
Secondary school degree ("*Realschule*")	2,448	17.4
Secondary school degree ("*Hauptschule*")	591	4.2
No secondary school degree	33	0.2
Other form of education	222	1.6

N = 14,048.

TABLE 2 | Descriptive statistics.

Predictor	*M*	*SD*	*S (SE = 0.021)*	*K (SE = 0.041)*
Extraversion	3.381	0.964	−0.281	−0.689
Openness	3.545	0.947	−0.304	−0.588
Neuroticism	2.698	0.885	0.218	−0.549
Agreeableness	3.166	0.748	−0.155	−0.249
Conscientiousness	3.775	0.771	−0.313	0.021
COVID-19-related fear	4.18	1.901	−0.278	−1.115
Adherent safety behavior	4.759	1.879	−0.547	−0.887
Dysfunctional safety behavior	2.526	1.468	0.814	−0.190

years and a median age category of 35–44. Demographics are shown in **Table 1**. Most of the participants were married and were with a high school diploma or university degree. Descriptive statistics are shown in **Table 2**.

Correlations

COVID-19-fear showed a significant correlation with ASB (rho = 0.538) and DSB (rho = 0.383). The correlations of ASB and DSB with the Big Five traits and COVID-19-fear are shown in **Table 3**.

All correlations were significant, except for DSB and openness, and COVID-19-fear and conscientiousness. Of all the correlations, the one between neuroticism and COVID-19-fear showed the highest effect, followed by the correlation between neuroticism, DSB, and ASB. Correlations between agreeableness, extraversion, and COVID-19-fear can be considered small.

Regression Analyses

The results of multiple regression models with the Big Five traits predicting the safety behavior of the subject are shown below. With exception of extraversion, all Big Five traits predict the ASB positively, and all predictions are with a level of significance of ≤0.001. This model provides an explained variance of 2.6% (**Table 4**). DSB is only predicted by neuroticism and openness, with an explained variance of 1.9% (**Table 5**). COVID-19-fear was predicted by all personality traits except extraversion, with the highest variance resolution of 6.7% (**Table 6**).

Mediator Analyses

According to this study and the findings of the correlation and regression analyses (shown above), a mediation effect was assumed for neuroticism showing the highest impact on fear and behavior. The results of the mediation model of the impact of neuroticism on the relationship between COVID-19-fear and ASB for completely standardized effects and bootstrap estimates are shown in **Figure 1** and **Supplementary Table 3** and total $R^2 = 0.300$ [$F(2, 14{,}045) = 3004.923$, $p > 0.001$, $N = 14{,}048$]. The indirect effects showed now significance after bootstrapping.

The results of the mediation model of neuroticism on the relationship between COVID-19-fear and DSB for standardized effects and bootstrap estimates are shown in **Figure 2** and **Supplementary Table 5**. All effects, within the completely standardized indirect effect of neuroticism, were significant with a total $R^2 = 0.137$ [$F(2; 14{,}045) = 1113.263$, $p > 0.001$, $N = 14{,}048$].

DISCUSSION

Since previous studies only focused on correlations between personality and pandemic behavior, the aim of this study with one of the largest samples investigating mental health and behavior during the pandemic ($N = 14{,}048$) was to give a more detailed insight into the impact of personality and its extent on COVID-19-fear and pandemic-related behavior by using further analyses. Two types of behavior were detectable in this pandemic phase: a rather adherent versus a dysfunctional type of behavior. At this, the COVID-19-fear showed a significant correlation with ASB and DSB. Neuroticism was correlated with ASB, DSB, and COVID-19-fear. The regression analyses only showed a small impact of the Big Five traits on pandemic safety behavior, with an explained variance of <3%. Both the ASB and the DSB could be more effectively explained by the COVID-19-fear. Based on the previous studies on the impact of personality on current pandemic behavior (Abdelrahman, 2020; Bayanfar, 2020; Weismüller et al., 2020), mediational effects were assumed. Current analyses in this large sample showed neuroticism being understood as a mediator of the effect of COVID-19-fear on

TABLE 3 | Spearman's rho correlation between the scales of adherent safety behavior (ASB), dysfunctional safety behavior (DSB), and COVID-19-fear and personality traits.

	Extraversion	Openness	Neuroticism	Agreeableness	Conscientiousness
Adherent safety behavior (ASB)	−0.053	0.067	0.116	0.036	0.037
P	≤0.001	≤0.001	≤0.001	≤0.001	≤0.001
Dysfunctional safety behavior (DSB)	−0.042	0.033	0.142	−0.028	−0.025
P	≤0.001	0.201	≤0.001	≤0.01	≤0.01
COVID-19-fear	−0.046	0.050	0.238	0.042	0.002
P	≤0.001	≤0.001	≤0.001	≤0.001	0.851

N = 14,048. Two-sided.

TABLE 4 | Regression analysis to predict the ASB by the Big Five traits.

Predictor	*β*	*βse*	*t*	*p*
Intercept	3.222		24.002	≤0.001
Extraversion	−0.120	−0.061	−7.022	≤0.001
Openness	0.137	0.069	8.149	≤0.001
Neuroticism	0.261	0.123	14.336	≤0.001
Agreeableness	0.123	0.049	5.827	≤0.001
Conscientiousness	0.096	0.039	4.624	≤0.001

Total R^2 = 0.026 [F(5) = 75.988; p ≤ 0.001; N = 14,048].

TABLE 5 | Regression analysis to predict the DSB by the Big Five traits.

Predictor	*β*	*βse*	*t*	*p*
Intercept	1.843		17.520	≤0.001
Extraversion	−0.010	−0.006	−0.732	0.464
Openness	0.063	0.041	4.797	≤0.001
Neuroticism	0.217	0.131	15.190	≤0.001
Agreeableness	−0.044	−0.023	−2.672	0.008
Conscientiousness	0.012	0.007	0.762	0.446

Total R^2 = 0.019 [F(5) = 55.253; p ≤ 0.001; N = 14,048].

TABLE 6 | Regression analysis to predict the COVID-19-fear by the Big Five traits.

Predictor	*β*	*βse*	*t*	*p*
Intercept	1.739		13.081	≤0.001
Extraversion	−0.032	−0.016	−1.909	0.056
Openness	0.111	0.055	6.698	≤0.001
Neuroticism	0.534	0.248	29.637	≤0.001
Agreeableness	0.173	0.068	8.290	≤0.001
Conscientiousness	0.044	0.018	2.145	0.032

Total R^2 = 0.067 [F(5) = 202.210; p ≤ 0.001; N = 10,048].

the association with DSB. There was no mediational effect on ASB. The mediation of neuroticism on fear-related DSB shows a positive direction: Individuals with a high level of COVID-19-related fear will tend to show more dysfunctional behavior mediated by their neurotic personality. Even though neuroticism correlated with COVID-19-related anxiety and also was a predictor of ASBs, no mediator effect was found for this relationship.

The previous study underlines the current correlative results for the Big Five trait neuroticism: People with a higher level of neuroticism perform more preventive behavior and are more afraid of the pandemic situation (Abdelrahman, 2020). Analyses showed clear effects of neuroticism on ASB and on hoarding or stockpiling behavior. Similar to the investigation by Carvalho et al. (2020), higher levels of extraversion were associated with less social distancing. Additionally, this study expands previous findings and shows that extroverted people show less dysfunctional behavior, e.g., hoarding. Moreover, extroverted people show less pandemic fear as well. Higher levels of the other personality traits are associated with higher expression of COVID-19-fear. According to the existing studies, openness is positively associated with adherent behavior not with dysfunctional behavior. In this study, it was found that persons who are more agreeable tend to hoard fewer disinfectants, face masks, and basic foodstuffs. According to the study by Abdelrahman (2020), it could not be demonstrated that agreeable people are less likely to practice social distancing, i.e., one of the governmental restrictions.

Looking beyond the correlations, personality effects on behavior appear extremely limited. Although neuroticism has no effect as a mediator on ASB, e.g., social distancing, it has been shown that neuroticism has a positively directed mediator effect on the relationship between COVID-19-related fear and dysfunctional behavior.

A limitation of this study is that the results can only be generalized to a certain degree, despite the immense number of cases. The current survey is based on 65.5% female, 34.2% male, and 0.3% gender queer responders. In Germany, however, gender distribution of 50.7% women and 49.3% of men has to be assumed (Statista, 2020b). Additionally, it is known that the Big Five traits depend on age (Soto et al., 2011). The current age distribution is not identical to the German population, in which the biggest cohort, with 23.5%, is built by the age-group of 40–59 years (Statista, 2020a). However, the mean age category of the current investigation was between 45 and 54 years.

CONCLUSIONS

Nevertheless, particular strengths of this study are the information at the early stage of the pandemic and its

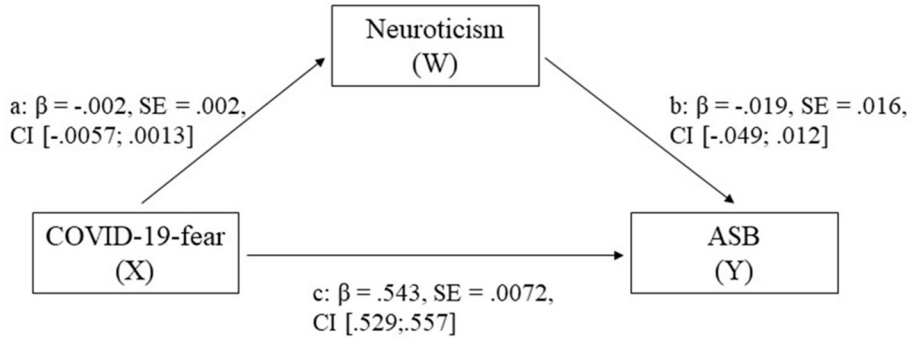

FIGURE 1 | Mediation model of neuroticism on the correlation between COVID-19-fear and adherent safety behavior (ASB). c shows the direct effect of COVID-19-fear and ASB, and a and b show the completely standardized indirect nonsignificant effects by the personality trait neuroticism.

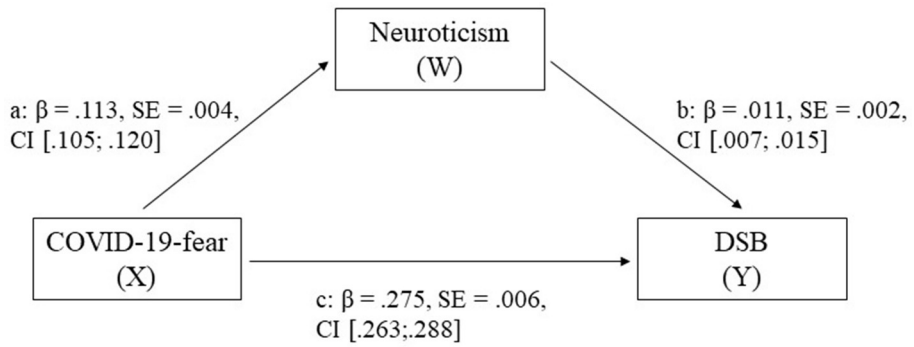

FIGURE 2 | Mediation model of neuroticism on the relationship of COVID-19-fear and dysfunctional safety behavior (DSB). c shows the direct effect of COVID-19-fear and DSB, and a and b show the completely standardized indirect significant effects by the personality trait neuroticism.

large sample size of more than 14,000 German-speaking respondents. Already published results on the correlations between personality traits and pandemic fear and the related behavior could be replicated. However, the analyses going beyond these correlations clearly show that the extent of the effect of personality traits, even of neuroticism, can be considered very small. This study was able to show that pandemic fear has an influence on current safety behavior through neuroticism. In contrast to common assumptions by the previous studies, the analyses show high levels of neuroticism do not *per se* lead to higher anxiety but that the relationship is more complex since personality traits, in our case neuroticism, often have a mediating effect rather than just a direct effect. Therefore, greater scope for intervention can be assumed. This association should be taken into account when it comes to developing new intervention programs (see Barlow et al., 2014) and conducting governmental efforts.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

MF: conceptualization, methodology, analysis, and writing or original draft preparation. AB: conceptualization, reviewing, and editing the manuscript. MF, AB, KS, NR, VM, HD, SM, BW, AS, MT, and E-MS: reviewing and editing the manuscript. MF: visualization. MT and E-MS: supervision and project administration. All authors have read and agreed to the published version of the manuscript.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.671768/full#supplementary-material

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