

# Community series in mental illness, culture, and society: Dealing with the COVID-19 pandemic, volume VI

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# Community series in mental illness, culture, and society: Dealing with the COVID-19 pandemic, volume VI

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# Editorial: Community series in mental illness, culture, and society: dealing with the COVID-19 pandemic, volume VI

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## KEYWORDS

coronavirus, healthcare professionals, mental health care, mental disorders, psychiatry, psychological distress, public health, SARS-CoV-2

## Editorial on the Research Topic

[Community series in mental illness, culture, and society: dealing with the COVID-19 pandemic, volume VI](#)

The COVID-19 pandemic has had significant consequences, impacting not only physical health but also mental wellbeing, social interactions, and economic stability (1–3). These effects have been further shaped by individual factors and specific sociocultural dynamics, such as norms, values, and religions (4, 5). There is a need to consider, not only medical and scientific aspects, but also the broader societal and cultural dynamics when addressing public health crises (6, 7). This Research Topic explores the effects of the pandemic on mental health from the perspective of local and sociocultural factors, focusing on vulnerable and special populations, and healthcare providers.

The sixth volume of our Community Series Research Topic titled “*Mental Illness, Culture, and Society: Dealing with the COVID-19 Pandemic*” builds upon the previous five volumes (8–12) and presents nine new papers exploring how mental health is impacted by the interplay of culture and society during and after the COVID-19 pandemic.

Kuhlmann et al. argued that violence against healthcare workers (HCWs) is a serious global issue that threatens healthcare workforce retention and health system resilience, especially during the fragile post-COVID “normalization” period. The authors used a comparative approach, analyzing the epidemiological, political, and geographic contexts of Brazil, the United Kingdom, New Zealand, and Germany to identify similarities and differences in violence against HCWs. Overall, the results showed a general sensitivity of HCWs to violence, with women, nurses, and migrant/minority groups being particularly exposed. The authors emphasized the need for attention to this topic and to all forms of violence in the world.

The study by Huang et al. aimed to compare depressive symptoms among HCWs in high-risk areas (HRAs) and low-risk areas (LRAs) during the initial stage of the COVID-19 pandemic in China. The results showed that HCWs in LRAs had 1.96 times higher odds of having depressive symptoms than those in HRAs. There were also significant differences in

workplace environment characteristics and the Health Belief Model between the two groups. The study highlighted the importance of considering the mental health of HCWs, especially in LRAs, and tailoring interventions to their specific needs.

The study conducted by [Savu et al.](#) aimed to determine the mediating role of HCWs' perception of their own health on pandemic stress, work-family conflict, work engagement, meaning and commitment to work, satisfaction of basic psychological needs, patient care, and burnout symptoms. The authors identified significant correlations between the investigated variables. In particular, HCWs with a positive perception of their own health were better at managing pandemic stress, burnout effects, and work-family imbalances.

[Ayub et al.](#) reviewed the impact of the COVID-19 pandemic on religious activities and beliefs, and explored the potential role of religious leaders and communities in mitigating the pandemic's impact through public health measures and community engagement. The authors identified the following main themes: the relationship between religious practices, beliefs, and the spread of COVID-19, and the role of religious leaders and faith communities in coping with and mitigating the impact of COVID-19. The review highlighted the essential role of religious leaders, faith-based organizations, and faith communities in promoting education, preparedness, and response efforts during the pandemic. The importance of collaboration between religious leaders, institutions, and public health officials was also emphasized.

[Ryu et al.](#) aimed to understand COVID-19 vaccine acceptance and related factors among 572 individuals with mental disorders residing in Korea. Clustering revealed three groups in relation to vaccine acceptance: totally accepting, somewhat accepting, and hesitant groups. Individuals in the high vaccine acceptance group were older, more likely to receive the influenza vaccine regularly, and more likely to trust formal information sources. The study highlighted the importance of understanding the behavioral and psychological characteristics associated with vaccine acceptance, to be able to effectively communicate its importance to individuals with mental disorders.

[Carbone and Knapp](#) investigated the use of mandatory psychiatric treatments during the COVID-19 pandemic, with a focus on the first and subsequent phases. Interviews were conducted with mental health care professionals and scholars from four countries. The analysis identified four major themes: the culture of psychiatric care services, the effect of the pandemic on involuntary hospitalizations, exceptional management of hospitalization to reduce infection spread, and policies and suggestions for more inclusive mental health treatments. The study found that during the first wave, there was a decrease in the use of involuntary treatments, while a gradual increase was observed in the following months.

With their study protocol, [Qiao et al.](#) documented the unique challenges faced by rural black women during the COVID-19 pandemic and tried to highlight their needs for effective management of social, physical, and mental health challenges. The study aimed to inform evidence-based decision-making for

policymakers and to contribute to the development of public health emergency preparedness plans. This would help promote the resilience of rural Black women and their families during future infectious disease outbreaks and other public health emergencies.

The study by [Park et al.](#) examined the connections between pandemic-related factors and anxiety/depressive symptoms in young adults from South Korea and the U.S.. The findings from 1,123 participants collected during the COVID-19 lockdown period showed similar network structures in both countries, suggesting a consistent relationship between the pandemic and internalizing symptoms, irrespective of sociocultural differences. COVID-related stress and negative anticipation of the future were identified as key factors connecting pandemic-related elements to psychological distress.

Finally, [Du](#) discussed the impact of the COVID-19 pandemic on community-centered engagement and healthcare services. The author particularly described the experiences of migrant workers in Singapore and community volunteers in Shanghai and the effectiveness of coordinated community efforts in providing essential supplies and support during lockdowns [Du](#). The article also emphasized the role of community health centers in testing and vaccination programs, especially among marginalized populations.

In brief, the articles collected in the Sixth Volume of this Research Topic provide a novel perspective on the pandemic's impact on mental health, further emphasizing the role of sociocultural, economic, and individual factors in this interplay. The influence of COVID-19 on psychiatry and mental health is significant and enduring. Further clinical and epidemiological research is necessary to address the vulnerabilities of the most fragile segments of society.

## 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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# The opinions of community-centered engagement and health care during and after COVID-19 pandemic

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## KEYWORDS

community-centered, health care, social determinants of health, COVID-19 pandemic,  
risk communication and community engagement, psychiatry and psychology, medical  
sociology

## 1. Introduction

The COVID-19 pandemic still remains an impending and grave threat to the global public health. A number of prominent social determinants in common, including more chronic disease, inefficient health care, shortage of education, and severe overcrowding, have been found to be associated with extremely high COVID-19 cases (1). In the context of attempts to curb the spread of the virus, a great deal of focus has been placed on community mitigation efforts (2).

The COVID-19 pandemic has added another layer of trauma to low-income class communities, who often experience the trauma of a historical legacy of racism that still has not been fully healed in some countries (3). Geographical inaccessibility and socioeconomic inequalities have caused unequal health care use across both urban and rural communities even in the same country and region. Following the experiences of Pakistan, Ethiopia, Brazil, and other countries, a coordinated community workforce can provide effective health and social care support on a large scale (4, 5). The UK has also proposed a large-scale emergency program to train Community Health Workers (CHWs) to provide a long-term model of care (6). Community-centered engagement and health care services play a key role in trying to combat this problem. In addition to professional or trained CHWs, other staffs who were in Community-Based Organizations (CBO), Community Health Centers (CHCs), provided essential health care services and contributed empirical experience to the existing research during and after COVID-19 pandemic.

This article introduces a themed issue focused on COVID-19 pandemic as it relates to community-centered engagement and health care services: (1) Risk communication and community engagement plan; (2) Advancing community-based testing and vaccination programs. It provides the general commentary on them.

## 2. Subsections relevant for the subject

### 2.1. Risk communication and community engagement plan

Community engagement is based on the premise that the voice of the community should be heard as it is empowered to play a meaningful role in the process by which it is affected and the solutions to the community's own problems. It is an essential



component of humanitarian assistance, civil society and international development practice (7). Risk communication and community engagement (RCCE) are essential components of a broader health emergency preparedness and response action plan (8). In the context of the COVID-19 pandemic, it encompasses two distinct but interrelated approaches to supporting communities to adopt disease-safe behaviors and to take community action to support ending disease transmission. It includes effective dissemination of scientific information, and also the range of communication actions required through the preparedness, response, and recovery phases, to encourage positive behavior change, and the maintenance of trust (9).

In Singapore, migrant workers who were not covered by the universal health care system are one portion of the vulnerable population. They mostly live in large, diverse, high-density housing, and are not governed by local labor laws regarding minimum wages, employment mobility, and occupational rights (10). RCCE's activities in their community lack coordination and are often led by government authorities and non-profit organizations. Through sustained efforts, the RCCE system has evolved from a grassroots approach to a scientifically effective strategy that is coordinated with national actions and disseminated to large, diverse migrant worker communities (11).

In response to the COVID-19 outbreaks, most countries or regions have restricted entry and exit, or imposed blockades in some cities at the beginning of 2020. Even city lockdowns are effective as a short-term tool to contain and slow the pandemic spreading, an important challenge for local governments is to ensure that basic supplies are provided to the residents of the communities, especially to vulnerable groups. The practical experience in Shanghai of China presented its essential feature during urban lockdowns: the community plays an important role in providing basic supplies as the main body of grassroots governance. In compliance with the government's advocacy of community closure, residents staying in their homes and maintaining social distance, the neighborhood committee has recruited many volunteers from residents to carry household goods from the community gate to residents' homes (12). In order to reduce the number of people gathered, volunteers from each building took out supplies from the temporary storage area and delivered them door-to-door (11). The basic livelihood security program for vulnerable groups was implemented by community-based units. Community engagement is essential for creating a local and context-specific community-centered interventions (13); at the same time, community engagement helps to build interpersonal trust and fosters interaction and networking among neighbors, which can help protect people's mental health and reduce the risk of isolation, depression, and even suicide that come with the closure during a lockdown (14).

## 2.2. Advancing community-based testing and vaccination programs

During the pandemic, Community Health Centers (CHCs) functioned as an important source of health care for low-income and non-privately insured populations, serving as a trusted source of care to engage the communities they served in

COVID-19 testing. There have been some successes with testing and vaccination programs in those low-income communities. CHCs have the infrastructure to maintain public health, and their place in the community also means they are a powerful force for health equity, social justice, community pride, and resilience. To meet community needs, the government started testing services in CHCs as the first place. In U.S.A, 97% of CHCs had implemented testing services before October 2020 (15). In one case study which aligns with principles of community-engaged research, it describes a community-partnered strategy to accelerate COVID-19 testing in historically marginalized populations that provides ongoing resources to CHCs for addressing the needs of testing in their communities (16). Following the acceleration of the testing strategies, CHC-community partnerships implemented outreach strategies to support testing in populations at increased risk for COVID-19 (17).

Federally Qualified Health Centers (FQHCs) now comprise the largest primary care network in the United States, that are non-profit, community-directed health care providers serving low-income and medically underserved communities, many of which provide limited access to psychiatric services currently (18). AltaMed Health Services, one of the largest FQHCs, implemented the COVID-19 vaccine outreach and education initiatives which applied Freirean liberation principles to an integrated model of crisis recovery and community resilience-building (19). Hispanic patients and Non-Hispanic Black have higher risk for COVID-19 infection and hospitalization (20), but have lower rates of COVID-19 vaccination (21). Two simultaneous interventions were conducted at the vaccination site in a racially and ethnically diverse neighborhood in northern Manhattan to address this issue: (1) Reschedule patients through the direct education and outreach service in a CBO. (2) A digital redesign to restrict online self-scheduled vaccinations to locally underserved racial and ethnic patient zip codes (17). The results suggest that the appropriate digital workflow designing for vaccination, may reduce health disparities directly, and such efforts highlight the importance of public health campaigns which was community-based engagement.

During the COVID-19 pandemic, people were asked to take such actions as wearing masks, testing, and vaccination. While these actions were beneficial to individuals in combination with others through community immunization, it cannot be assumed that people were enthusiastic about taking these beneficial actions. The community characteristics that are associated with higher testing rates in a voluntary mass testing scheme implemented in the Italian region of South Tyrol between November 18th and 25th of 2020, shows the key community determinants and characteristics that are associated with higher testing rates, such as socioeconomic status, the convenience, religiosity and social capital (22). In the vaccination campaign, different regions of China have different rates of vaccination and different factors that influence people to vaccinate, which may be due to some complex sociodemographic characteristics. Incentives similar to the testing could be used for vaccination, but may prove to be a challenge, so it is of considerable interest to study fully voluntary participation in vaccination. Vaccination strategies need to be tailored to the gender of the community population, the dissemination of vaccination information to achieve higher levels of COVID-19 vaccination (23).

### 3. Discussion and conclusion

The COVID-19 pandemic has exposed structural social inequalities and systemic inequities in our health care systems (24). There were many inequalities in social determinants and exposure to risk, access to health care, and ability to engage in COVID-19 prevention behaviors (25). The early detection of vulnerable categories, at risk to become ill and develop long-term health status, would help to prevent impacts on overall wellbeing by allocating resources for targeted interventions to manage psychosocial stress and increase the resilience of vulnerable populations toward post-COVID-19 crises (26). Public health agencies and health care providers should consider strengths, challenges, the needs of specific communities, and avoid using a uniform “one size fits all” approach when tackling all issues related to COVID-19 (2).

Up to now, the COVID-19 pandemic has greatly imposed stressful conditions that may affect the ability of community health care providers to provide safe and effective care (27). It challenged the community-centered health care providers and inspired new ideas. The concept of resilience which is widely used in various academic fields could also be implemented in the community. The experience of community engagement of the migrant workers in Singapore and the volunteers from residents in Shanghai of China, which were described in the above, have also shown that coordinated and timely RCCE in response could be achieved by establishing specific systems and structures, even in crisis settings where the concept of RCCE is not understood (11).

The findings of the community-centered intervention in testing and vaccination programs showed some significant changes in the racial and ethnic composition of COVID-19 before and after these interventions. Community Health Workers (CHWs), whose close relationship with community members assists in bridging the gap between the community and the health care system, have been shown to play a critical role in limiting the spread of the virus during the pandemic (5). There were other staffs who were in CBO, CHCs, etc. They provided community patient-centered care in the COVID-19 pandemic which could serve as a new starting point for improving and expanding their role in the health care system (28). The COVID-19 provides a window of opportunity for observing community resilience initiatives. The qualitative study, based on the Community Resilience Initiative Framework, investigated the initiatives of urban communities in China (29). The collective experience

in fighting the COVID-19 boosted community interaction, understanding and trust. It thus established community self-organization including the agency of community actors, grid management systems, and the utilization of WeChat groups, and further promoted the capacity of problem solving in the community. We will continually apply the concept of resilience to examine various types of community-based organization that are adaptive to the challenges associated with COVID-19 and continue to provide services to the community residents (30). Finally, the COVID-19 pandemic has also posed an unprecedented demand and a huge burden for healthcare workers (HCWs) including CHWs worldwide, with alarming reports of heightened mental health problems, so protecting and promoting their mental health should receive more attention (31).

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The author confirms being the sole contributor of this work and has approved it for publication.

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# COVID-19 vaccine acceptance and related behavioral and psychological characteristics in individuals with mental disorders in Korea

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**Objective:** This study aimed to investigate COVID-19 vaccine acceptance and related factors in individuals with mental disorders in Korea.

**Methods:** We surveyed 572 individuals with mental disorders about their attitudes toward COVID-19 vaccination using a 7-item self-rating questionnaire on vaccine acceptance and hesitancy. We categorized the respondents into groups based on their level of vaccine acceptance using hierarchical clustering. In addition, we evaluated the respondents' vaccination status and trust in sources of information regarding COVID-19 vaccines, and assessed their psychological characteristics using the Patient Health Questionnaire-9, Gratitude Questionnaire-6, and Big Five Inventory-10.

**Results:** Clustering revealed three groups according to vaccine acceptance: 'totally accepting' ( $n=246$ , 43.0%), 'somewhat accepting' ( $n=184$ , 32.2%), and 'hesitant' ( $n=142$ , 24.8%) groups. Three quarters of all participants, who belonged to the 'totally accepting' or 'somewhat accepting' groups, were willing to receive a COVID-19 vaccine despite concerns about its side effects. Individuals in the high vaccine acceptance group were older ( $F=12.52$ ,  $p<0.001$ ), more likely to receive the influenza vaccine regularly, and more likely to trust formal information sources. Additionally, they had higher levels of gratitude ( $F=21.00$ ,  $p<0.001$ ) and agreeableness ( $F=4.50$ ,  $p=0.011$ ), and lower levels of depression ( $\chi^2=11.81$ ,  $p=0.003$ ) and neuroticism ( $F=3.71$ ,  $p=0.025$ ).

**Conclusion:** The present study demonstrated that individuals with mental disorders were generally willing to receive COVID-19 vaccination. However, they weighed its need and effectiveness against potential side effects before coming to a decision. It is important to understand the behavioral and psychological characteristics associated with vaccine acceptance, to effectively communicate its importance to individuals with mental disorders.

## KEYWORDS

COVID-19, mental disorders, COVID-19 vaccines, vaccine hesitancy, cluster analysis



## Introduction

Coronavirus disease 2019 (COVID-19) emerged as a global health issue in early 2020. Compulsory public health measures, including mandatory face mask wearing and social distancing, were implemented during the early period of the pandemic to curtail the rapid spread of COVID-19 (1, 2). Almost a year after the pandemic began, COVID-19 vaccines showing promising efficacy and safety were developed, and government authorities strongly encouraged as many people as possible to be vaccinated (3). Such stringent measures were necessary to reduce morbidity and mortality among older individuals and patients with medical comorbidities. However, some individuals felt that their personal freedoms were violated and raised concerns about the efficacy and safety of the vaccines (4).

Preexisting mental disorders have been associated with a disproportionately higher likelihood of contracting COVID-19, and being hospitalized or dying, compared to the general population (5). Several factors might contribute to the poor COVID-19 outcomes of individuals with mental disorders, including a higher prevalence of physical comorbidities, unhealthy lifestyle, and immunological disturbances related to the psychopharmacological treatments (6, 7). Many individuals with mental disorders also have adverse socioeconomic conditions, which make it difficult to access appropriate physical healthcare (8). In particular, patients in closed psychiatric wards are likely to have an increased risk of contracting COVID-19 due to the overcrowded and closed nature of the environment (9, 10). In this regard, individuals with mental disorders have been considered one of the most vulnerable populations to COVID-19, and in urgent need of COVID-19 vaccination (11, 12). A longitudinal cohort study found that COVID-19 vaccination can significantly reduce COVID-19-related hospitalization and mortality rates in patients with schizophrenia to levels comparable to the general population (13).

Despite the urgent need for COVID-19 vaccination, individuals with mental disorders may be reluctant to receive the vaccine due to socioeconomic inequalities, including lower income and education levels, impaired function, and social isolation (14, 15). Psychological conditions may also significantly influence their perceptions about COVID-19 vaccination (16). However, there are limited studies on the willingness, hesitancy or reluctance of individuals with mental disorders to get vaccinated, and the extent of vaccine acceptance in this population is not well understood (17, 18). Since vaccine acceptance is a complex outcome behavior resulting from a decision-making process, it is necessary to comprehensively investigate the attitudes and behaviors of individuals with mental disorders toward COVID-19 vaccination. (19, 20).

In Korea, COVID-19 vaccination was initiated at the end of February 2021, with priority given to individuals with mental disorders (21). This study aimed to investigate COVID-19 vaccine acceptance and related factors in this population. We first examined attitudes toward vaccination and then used clustering analysis to identify patterns of vaccine acceptance. We also explored behavioral and psychological characteristics associated with vaccine acceptance. The results provided a detailed understanding of COVID-19 vaccine acceptance in individuals with mental disorders, including vaccine acceptance rates, vaccination behaviors, and related psychological factors.

## Materials and methods

### Participants

This study enrolled 663 individuals with mental disorders from two university hospitals (277 outpatients), two mental hospitals (206 outpatients), and two community mental health centers (180 individuals) in South Korea between August 2 and December 31, 2021. Participants were aged 19–70 years, presented to the psychiatric outpatient clinic or community mental health center, were able to provide informed consent and complete the questionnaire. The potential participants were selected using non-probability sampling. A psychiatrist, psychologist, or mental health social worker explained the study procedures to the participants and obtained written informed consent prior to the completion of self-rated questionnaires. In total, 572 participants were included in the analysis, after excluding 91 who did not complete the questionnaires or had missing demographic data. The study was approved by the Chonnam National University Hospital Institutional Review Board (CNUH-2021-297).

### Measures

The participants indicated their acceptance and hesitancy with regard to COVID-19 vaccination via seven items on a COVID-19 vaccination attitude questionnaire that we developed based on existing literature and our experience. The responses were rated using a 5-point Likert scale ranging from 1 (*Strongly disagree*) to 5 (*Strongly agree*; Table 1). The internal consistency of this questionnaire was acceptable (Cronbach's  $\alpha=0.75$ , when questions 1–3 were reverse-scored). The participants were also asked about their vaccination status for COVID-19 and influenza vaccines, and then only those who had already received the COVID-19 vaccine or were scheduled to receive it shortly, responded to six Yes or No questions regarding their reasons for receiving the vaccine. In addition, all participants were asked six Yes or No questions about trustworthy sources of information regarding COVID-19 vaccination.

Depression was measured using the Patient Health Questionnaire (PHQ)-9 (22). The PHQ-9 items were scored based on frequency using a 4-point Likert scale ranging from 0 (*not at all*) to 3 (*nearly every day*). A cutoff score of  $\geq 10$  indicates clinically relevant symptoms of depression. We used the Korean version of the PHQ-9, which is a reliable and valid tool for screening depressive symptoms in Korean

TABLE 1 COVID-19 vaccination attitude questionnaire.

| No | Item contents                                                                         |
|----|---------------------------------------------------------------------------------------|
| 1  | I am worried that the COVID-19 vaccination will cause side effects.                   |
| 2  | I am afraid of getting an injection.                                                  |
| 3  | I do not need COVID-19 vaccination.                                                   |
| 4  | I am willing to receive COVID-19 vaccination annually, if necessary.                  |
| 5  | I think that the benefit of COVID-19 vaccination outweighs the risks of side effects. |
| 6  | I am willing to recommend COVID-19 vaccination to individuals around me.              |
| 7  | I think COVID-19 vaccines effectively prevent COVID-19.                               |

All items on the questionnaires were rated using a 5-point Likert scale (1, strongly disagree; 2, disagree; 3, neutral; 4, agree; 5, strongly agree).

populations (23). In this study, the Cronbach's  $\alpha$  of the PHQ-9 was 0.91, indicating acceptable internal consistency.

Gratitude was assessed using the Gratitude Questionnaire (GQ)-6, which evaluates the experience and expression of gratitude in daily life (24). The GQ-6 items were rated on a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Higher scores indicate more grateful attitudes and more positive emotions. We used the Korean version of the GQ-6, which has demonstrated high reliability and validity (25). In this study, the Cronbach's  $\alpha$  of the GQ-6 was 0.87, indicating acceptable internal consistency.

Personality traits were assessed using the Big Five Inventory (BFI)-10, which is a short-form version of the BFI that measures five dimensions of personality, including extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience (26). The BFI-10 items were rated on a 5-point Likert scale ranging from 1 (*disagree strongly*) to 5 (*agree strongly*). The score for each personality dimension was calculated as the sum of the normal score question and reverse score question. We used the Korean version of the BFI-10, which has been validated with good reliability and validity (27).

## Statistical analysis

We performed cluster analysis on the responses to the seven questions comprising the COVID-19 vaccination attitude questionnaire, to identify a set of individuals with similar levels of vaccine acceptance. The 5-point Likert scale scores were treated as ordinal variables and subjected to hierarchical clustering using Ward's minimum variance method, which minimizes the total variance within each cluster. Gower's distance was used as a dissimilarity matrix, suitable for ordinal variables (28). Hierarchical clustering constructs a dendrogram of nested clusters by repeatedly merging or splitting clusters (29). We determined the optimal number of clusters using both the elbow and silhouette methods. The elbow method considers only intra-cluster distances, while the silhouette method uses a combination of inter- and intra-cluster distances, which may lead to different results (30). We visualized individual response patterns to determine properties of the clusters. This process was performed using the R packages 'cluster' and 'factoextra'. Then, we compared vaccination behaviors and psychological characteristics among clusters, using the Chi-squared test for categorical variables and Quade non-parametric covariance analysis for covariate-adjusted continuous variables (31). All statistical tests were two-tailed.  $p < 0.05$  was considered statistically significant. Statistical analyses were performed using R (version 4.0.3; R Foundation for Statistical Computing, Vienna, Austria) and SPSS software (version 27.0; IBM Corp, Armonk, NY, United States).

## Results

### Identification of clusters

The elbow and silhouette method suggested that two or three clusters would be optimal. Considering the dendrogram and heatmap, we decided to classify the study population into three clusters (Figure 1). In cluster 1 ( $n = 246$ , 43.0%), most respondents strongly agreed with the items related to a positive attitude toward

COVID-19 vaccination (questions 4–7) and strongly disagreed with question 3 (i.e., "I do not need the COVID-19 vaccination"). Approximately half of the respondents in cluster 1 strongly agreed or agreed that they were concerned about potential side effects of the COVID-19 vaccines in question 1. Similarly, in cluster 2 ( $n = 184$ , 32.2%), most participants agreed with questions 4–7 and disagreed or strongly disagreed with question 3. By contrast, in cluster 3 ( $n = 142$ , 24.8%), most participants were neutral toward, or disagreed or strongly disagreed, with questions 4–7, and many of them strongly agreed or agreed with question 3. In addition, > 60% of the respondents in cluster 3 expressed concerns about side effects in question 1. Based on these patterns of responses, clusters 1–3 were labeled 'totally accepting', 'somewhat accepting', and 'hesitant' groups, respectively.

### Demographic characteristics

The study participants had a mean age of  $36.6 \pm 12.0$  years, and 47% were males. The most common diagnosis was schizophrenia (58.0%), followed by depressive disorder (19.6%), bipolar disorder (11.5%), anxiety disorder (3.8%), and others (7.0%).

There were no significant differences in demographic characteristics among the three groups, except in age (Table 2). Participants in the 'totally accepting' group were significantly older than those in the 'somewhat accepting' and 'hesitant' groups ( $F = 12.52$ ,  $p < 0.001$ ). Therefore, we controlled for age as a covariate when comparing other continuous variables among the three groups.

### Vaccination behaviors

At the time of the survey, almost 50–60% of participants in the 'totally accepting' and 'somewhat accepting' groups had already received the COVID-19 vaccine (Table 3A). However, only 33% of participants in the 'hesitant' group had been vaccinated. The proportion of participants who regularly received the influenza vaccine was lower in the 'hesitant' group (< 20%) compared to the other two groups.

Among participants who had already received the COVID-19 vaccine or were scheduled to receive it soon, those in the 'totally accepting' and 'somewhat accepting' groups were more likely to state that prevention of infection and exemption from quarantine or other restrictions were the major reasons for receiving a COVID-19 vaccine compared to those in the 'hesitant' group (Table 3B). However, the proportion of those participants who had been vaccinated against their will was significantly higher in the 'hesitant' compared to 'totally accepting' group.

More than half of the participants in the 'totally accepting' and 'somewhat accepting' groups stated that they trusted the information related to COVID-19 vaccination presented on TV and radio news, as well as by medical professionals (Table 3C). However, in the 'hesitant' group, the proportion of participants who trusted these sources of information was significantly lower than in the other two groups. Additionally, individuals with mental disorders were less likely to trust information provided by online videos, social network services, and acquaintances, regardless of their vaccine acceptance status.

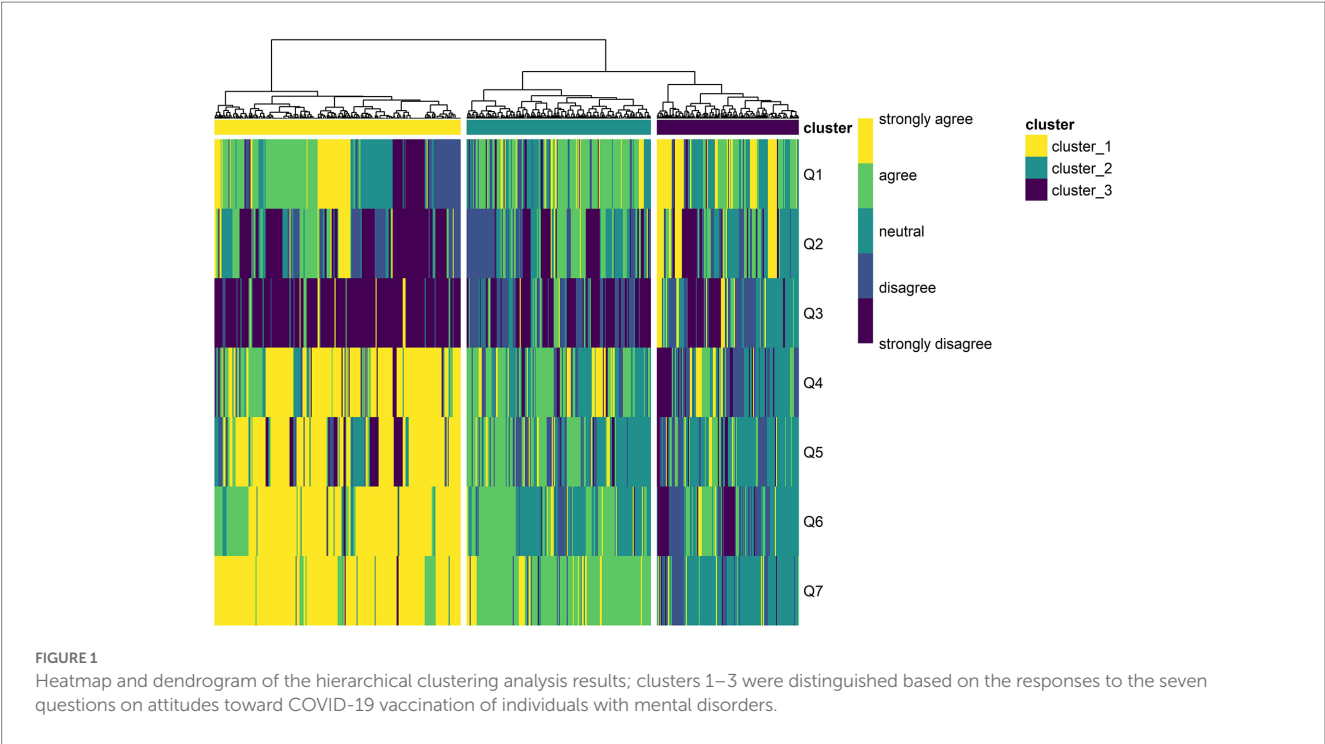


TABLE 2 Comparison of demographic characteristics among the three COVID-19 vaccine acceptance groups.

| Totally accepting                                                                        | Somewhat accepting                | Hesitant                         | Statistics <sup>a</sup>    |
|------------------------------------------------------------------------------------------|-----------------------------------|----------------------------------|----------------------------|
| Sex (male / female)                                                                      |                                   |                                  |                            |
| 114 / 132 (46.3 / 53.7)                                                                  | 91 / 93 (49.5 / 50.5)             | 64 / 78 (45.1 / 54.9)            | $\chi^2 = 0.70, p = 0.704$ |
| Age, years                                                                               |                                   |                                  |                            |
| 39.38 ± 12.30 (19–70)                                                                    | 34.47 ± 11.26 (19–69)             | 34.47 ± 11.26 (19–69)            | $F = 12.52, p < 0.001$     |
| Marital status (single / married)                                                        |                                   |                                  |                            |
| 186 / 57 (76.5 / 23.5)                                                                   | 132 / 50 (72.5 / 27.5)            | 109 / 33 (76.8 / 23.2)           | $\chi^2 = 1.12, p = 0.572$ |
| Education (≤ 12 / > 12 years)                                                            |                                   |                                  |                            |
| 95 / 150 (38.8 / 61.2)                                                                   | 78 / 105 (42.6 / 57.4)            | 58 / 84 (40.8 / 59.2)            | $\chi^2 = 0.65, p = 0.722$ |
| Occupation (employed / unemployed)                                                       |                                   |                                  |                            |
| 86 / 157 (35.4 / 64.6)                                                                   | 59 / 124 (32.2 / 67.8)            | 48 / 91 (34.5 / 65.5)            | $\chi^2 = 0.47, p = 0.790$ |
| Medical insurance (health insurance / Medicare)                                          |                                   |                                  |                            |
| 169 / 68 (71.3 / 28.7)                                                                   | 140 / 39 (78.2 / 21.8)            | 101 / 35 (74.3 / 25.7)           | $\chi^2 = 2.54, p = 0.280$ |
| Diagnosis (schizophrenia and bipolar disorder / depressive and anxiety disorder / other) |                                   |                                  |                            |
| 172 / 56 / 18 (69.9 / 22.8 / 7.3)                                                        | 130 / 42 / 12 (70.7 / 22.8 / 6.5) | 96 / 36 / 10 (67.6 / 25.4 / 7.0) | $\chi^2 = 0.51, p = 0.973$ |

Data are presented as number (%) or mean ± standard deviation (range). Some data were missing. <sup>a</sup>Chi-square test or ANOVA.

Psychological characteristics associated with COVID-19 vaccine acceptance

The total PHQ-9 score was not significantly different among the three groups ( $F = 2.80, p = 0.062$ ), but the proportion of participants who had clinically significant depression (i.e., PHQ-9 score  $\geq 10$ ) was significantly lower in the ‘totally accepting’ group (20.7%) compared to the ‘somewhat accepting’ (33.2%) and ‘hesitant’ (34.5%) groups ( $\chi^2 = 11.81, p = 0.003$ ; Table 4A).

The total GQ-6 score was significantly different among the three groups ( $F = 21.00, p < 0.001$ ; Table 4B). *Post hoc* tests showed that the ‘totally accepting’ group had a higher level of gratitude compared to the ‘somewhat accepting’ and ‘hesitant’ groups.

Regarding the BFI-10 scores, there were significant differences in agreeableness ( $F = 4.50, p = 0.011$ ) and neuroticism ( $F = 3.71, p = 0.025$ ) among the three groups (Table 4C). *Post hoc* tests showed that the level of agreeableness was higher in the ‘totally accepting’ than ‘hesitant’ group, and the level of neuroticism was higher in the ‘hesitant’ than ‘totally accepting’ and ‘somewhat accepting’ groups.



TABLE 3 Comparisons of vaccination behaviors among the three COVID-19 vaccine acceptance groups.

| Totally accepting                                                                              | Somewhat accepting                | Hesitant                          | Statistics <sup>a</sup>     |
|------------------------------------------------------------------------------------------------|-----------------------------------|-----------------------------------|-----------------------------|
| <b>A. Vaccination status</b>                                                                   |                                   |                                   |                             |
| COVID-19 vaccination (already vaccinated / soon to be vaccinated / not yet vaccinated)         |                                   |                                   |                             |
| 154 / 73 / 19 (62.6 / 29.7 / 7.7)                                                              | 90 / 61 / 33 (48.9 / 33.2 / 17.9) | 47 / 46 / 49 (33.1 / 32.4 / 34.5) | $\chi^2 = 52.65, p < 0.001$ |
| Influenza vaccination (vaccinated every year / vaccinated every few years / seldom vaccinated) |                                   |                                   |                             |
| 88 / 72 / 86 (35.8 / 29.3 / 35.0)                                                              | 48 / 62 / 74 (26.1 / 33.7 / 40.2) | 25 / 43 / 74 (17.6 / 30.3 / 52.1) | $\chi^2 = 18.17, p = 0.001$ |
| <b>B. Reasons for receiving COVID-19 vaccination (yes / no)<sup>b</sup></b>                    |                                   |                                   |                             |
| To prevent COVID-19 infection                                                                  |                                   |                                   |                             |
| 198 / 26 (88.4 / 11.6)                                                                         | 112 / 37 (75.2 / 24.8)            | 57 / 36 (61.3 / 38.7)             | $\chi^2 = 30.54, p < 0.001$ |
| To prevent people around me from getting infected                                              |                                   |                                   |                             |
| 148 / 76 (66.1 / 33.9)                                                                         | 91 / 58 (61.1 / 38.9)             | 44 / 49 (47.3 / 52.7)             | $\chi^2 = 9.71, p = 0.008$  |
| To avoid quarantine                                                                            |                                   |                                   |                             |
| 54 / 170 (24.1 / 75.9)                                                                         | 26 / 123 (17.4 / 82.6)            | 8 / 85 (8.6 / 91.4)               | $\chi^2 = 10.61, p = 0.005$ |
| To enjoy unrestricted activities of daily living                                               |                                   |                                   |                             |
| 116 / 108 (51.8 / 48.2)                                                                        | 72 / 76 (48.6 / 51.4)             | 35 / 58 (37.6 / 62.4)             | $\chi^2 = 5.32, p = 0.070$  |
| Recommended by those around me                                                                 |                                   |                                   |                             |
| 22 / 202 (9.8 / 90.2)                                                                          | 26 / 123 (17.4 / 82.6)            | 20 / 73 (21.5 / 78.5)             | $\chi^2 = 8.63, p = 0.013$  |
| Following those around me who got vaccinated                                                   |                                   |                                   |                             |
| 60 / 164 (26.8 / 73.2)                                                                         | 43 / 106 (28.9 / 71.1)            | 25 / 68 (26.9 / 73.1)             | $\chi^2 = 0.21, p = 0.899$  |
| <b>C. Trust in information sources regarding the COVID-19 vaccination (yes / no)</b>           |                                   |                                   |                             |
| Internet news                                                                                  |                                   |                                   |                             |
| 103 / 141 (42.2 / 57.8)                                                                        | 64 / 117 (35.4 / 64.6)            | 46 / 95 (32.6 / 67.4)             | $\chi^2 = 4.09, p = 0.130$  |
| Internet videos (e.g., YouTube)                                                                |                                   |                                   |                             |
| 43 / 201 (17.6 / 82.4)                                                                         | 26 / 155 (14.4 / 85.6)            | 20 / 121 (14.2 / 85.8)            | $\chi^2 = 1.17, p = 0.558$  |
| TV and radio news                                                                              |                                   |                                   |                             |
| 168 / 76 (68.9 / 31.1)                                                                         | 99 / 82 (54.7 / 45.3)             | 71 / 70 (50.4 / 49.6)             | $\chi^2 = 15.50, p < 0.001$ |
| Social network services                                                                        |                                   |                                   |                             |
| 24 / 220 (9.8 / 90.2)                                                                          | 22 / 159 (12.2 / 87.8)            | 8 / 133 (5.7 / 94.3)              | $\chi^2 = 3.90, p = 0.142$  |
| Acquaintances (family, friends, etc.)                                                          |                                   |                                   |                             |
| 74 / 170 (30.3 / 69.7)                                                                         | 52 / 129 (28.7 / 71.3)            | 46 / 95 (32.6 / 67.4)             | $\chi^2 = 0.57, p = 0.752$  |
| Medical professionals                                                                          |                                   |                                   |                             |
| 144 / 100 (59.0 / 41.0)                                                                        | 96 / 85 (53.0 / 47.0)             | 54 / 87 (38.3 / 61.7)             | $\chi^2 = 15.50, p < 0.001$ |

Data are presented as the number (%). Some data were missing.

<sup>a</sup>Chi-square test.

<sup>b</sup>Among those who had already received COVID-19 vaccination or were scheduled to be vaccinated soon.

## Discussion

Our clustering analysis showed that three-quarters of the participants (75.2%) accepted COVID-19 vaccination, and perceived it as efficacious and necessary. However, the remaining participants (24.8%) were reluctant to get vaccinated and were overly concerned about side effects. We also analyzed the demographic factors, motivations, trust in information sources, and psychological characteristics associated with vaccine acceptance.

## Hierarchical clustering for COVID-19 vaccine acceptance in individuals with mental disorders

This study aimed to identify COVID-19 vaccine acceptance in individuals with mental disorders by examining their concerns,

needs, and motivations for vaccination. Only a few studies have been conducted on COVID-19 vaccine acceptance in this population, and these studies have often relied on one or two simple questions about vaccination intent, such as “Do you intend to be vaccinated against COVID-19 in the future?” or “Will you accept vaccination against coronavirus, once it is offered to you?” (17, 18). However, vaccine decision-making is a complex process that involves an individual's values, background, and coping strategies (19, 20). Therefore, to gain a more comprehensive understanding of vaccine acceptance in individuals with mental disorders, we utilized a wider range of questions about COVID-19 vaccination and a clustering method instead of relying solely on simple questions and analyses based on fixed cut-off scores. Clustering is an exploratory analysis technique used to identify subgroups of individuals within a larger population who share similar characteristics (32). When validated tools to assess vaccination behaviors in a specific population are not available,

TABLE 4 Comparison of psychological characteristics among the three COVID-19 vaccine acceptance groups.

| Totally accepting                                     | Somewhat accepting     | Hesitant              | Statistics <sup>a</sup>     |
|-------------------------------------------------------|------------------------|-----------------------|-----------------------------|
| <b>A. Depression (Patient health questionnaire-9)</b> |                        |                       |                             |
| Total score                                           |                        |                       |                             |
| 6.02 ± 6.56                                           | 7.02 ± 6.45            | 7.42 ± 6.86           | $F = 2.80, p = 0.062$       |
| Score of <10 / ≥10                                    |                        |                       |                             |
| 195 / 51 (79.3 / 20.7)                                | 123 / 61 (66.8 / 33.2) | 93 / 49 (65.5 / 34.5) | $\chi^2 = 11.81, p = 0.003$ |
| <b>B. Gratitude (Gratitude questionnaire-6)</b>       |                        |                       |                             |
| 32.98 ± 7.54                                          | 29.30 ± 7.20           | 27.96 ± 7.96          | $F = 21.00, p < 0.001^b$    |
| <b>C. Personality traits (Big five inventory-10)</b>  |                        |                       |                             |
| Extraversion                                          |                        |                       |                             |
| 5.90 ± 1.70                                           | 5.89 ± 1.51            | 5.75 ± 1.53           | $F = 0.28, p = 0.753$       |
| Agreeableness                                         |                        |                       |                             |
| 7.13 ± 1.54                                           | 6.82 ± 1.27            | 6.62 ± 1.29           | $F = 4.50, p = 0.011^c$     |
| Conscientiousness                                     |                        |                       |                             |
| 6.50 ± 1.98                                           | 6.17 ± 1.54            | 6.13 ± 1.44           | $F = 0.74, p = 0.476$       |
| Neuroticism                                           |                        |                       |                             |
| 5.69 ± 1.98                                           | 5.81 ± 1.50            | 6.19 ± 1.64           | $F = 3.71, p = 0.025^d$     |
| Openness to experience                                |                        |                       |                             |
| 7.07 ± 1.86                                           | 6.85 ± 1.68            | 6.82 ± 1.76           | $F = 2.86, p = 0.058$       |

Data are presented as mean ± standard deviation or number (%).

<sup>a</sup>Quade's nonparametric ANCOVA (including age as a covariate) or chi-square test.

<sup>b</sup>Totally accepting > Somewhat accepting, Totally accepting > Hesitant.

<sup>c</sup>Totally accepting > Hesitant.

<sup>d</sup>Totally accepting < Hesitant, Somewhat accepting < Hesitant.

clustering analysis can be used for data-driven categorization of the population according to COVID-19 vaccine acceptance or hesitancy. A recent study based on cluster analysis found that patients with autoimmune and inflammatory diseases were characterized by three main patterns of beliefs and intentions related to COVID-19 vaccination (33).

In the present study, hierarchical clustering identified three main types of attitudes toward COVID-19 vaccination in individuals with mental disorders: 'totally accepting', 'somewhat accepting', and 'hesitant'. Most participants in the 'totally accepting' group strongly agreed that COVID-19 vaccines are efficacious and necessary, and expressed high willingness to be vaccinated. Additionally, many participants in the 'somewhat accepting' group were somewhat willing to be vaccinated, and agreed with the necessity of vaccination. However, a considerable proportion of participants in both the 'totally accepting' and 'somewhat accepting' groups expressed concerns about potential side effects. The 'totally accepting' and 'somewhat accepting' groups accounted for three-quarters of all participants (75.2%). This vaccine acceptance rate was lower than that reported in a Danish study of mental disorder patients (84.8%) (18), but was higher than that reported in a Chinese study (50.8%) (17). These discrepancies may be because of differences in the measure of vaccine acceptance, survey timing, and study populations. By contrast, most participants in the 'hesitant' group (24.8%) were neutral regarding the prospect of receiving the COVID-19 vaccine, or were reluctant to receive it, and were also highly concerned about side effects.

Altogether, our clustering analysis showed that vaccine acceptance was influenced by the perceived necessity of the vaccine and concerns

about potential side effects. We found that the majority of individuals with mental disorders in Korea were willing to receive the COVID-19 vaccines despite concerns about side effects. However, some individuals expressed doubts about the necessity and efficacy of the vaccines.

## Demographic characteristics associated with COVID-19 vaccine acceptance

Participants in the 'totally accepting' group were older than those in the 'somewhat accepting' and 'hesitant' groups. Our results are largely consistent with those of recent studies showing that older people were more willing to get vaccinated (34, 35). The higher vaccine acceptance among older patients may be due to their awareness of worse COVID-19 outcomes in the unvaccinated or higher prevalence of comorbid physical illness (36). In contrast, young people who are generally healthy and have been less affected by COVID-19 may be less inclined to receive the vaccines (37). On the other hand, we found no differences between the three groups in terms of sex, level of education, occupational status, and diagnosis. Recent studies of the general population have shown mixed results regarding the effects of these factors on vaccine acceptance. Some studies have shown that men and employed individuals are more likely to accept COVID-19 vaccines compared to women and unemployed individuals (38, 39), while others have reported the opposite (34, 40). A global survey reported that vaccine hesitancy was associated with a lower education level, while vaccine refusal was associated with a higher education level (14). The effects of mental disorder diagnosis

and severity on vaccination behaviors also remain unclear. Further investigation is needed to understand the differences in vaccine acceptance based on demographic and clinical characteristics.

## Vaccination behaviors associated with COVID-19 vaccine acceptance

Our 'hesitant' group had the lowest rate of past influenza vaccination as well as current COVID-19 vaccination, suggesting that existing perceptions and attitudes toward vaccination might play important roles in the decision to receive a COVID-19 vaccine. COVID-19 vaccine hesitancy in the general population has been associated with not obtaining an influenza vaccination (41, 42). A systematic review also pointed out concerns over safety, lack of trust, lack of need for vaccination, and cultural reasons as common causes of vaccine hesitancy for COVID-19 and influenza vaccines (43). We speculate that negative perceptions of vaccines may underlie the hesitation or reluctance to receive COVID-19 or influenza vaccines.

Among participants who were accepting of COVID-19 vaccination, prevention of COVID-19 infection and exemption from restrictions on daily life were important factors in the decision to be vaccinated. This shows that, in addition to the prevention of infections and reduction of mortality, the benefits of vaccination for daily life might be important in the decision to be vaccinated (44). In this regard, encouraging positive perceptions and attitudes toward COVID-19 vaccines in individuals with mental disorders may increase the likelihood of COVID-19 vaccination.

Participants who exhibited high vaccine acceptance considered traditional mass media and medical professionals as reliable information sources. However, participants who were hesitant to receive the COVID-19 vaccine had less trust in these information sources. A recent study from Singapore found that trust in formal rather than informal sources of information was associated with complete vaccination among middle-aged and older individuals (45). A Swiss study found that institutional trust plays a strong role in the decision to be vaccinated (46). It is not clear whether individuals with greater vaccine acceptance are more likely to trust formal sources of information or vice versa. Additionally, vaccine acceptance in individuals with mental disorders may be influenced by the types of sources they have access to (47). Those who had more access to formal information or less access to informal information may have been more willing to get vaccinated (48). Nevertheless, providing appropriate formal or informal information on COVID-19 vaccination to individuals with mental disorders is important to increase their vaccine acceptance (49, 50).

Overall, our findings suggest that public health strategies effectively communicating the necessity and benefits of COVID-19 vaccines to individuals with mental health problems are needed.

## Psychological characteristics associated with COVID-19 vaccine acceptance

Among participants who were totally accepting of COVID-19 vaccination, the proportion who had experienced clinically significant depression was significantly lower, compared to the other groups. Depressed individuals are likely to become ambivalent, have reduced

adaptive coping resources, and exhibit reluctance to take preventive actions against COVID-19 (51). Conversely, vaccination might reduce the perceived risk of COVID-19 and associated psychological distress (52). Given that individuals with mental disorders may be more vulnerable to experiencing COVID-19-related depression, anxiety, and stress, it is important to consider how these psychological conditions may impact their willingness to receive the COVID-19 vaccines (53–55).

Participants who were totally accepting of vaccination exhibited higher levels of gratitude. Gratitude is a general state of thankfulness and appreciation in response to the receipt of something that is valuable and meaningful to a given individual (56). Gratitude improves adaptive coping in the face of adversity (57). In particular, it was associated with better mental health during the COVID-19 pandemic, including less anxiety and depression, as well as a higher level of subjective well-being (58, 59). Although little is known regarding the effects of gratitude on vaccination behaviors during the pandemic, we assumed that grateful individuals with mental disorders might cope better with concerns about the new COVID-19 vaccines (60).

Participants who exhibited high vaccine acceptance had higher agreeableness and less neuroticism. Agreeableness refers to an individual's level of cooperativeness and compassion; individuals with a high level of agreeableness are more likely to be warm, caring, and supportive toward others (61). By contrast, individuals with a high level of neuroticism are characterized by anxiety, sadness, and emotional instability; individuals with a high level of neuroticism feel more depressed, impulsive, and insecure (62). Several studies conducted before and after the pandemic have shown that personality traits such as agreeableness, conscientiousness, and neuroticism may influence vaccine acceptance and hesitancy in the general population (63, 64).

Taken together, our findings suggest that the psychological state and traits of individuals with mental disorders may play an important role in the willingness to receive the COVID-19 vaccine.

## Limitations

This study had some methodological limitations. First, the present study included only community-dwelling patients, recruited through non-probability sampling, who may not be representative of the mental disorder population. Therefore, the results should be interpreted cautiously. Second, the study population was heterogeneous in terms of underlying psychotic and neurotic diseases. Although there was no association between the underlying diagnosis and vaccine acceptance, future studies are warranted to investigate vaccination behavior in the context of individual psychiatric disorders. Third, because the study population was grouped using a clustering method rather than based on cutoff scores or criteria, the clusters in the present study did not fully reflect the absolute level of vaccine acceptance. In addition, the study did not differentiate between vaccine hesitancy and vaccine refusal. Data-driven approaches allow classification of vaccine acceptance based on the study population and investigator judgment. Fourth, the associations between vaccine acceptance and behavioral and psychological characteristics do not indicate causation direction. Further studies are needed to examine causal relationships. Fifth, this study was conducted over several months during the COVID-19 vaccination program. Therefore, temporal changes in the vaccination rates and the phasic nature of the

program should be taken into consideration. Longitudinal studies are needed to understand the changes in attitudes and behavior toward COVID-19 vaccination before and after the vaccination program.

## Conclusion

In this study, we found that the majority of individuals with mental disorders were willing to receive the newly developed COVID-19 vaccines. However, some remained doubtful about the need for vaccination and were overly concerned about vaccine side effects. Perceptions of the efficacy and necessity of COVID-19 vaccines varied among this population. Additionally, the way individuals weighed the benefits and risks of vaccination may have influenced their acceptance or hesitancy toward receiving the COVID-19 vaccines. Depression, gratitude, and personality characteristics also play important roles in attitudes and decisions regarding COVID-19 vaccination in individuals with mental disorders. Effective communication of objective information about COVID-19 vaccination to this population is crucial to help them understand the importance of vaccination and alleviate their concerns about potential side effects. Public health strategies should consider the behavioral and psychological characteristics of this population to improve their adherence to vaccination and reduce vaccine hesitancy or refusal.

## 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 Chonnam National University Hospital Institutional

Review Board. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

S-WK and SR have contributed to the conception, design of the study, and drafted the manuscript. HK, H-RJ, HY, S-HK, T-SK, and SC conducted the data collection. S-WK, SR, and J-WK were involved in the analysis. J-YL, J-MK, S-IJ, and B-HY critically revised the draft. All authors contributed to the article and approved the submitted version.

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## Conflict of interest

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

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# Violence against healthcare workers in the middle of a global health crisis: what is it about policy and what to learn from international comparison?

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**Introduction:** Violence against healthcare workers is a global health problem threatening healthcare workforce retention and health system resilience in a fragile post-COVID 'normalisation' period. In this perspective article, we argue that violence against healthcare workers must be made a greater priority. Our novel contribution to the debate is a comparative health system and policy approach.

**Methods:** We have chosen a most different systems comparative approach concerning the epidemiological, political, and geographic contexts. Brazil (under the Bolsonaro government) and the United Kingdom (under the Johnson government) serve as examples of countries that were strongly hit by the pandemic in epidemiological terms while also displaying policy failures. New Zealand and Germany represent the opposite. A rapid assessment was undertaken based on secondary sources and country expertise.

**Results:** We found similar problems across countries. A global crisis makes healthcare workers vulnerable to violence. Furthermore, insufficient data and monitoring hamper effective prevention, and lack of attention may threaten women, the nursing profession, and migrant/minority groups the most. There were also relevant differences. No clear health system pattern can be identified. At the same time, professional associations and partly the media are strong policy actors against violence.

**Conclusion:** In all countries, much more involvement from political leadership is needed. In addition, attention to the political dimension and all forms of violence are essential.

## KEYWORDS

healthcare workforce, violence against healthcare workers, health policy, global health crisis, public health, COVID-19 pandemic, international comparison

## Introduction

Violence against healthcare workers (HCWs) is a persistent and pressing concern, and the COVID-19 pandemic has added new threats. Systematic data and monitoring are still lacking, yet international organisations and mounting individual cases call to action, highlighting sharp increases and qualitatively new dimensions of hate, harassment, and severe violent attacks against HCWs (1–4). An increase in violence amidst a major global health crisis is exceptionally problematic, considering the dire need for HCWs who are subjected to immense pressures and run high risks of illness (5, 6). These attacks threaten individual HCWs and may even result in traumatisation and temporary absence due to illness. They also create long-term risks for the healthcare workforce (HCWF) and strain recruitment and retention efforts. Since women account for about 75% of HCWs in most countries, the gender-based and sexual violence dimensions, as well as the threats to nurses, are evident (1, 3, 6).

Increased violence against the HCWs comes at a critical point in the global health crisis when countries worldwide struggle to meet population health demands due to severe HCWF shortages (7–10). Given the resolute nature of the concern, its impact on health and care systems, and its detrimental effect on HCWs and gender equality, it is time that violence against HCWs is given much greater priority as a policy problem.

## Bringing health systems, policy and politics into the debate: using a country comparison to identify gaps

This perspective article brings policy and politics into the debate on violence against HCWs. Available evidence shows that violence was heightened during the pandemic, even in countries with formal democratic institutions and upper-middle to high-resourced healthcare systems. This raises questions as to whether and how institutional/systemic, epidemiological, and pandemic policy conditions shape the debate on violence. Applying a comparative lens and exploring the problem within various countries may help identify policy gaps and develop new policy solutions.

We have chosen a most different systems comparative approach concerning the epidemiological, political, and geographic contexts. In our research design (Table 1), Brazil (under the Bolsonaro government) and the United Kingdom (under the Johnson government) serve as examples of countries that were strongly hit by the pandemic in epidemiological terms while also displaying policy failures attributed to populist right-wing governments (12, 13). New Zealand and Germany represent the opposite. They serve as representatives of countries that managed the pandemic comparatively well under more moderate and balanced political constellations (14, 15). We refer to the period of the COVID-19 pandemic from its onset in 2020 until the end of 2022.

We rapidly assessed available data, policy responses and actors, and material on the discourse surrounding violence and actions taken against it in the four selected countries. A topic guide served as a framework for the comparative assessment, drawing on country expertise and secondary sources (media reports, documents, public data, and surveys).

## Making policy gaps visible

Our comparative assessment (Table 2) highlights two significant elements: the global dimension of violence against HCWs, and specific policy gaps that may hamper action taken to prevent violence. The results concerning the global dimension broadly reveal similar challenges in a country sample characterised by institutional and epidemiological differences in higher-middle and high-income countries (Table 1). This is an important finding because it suggests that violence occurs no matter how rich, developed or epidemiologically advanced a country may be. Therefore, increased funding and staffing are essential but insufficient to resolve the problem without additional measures. At the same time, we found some important differences related to policy and actors. Against this backdrop, a better understanding of policy gaps may pave the way for new opportunities for action both globally and in the national context.

## The lack of data and monitoring hampers policy solutions

Available data is scattered, and access is generally limited in all countries. Evidence is mainly based on either criminal (police) statistics or surveys, both of which are limited in their ability to tell a holistic story. While pre-COVID survey data exists in New Zealand and the UK, suggesting that violence was a relevant health system problem before the pandemic, a lack of systematic data and monitoring systems makes it difficult to explore to what extent and why violence actually increased during the pandemic. Insufficient empirical evidence hampers a critical debate and the development of effective policy solutions and also opens the door for various forms of interest-driven politics.

## Policy and actors: more involvement from political leadership is needed

Strong political leadership and effective policies play a critical role in aiding HCWs. Unfortunately, political leadership in the examined countries has remained sparse; however, health professional associations (doctors, nurses, and paramedics) have proven to be important and valuable supporters. The nurses' associations appear to play the biggest supportive role in Brazil, while doctors' associations take the lead in Germany. The associations in New Zealand and the UK also matter, including hospital organisations and paramedics associations.

The policy initiatives among the cases reflect country-specific governance arrangements, particularly centralised vs. decentralised governance structures. The most centralised efforts can be seen in the UK, where the NHS is working to improve data collection and analysis across NHS trusts, propelled by the #WorkWithoutFear campaign. The associations and some regional (Länder) governments called for a centralised register system to monitor attacks in Germany. In addition, legal action was taken to improve policy statistics; here, we can observe more decisive action taken on the organisational and operational levels of governance (e.g., increasing security services and technical support). The other two countries showed limited initiative. Overall, sensitivity to the problem seems to be increasing, yet change is incremental, action is limited to piecemeal work, and actor collaboration is poorly



TABLE 1 Mapping the country sample: health system, workforce, and COVID-19 pandemic characteristics.

| Item                                                                     | Brazil                                                                                                   | Germany                                                                                                                                               | New Zealand                                                                                                               | United Kingdom                                                                                                                                                                  |
|--------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Country profile                                                          |                                                                                                          |                                                                                                                                                       |                                                                                                                           |                                                                                                                                                                                 |
| Government/Leader                                                        | Jair Bolsonaro as President in a conservative extreme right-wing coalition, until December 2022.         | Angela Merkel, coalition government led by Conservatives until October 2021; since then, Olaf Scholz, coalition of social democrats/ Green/ liberals. | Jacinda Ardern, Labour party-led coalition until October 2020, then single party majority.                                | Boris Johnson, Prime Minister for the conservative party until September 2022, prominent figure in the populist Brexit campaign/ anti-European Union (EU) membership referendum |
| Funding                                                                  | Mainly by national taxes supplanted by some private insurance.                                           | Mainly employer-employee contributions supplemented by little taxation and private contributions.                                                     | Mainly taxation supplemented by 14% out-of-pocket and 5% private insurance.                                               | General taxation supplemented by National Insurance contributions (NICs).                                                                                                       |
| Provision                                                                | Universal Health System (SUS), public, free and universal service provision, underfunded.                | Social health insurance (SHI) system; well-resourced hospital and primary care sectors.                                                               | Hospitals publicly owned, primary care predominantly private, small business, 2010–18 decade of significant underfunding. | NHS system, massively underfunded.                                                                                                                                              |
| Total health expenditure % GDP*                                          | 9.6                                                                                                      | 12.8                                                                                                                                                  | 9.7                                                                                                                       | 11.9                                                                                                                                                                            |
| HCWF density* practising per 1,000                                       |                                                                                                          |                                                                                                                                                       |                                                                                                                           |                                                                                                                                                                                 |
| • Physicians                                                             | 2.15                                                                                                     | 4.53                                                                                                                                                  | 3.53                                                                                                                      | 3.18                                                                                                                                                                            |
| • Nurses                                                                 | 1.55 (10.1)*                                                                                             | 12.06                                                                                                                                                 | 10.91                                                                                                                     | 8.68                                                                                                                                                                            |
| • Care personnel                                                         | n.a.                                                                                                     | 7.57                                                                                                                                                  | n.a.                                                                                                                      | 18.47                                                                                                                                                                           |
| COVID-19 epidemiology, cumulative deaths per million until February 2023 | 3,240.05                                                                                                 | 1,997.44                                                                                                                                              | 482.52                                                                                                                    | 3,212.72                                                                                                                                                                        |
| COVID-19 policy                                                          | Decentralised with denialism at the federal level; policies implemented locally by governors and majors. | Decentralised and multi-stakeholder based, with some centralised action.                                                                              | Strongly centralised.                                                                                                     | Strongly decentralised and multi-stakeholder based; limited political attention at the federal level, particularly during the first wave.                                       |
|                                                                          | Moderate lockdown/ local decisions.                                                                      | Moderate to strong lockdown and social distancing policies; public funding to mitigate social effects.                                                | Strong lockdowns nationally in 2020 and regionally in 2021.                                                               | Moderate to strong lockdown and social distancing policies; public funding to mitigate social effects.                                                                          |
|                                                                          | Lack of funding; vaccines applied only after pressure over the President.                                | Vaccines available and easy accessible.                                                                                                               | Successful vaccination policy, except for inequitable rollout of vaccines.                                                | Vaccines available and easy accessible.                                                                                                                                         |

Authors' own table. \*OECD (11), data refer to 2021 or the latest available year.

\*Methodological differences concerning nurses; Brazilian government data are much higher than OECD (11) data.

developed (reflecting professional silos). Much more involvement from political leadership is necessary to set the agenda throughout government and society, thereby increasing the likelihood of action and, hopefully, changing the status quo on violence against the HCW.

## Substance: gender-blind and insufficient attention to the political dimension

If violence is addressed, this mainly relates to doctors and nurses as the most significant groups, with some country-specific variation.

However, health workforce policy primarily focuses on health labour markets and system needs rather than on HCWs as human beings with specific conditions and needs related to age, sex, gender, ethnicity/race, and other social positions. Ignoring the human behind every HCW seriously obstructs the opportunity to protect HCWs better and improve prevention. This creates additional policy gaps exacerbating existing social inequalities in the HCWF, especially in professional groups with more women and migrant HCWs.

The connection to the COVID-19 pandemic was substantial, especially in Germany and Brazil, where increased violence against HCWs was most prominent. New Zealand and especially the

TABLE 2 Comparative analysis of violence against healthcare workers, policy and actors.

| Item                                             | Cross-country comparative results                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data availability                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Accessible data                                  | <ul style="list-style-type: none"> <li>Generally limited data with only occasional studies and small surveys. The exception is the UK, where NHS staff surveys have been regularly conducted.</li> </ul>                                                                                                                                                                                                                                                                                                                                             |
| Monitoring availability for the COVID-19 period  | <ul style="list-style-type: none"> <li>There are no monitoring policies in place, and the evidence for trends during COVID-19 is poor. Nurses' unions in New Zealand doubt the accuracy of official data. Germany has had police statistics available since 2022.</li> </ul>                                                                                                                                                                                                                                                                         |
| Policy and actors                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Public debate and media                          | <ul style="list-style-type: none"> <li>President Bolsonaro supported attacks against HCWs during the pandemic in Brazil, while the media supported the HCWs. In the other countries, national and media support was geared toward the HCWs. In Germany, this support climaxed around the New Year's Eve attacks on HCW, while New Zealand and the UK showed little increase in media attention during the pandemic.</li> </ul>                                                                                                                       |
| Political radar                                  | <ul style="list-style-type: none"> <li>Political action can be found in the UK with the 2021 National Violence Prevention and Reduction Standard and the Spring 2022 campaign #WorkWithoutFear. In Germany, medical associations and the Länder have released some statements, and a centralised register system to monitor attacks was called for. In Brazil, unions and associations have called to action without government attention; in New Zealand, nurses have released statements.</li> </ul>                                               |
| Health policy, action and future plans           | <ul style="list-style-type: none"> <li>NHS England is working to establish a coherent approach for collecting data, with an aim to ensure alignment with the NHS Violence Prevention and Reduction Standard. In Germany, the policy is decentralised, and responsibility shifted to the organisational level; several hospitals and ambulances have increased security and support, and some pilot projects have been discussed. In New Zealand, responses are generally weak and decentralised, and nothing was on the agenda in Brazil.</li> </ul> |
| Legal action                                     | <ul style="list-style-type: none"> <li>No specific action during COVID-19 for most countries aside from Germany, where attacks against HCWs have been registered separately in police statistics.</li> </ul>                                                                                                                                                                                                                                                                                                                                         |
| Professional associations                        | <ul style="list-style-type: none"> <li>Professional associations are key actors in all countries, yet the relative contribution of doctors and nurses varies. During the pandemic, nurses seemed to be the strongest actors in Brazil and doctors in Germany, with New Zealand and the UK, taking a middle position. Paramedics also play a role.</li> </ul>                                                                                                                                                                                         |
| Key actors engaged in the debate                 | <ul style="list-style-type: none"> <li>The media and professional (nursing and/or medical) associations are the strongest actors in all countries. Paramedics, hospital organisations, and some institutional and government actors (Ministers of Health, Presidents/Chancellors) also play a role (centralised/NHS or decentralised/local).</li> </ul>                                                                                                                                                                                              |
| The substance of the debate and action           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| What groups of HCWs are addressed?               | <ul style="list-style-type: none"> <li>There is a focus on doctors, nurses, and paramedics, with some variation between countries; less attention to other groups. Germany reflects the professional hierarchy of medicine most strongly, while the NHS systems seem to be more inclusive, and Brazil prioritises nurses/carers.</li> </ul>                                                                                                                                                                                                          |
| Is gender-based and sexual violence addressed?   | <ul style="list-style-type: none"> <li>Usually not explicitly addressed; not systematically connected to an emergent sexual violence and harassment (#Metoo) debate in healthcare. Some signs of improved attention in Germany.</li> </ul>                                                                                                                                                                                                                                                                                                           |
| Is racialised violence addressed?                | <ul style="list-style-type: none"> <li>Usually not explicitly addressed, except in the UK, occasionally (mis)used by populist politics as a racialised anti-migration discourse in relation to the offenders, as observed in Germany.</li> </ul>                                                                                                                                                                                                                                                                                                     |
| Is the violence discourse connected to COVID-19? | <ul style="list-style-type: none"> <li>Some connection in Germany and Brazil. Usually, no explicit connection in the UK and New Zealand, as violence was an issue pre-COVID, e.g., due to long waiting hours and underfunding. Some controversial evidence.</li> </ul>                                                                                                                                                                                                                                                                               |
| Is the political dimension addressed?            | <ul style="list-style-type: none"> <li>In Brazil, some connection to the populist radical right Bolsonaro government. In New Zealand and the UK, no explicit connections to the government but understaffing and underfunding have been major problems pre-COVID for years. In Germany, some connection to populist radical right movements surrounding anti-vaxxers and anti-abortion, and some connection to HCW shortages.</li> </ul>                                                                                                             |

Authors' own table, based on country case studies (Supplementary Tables S1–S4).

United Kingdom have faced the challenge of violence well before the pandemic; however, only the latter country has developed the beginnings of a strategy to combat it. We generally observed an overall

lack of attention to the political dimension of violence against HCWs. However, there were also some examples of explicit connections to the populist radical right movement in Brazil.

## Conclusion

Violence against HCWs is and will remain a problem long after the pandemic subsides. If political action is not taken, HCWs will have an additional reason to leave their profession and workplace, and potential candidates will be made to consider the increasing risks of HCWs and pursue a different line of work. In a time when countries across the globe are struggling with HCW retention and recruitment protecting the health and care workforce is essential. Getting support and protection right enhances the retention of the existing workforce and will attract new generations of HCWs. Improved working conditions, mental health, and physical safety of HCWs are an obligation not only of organisations and employers but also of governments and policymakers. This will require governments to prioritise developing feasible and effective policy responses that tackle the many individual risk factors the HCWs face on a daily basis, as well as the health workforce and system-related risks.

## Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding author.

## Author contributions

EK and MF had the idea, developed the framework, supervised the analysis, and prepared a draft. EK, MF, GL, TT, and AD-J collected the country cases, contributed to the analysis, commented on the

draft, and have read and approved the final version. 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/fpubh.2023.1182328/full#supplementary-material>

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# Bridging science and spirituality: the intersection of religion and public health in the COVID-19 pandemic

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**Background:** The COVID-19 pandemic has had global impacts on social interactions and religious activities, leading to a complex relationship between religion and public health policies. This article reviews impact of the COVID-19 pandemic on religious activities and beliefs in relation to the spread of the virus, as well as the potential of religious leaders and faith communities in mitigating the impact of the pandemic through public health measures and community engagement.

**Methods:** A literature review was conducted using PubMed and Google Scholar, with search terms including “religion,” “COVID-19,” “pandemic,” “coronavirus,” and “spirituality.” We included English articles published between January 2020 and September 2022, focusing on intersection of religion and COVID-19.

**Results:** We identified two main themes emerging, with the selected 32 studies divided in 15 studies focused on the relationship between religious practices, beliefs, and the spread of COVID-19, while 17 studies explored the role of religious leaders and faith communities in coping with and mitigating the impact of COVID-19. Religious activities were found to correlate with virus spread, particularly in early days of the pandemic. The relationship between religiosity and adherence to government guidelines was mixed, with some studies suggesting increased religiosity contributed to misconceptions about the virus and resistance to restrictions. Religious beliefs were also associated with vaccine hesitancy, particularly conservative religious beliefs. On the other hand, religious leaders and communities played a crucial role in adapting to COVID-19 measures, maintaining a sense of belonging, fostering emotional resilience, and upholding compliance with public health measures. The importance of collaboration between religious leaders, institutions, and public health officials in addressing the pandemic was emphasized.

**Conclusions:** This review highlights the essential role of religious leaders, faith-based organizations, and faith communities in promoting education, preparedness, and response efforts during the COVID-19 pandemic. Engaging with religious leaders and communities can improve pandemic control and prevention efforts. Collaboration between religious leaders, governments, and

healthcare professionals is necessary to combat vaccine hesitancy and ensure successful COVID-19 vaccination campaigns. The insights from this review can guide future research, policy development, and public health interventions to minimize the impact of the pandemic and improve outcomes for individuals and communities affected.

#### KEYWORDS

COVID-19, religion, spirituality, public health, pandemic, misinformation, vaccine hesitancy and refusal, conspiracy

## 1. Introduction

The COVID-19 pandemic has impacted nearly every aspect of our lives, its implications even reaching our religious activities, which remains an important topic of debate and ongoing research ranging from social distancing at religion functions to vaccination acceptance among congregations. A significant toll has been taken on traditional human connections such as these, and this has forced all stakeholders to adopt innovative approaches to address religious gatherings' emergent issues. Whether holding virtual meetings or deploying contact tracing apps, individuals and organizations alike have adopted creative ways to continue communing with one another while trying to keep the risk of transmission low. Historically, religion has served a crucial role in shaping public health outcomes during times of crisis—consider the Ebola epidemic, pandemic influenza, and ongoing worldwide health concerns such as HIV/AIDS (1). Indeed, religion's influence has appeared before us in beneficial, and at times, detrimental ways during these emergencies (1, 2). Positive and negative impacts have stemmed from religious gatherings and rituals due to the extent which religious leaders have adhered to established guidelines. In the case of COVID-19, while some religious groups have been praised for their adherence to public health precautions, others have received criticism for disregarding limitations and thus contributing to the virus's spread. This latest pandemic highlighted the role of religious institutions and practices in either curbing or accelerating viral spread, as well as their contribution to public health efforts to control previous pandemics, such as the Spanish flu and H1N1.

The COVID-19 pandemic led to changes in religious practices and rituals, with some communities resisting or outright defying restrictions suggested by their national or local governments or scientific communities. In turn, this had the negative effect of contributing to viral spread. Unfortunately, these negative cases pitted religion against evidence-based science, with the former seeing its adherents clinging to their religious faith for protection instead of listening to scientific advice (1). Meanwhile, in the positive sense, other religious communities successfully followed both religious guidance and scientific recommendations to reduce the risk of viral spread.

To better understand the interplay of religion and public health amid the COVID-19 pandemic, several global studies have explored the ways religion has influenced individuals and communities during this crisis. One study revealed how the pandemic forced religious leaders to redesign mosque worship and how Muslims

adapted their practices (3). Another study in Israel revealed how ultra-Orthodox Jewish communities experienced a significantly higher rate of COVID-19 infections due to factors such as overcrowding, distrust of state authorities, and resistance to social-distancing orders. The rapid spread of the virus in such religious communities increased tensions and raised questions about the balance between religious practice and public health (4).

Studies from global regions as diverse as Ghana, Poland, and Malaysia have explored the impact of COVID-19 on religious communities, psychospiritual gatherings, and other religious practices; as well as the role of religious expression in coping with pandemic-derived stress. In Ghana, Osei-Tutu et al. (5) explored religious leaders' views on the impact of COVID-19 as it related to restrictions placed on their congregants' wellbeing. The study found that people suffered a plethora of psychospiritual effects due to the pandemic, such as a decline in spiritual life, a sense of loss of fellowship and community, financial difficulties, anxiety over childcare, and fear of infection (5). Osei-Tutu's study revealed how religious leaders positively intervened by delivering sermons on hope, faith, and repentance, with some going so far as to sensitize their membership to topics such as health hygiene and COVID-19-related stigma. In Poland, Sulkowski et al. (6) investigated the impact of the pandemic on that country's religious life, finding that some churches either limited or entirely suspended their traditional community-based religious life in light of the pandemic, seeking to reduce risk of viral spread while maintaining contact with and among believers via modern technology (6). A Malaysian study by Ting et al. (7) investigated several pandemic-related variables, such as illness perception, stress levels, and religious expressions of major religious groups (7). Ting et al. (7) study notably reported that religious expression carried a negative relationship with stress levels, highlighting the importance of religion's role in shaping responses to public-health emergencies, particularly in communities where religion serve a significant role in people's lives. Taken together, these studies confirm the important, even primary role religion can play in shaping responses to public health emergencies (5–7).

Researchers from other countries such as Colombia, South Africa, and the United States, have examined the roles of hope, religious coping, and community organizations in promoting wellbeing during the COVID-19 pandemic. Counted et al. (8) examined these roles and their wellbeing effects in Colombia and South Africa, revealing that hope was positively associated with wellbeing and that the relationship between hope and wellbeing was itself moderated by religious coping. When hope was low, the



researchers found, wellbeing trended higher when positive religious coping was high and negative religious coping was low (8). This study highlights the importance of considering the role of religious leaders and their support in addressing the psychospiritual impacts of the pandemic, particularly in communities where religion plays a significant role in people's lives, as other studies have concluded. In the United States, Weinberger-Litman's (9) study examined anxiety and distress among members of the first community in the USA to be quarantined due to the COVID-19 pandemic, a community of Orthodox Jews (9). The study found that community organizations were trusted more than any other source of COVID-19-related information and played a vital role in promoting the wellbeing of their constituents by organizing support mechanisms such as the provision of tangible needs, social support, virtual religious services, and dissemination of virus-related health information. In their conclusions, these studies supported the findings of the mentioned prior ones (8, 9).

Similar studies conducted in Portugal, Bosnia and Herzegovina, and New Zealand have explored the roles of spiritual-religious coping, religious freedom restrictions, and worship adaptations during the COVID-19 pandemic (10–12). Prazeres et al. (11) examined the impact of spiritual-religious coping on fear and anxiety related to COVID-19 in Portugal's healthcare workers, finding that religiosity was not a significant factor in reducing coronavirus-related anxiety, and that higher levels of hope and optimism along the spirituality scale were associated with less anxiety (11). Begović (10) found that religious communities in Bosnia and Herzegovina displayed varying responses to pandemic restrictions on religious freedom imposed by state regulations (10). Here, some communities willingly agreed to the restrictions placed on their religious guidelines and practices, while others struggled to agree. Despite their differences, the researcher found, all communities were able to find support in their religious laws and theological views, which emphasized the value of human life and the importance of caring for their community's wellbeing (10). In New Zealand, Oxholm (12) reported that the COVID-19 pandemic caused religious communities to review their worship practices and prioritize community welfare and pastoral care for the elderly and vulnerable (12). To that end, congregations shifted to virtual worship. In this case, the challenges of mitigating transmission risk, social distancing, and providing welfare overlapped (12).

COVID-19 indeed caused significant global upheaval, leading to quarantines and a rising death toll. With healthcare professionals plying science to control the virus, religious organizations and psychospiritual groups provided solace while, with a few exceptions, also contributing to the recommended protective measures, such as social distancing and the cancellation or conversion of large gatherings in some faiths (13). The exceptions included the Islamic State, which regarded the pandemic as divine retribution; and Feng shui practitioners, who attributed it to an imbalance of elements in the Year of the Rat (14). It remains notable that major religious gatherings were identified as significant clusters of viral spread in Singapore, Malaysia, and South Korea (14).

For complying religious groups, the pandemic prompted a transition from in-person religious communities to virtual congregations, challenging conventional notions of belonging and participation (15). This transformation required embracing digital

platforms for live-streaming of services, Zoom baptisms, and Skype confessions, etc. (15, 16) while less-compliant religious groups resisted change. Additionally, religious leaders here offered explanations and comfort to their congregations during uncertain times, highlighting the resurgence of religion and spirituality in the face of a global crisis (14).

A survey study by Seryczynska et al. (17) explored the role of religious capital in coping during the COVID-19 pandemic in four European countries: Spain, Italy, Poland, and Finland. Their results revealed that religious capital indeed can impact individuals' coping strategies, but its dynamics, the ways it does so, are complex (17). This survey's results provide a better understanding of the role of religious capital in helping people cope with harsh circumstances.

While the scientific community has largely come together in controlling the spread of the coronavirus, primarily through advising mask wearing, social distancing, and developing vaccines, its pandemic-curtailling efforts have been hampered by various factors, oftentimes religious gatherings. Such gatherings provide an essential role in society, but governments, the scientific community, and healthcare entities worldwide have experienced pushback from certain religious entities regarding their advised pandemic-response measures.

The present paper reviews the impact of the COVID-19 pandemic on lives around the world, including the responses by the respective public health authorities, the associated factors that dictated the outcome of those responses, and the implications of the intertwined nature of religion, public-health policy, and social responsibility. The researchers subsequently investigate two main intersections where religion met public health during the COVID-19 pandemic: first, the connections between religious practices, beliefs, and the spread of the virus, including both the positive and negative consequences of religious activities; and second, the role of religious leaders and faith communities in coping with and mitigating the impact of COVID-19. In doing so, we hope to offer a unique multidisciplinary perspective on the complex interplay between religious practices and public-health outcomes, emphasizing the importance of taking a balanced, holistic approach to mitigating—or preventing—public health crises. By synthesizing this intersectional area's existing research, we can not only contribute to the related literature by providing a better understanding of the intersection of religion and public health crises, but also identify any potential gaps warranting future research.

## 2. Method

We conducted a structured and systematic literature search on PubMed and Google Scholar using keywords such as “religion,” “COVID-19,” “pandemic,” “coronavirus,” and “spirituality” to study the intersection of religion and the COVID-19 pandemic. Our search was conducted from January 2020 to March 2023. We included peer-reviewed articles, published in English language, primarily observational studies, cross-sectional studies, surveys, and systematic reviews. We excluded case reports, case series, non-English papers, papers not directly related to the topic, papers with data that was difficult to extract, and unpublished papers.

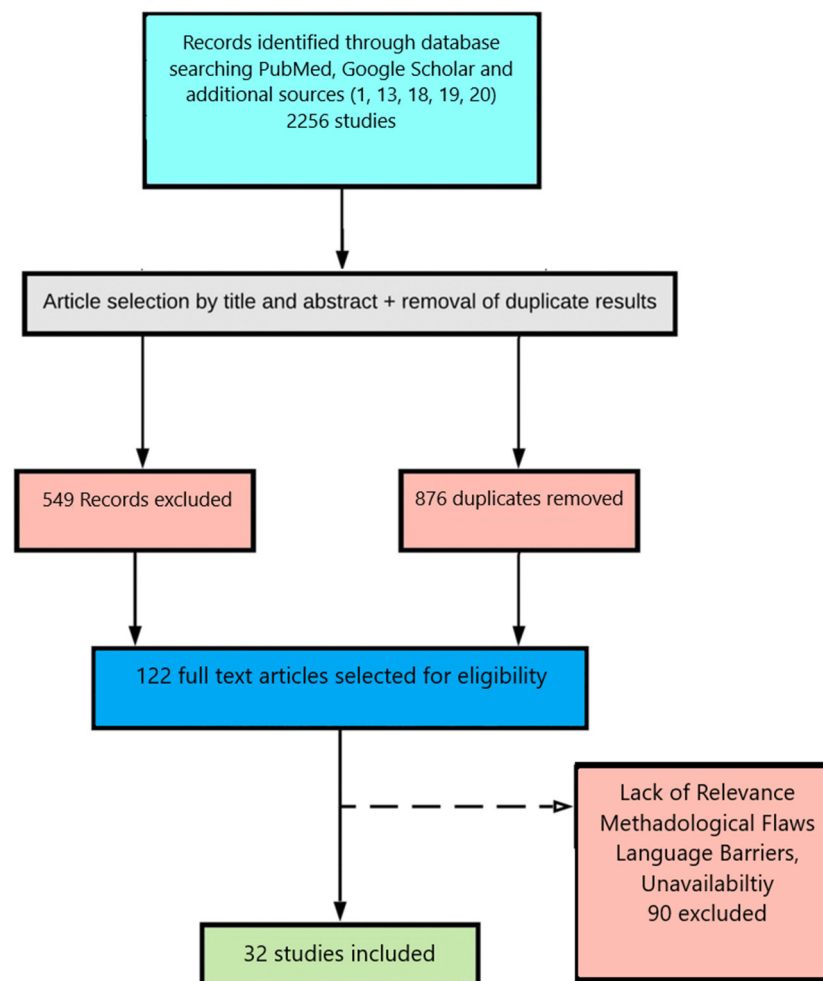


FIGURE 1  
Search strategy.

The articles must focus on one or both of the following aims: investigating connections between religious practices, beliefs, and the spread of the COVID-19 virus, including both the positive and negative consequences of religious activities; and exploring the role of religious leaders and faith communities in coping with and mitigating the impact of the COVID-19 pandemic.

Initially, we identified 2,256 papers through our search strategy, which we then narrowed down to 876 by removing duplicates. After screening the titles of these papers, we included 327 citations for abstract screening. During abstract screening, we excluded 549 citations based on our inclusion criteria, which focused on studies that provided insights into the role of religion and religious activities in the context of the COVID-19 pandemic. The remaining 122 papers were reviewed for eligibility by SA and LJ, and any disagreements were mediated by a third reviewer (SA). Additionally, we employed a snowballing technique whereby we identified and selected review articles on our topic of interest (1, 13, 18–20), and then used their reference lists to further identify relevant studies. This approach helped us to expand our search results and ensure that we did not miss any important studies that were relevant to our topic. We have included a study selection

flow diagram (Figure 1) to illustrate the process of identifying, screening, and selecting articles for our review. This diagram provides a transparent representation of our literature search and selection process.

## 3. Results

### 3.1. Description of studies included

32 full-text articles were identified that met our inclusion criteria for this literature review. We categorized these articles into two tables based on their focus: Table 1, which captures studies investigating the relationship between religious practices, beliefs, and the spread of COVID-19, and Table 2, which explores the role of religious leaders and faith communities in coping with and mitigating the impact of the pandemic. We acknowledge that the studies included in our review come from various research designs, and our aim was to provide a comprehensive overview of the existing literature on the topic rather than a strict synthesis of the findings.



TABLE 1 Studies focusing on the role of religious practices and beliefs in the spread of COVID-19.

| Study | Author(s)/Source             | Religion                                        | Year | Objectives, observations, study highlights, and key findings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------|------------------------------|-------------------------------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.    | Quadri and Padala (21)       | Hinduism                                        | 2021 | <ul style="list-style-type: none"> <li>The study focuses on individuals practicing Hinduism and their deeply rooted historical traditions, including pilgrimages and religious gatherings.</li> <li>Study's focus is on the significance of <i>Kumbh Mela</i>, a Hindu religious festival that takes place in India, and its religio-socio-cultural aspects in the context of COVID-19 and its impact.</li> <li>The study outlines the various ceremonies performed by the devotees during the <i>Kumbh Mela</i>, and the potential of these ceremonies to contribute to the COVID-19 outbreak in India.</li> <li>Authors proposed several strategic interventions that can be followed by religious leaders, government officials, elected leaders and to avert the <i>Kumbh Mela</i> from contributing to a public health emergency. these steps include - <ul style="list-style-type: none"> <li>Restricting the number of participants and preventing the sick and the vulnerable elderly from participating.</li> <li>Registering participants and using technology (Drones, GPS tracking etc.) to monitor and trace devotees.</li> <li>Spreading information about COVID-19 by working together with religious leaders to promote COVID-19 guidelines (mask wearing, hand sanitization, etc.).</li> <li>Providing alternative pilgrimage sites.</li> <li>Develop a comprehensive response strategy.</li> <li>Improving healthcare infrastructure and expanding quarantine facilities.</li> </ul> </li> </ul> |
| 2.    | Quadri (22)                  | Islam, Christianity, Judaism, Sikhism, Hinduism | 2020 | <ul style="list-style-type: none"> <li>The study examines the implications of religious gatherings during the pandemic.</li> <li>Authors present various examples from different religions and countries, illustrating how religious congregations contributed to the spread of COVID-19 and how suspending these gatherings led to a slower spread of the virus.</li> <li>The study highlights how countries that suspended religious gatherings early had lower incidences of COVID-19 infections.</li> <li>The study highlights the importance of collaboration between clergy and government in suspending religious gatherings and creating contingency plans for infectious epidemics.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 3.    | Al-Rousan and Al-Najjar (23) | Islam (Shi'ite sect) and Judaism                | 2020 | <ul style="list-style-type: none"> <li>The study examines various Islamic sects, focusing on their traditional pilgrimages and religious gatherings during the COVID-19 pandemic.</li> <li>Authors utilized hierarchical clustering principles to trace COVID-19 infections in the Middle East and link the spread of COVID-19 to human mobility for religious reasons (visiting holy places, pilgrimage etc.).</li> <li>Key findings: Jewish pilgrims may have spread COVID-19 to Israel via religious rituals as well.</li> <li>Human mobility, tourism, and visiting religious sites are the main causes of COVID-19 spread in various countries.</li> <li>The study identified human mobility, tourism, and visiting religious sites are the main causes of COVID-19 spread in various countries.</li> <li>Authors presented some solutions such as the closure of borders between Gulf countries, Lebanon, and Iran to prevent further human mobility and exposure to people who traveled to Gulf countries.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 4.    | Kim et al. (24)              | Shincheonji Church of Jesus                     | 2020 | <ul style="list-style-type: none"> <li>Authors utilized data provided from Korea's Center for Disease Control and Prevention, Department of Public health and news reports to establish time delay from illness onset to COVID-19 confirmation in COVID-19 cases linked to the Shincheonji religious group.</li> <li>This paper discusses the beliefs and religious practices of the Shincheonji religious group, and how they conflict with COVID-19 guidelines.</li> <li>The study highlights how Shincheonji religious group's practices contributed to many of their members being infected with COVID-19.</li> <li>The study discusses the legal steps enacted by the Korean Government to tackle this challenge.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 5.    | Linke and Jankowski (25)     | Multiple                                        | 2022 | <ul style="list-style-type: none"> <li>The study analyzes data from 47 countries in World Values Survey Wave 7.</li> <li>The study aims to examine the relationship between the COVID-19 pandemic situation in the country and internal/external indices of religiosity and religious fundamentalism.</li> <li>Results show that countries with more residents attending religious services had more COVID-19 cases and more deaths.</li> <li>Authors noted an observation that fewer COVID-19 tests were conducted in countries with higher percentages of the population declaring belief in God and trust in religion over science.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 6.    | Taragin-Zeller et al. (26)   | Judaism (Haredi Judaism)                        | 2020 | <ul style="list-style-type: none"> <li>The study focuses on COVID-19 related decision-making by the Ultra-Orthodox (Haredi) Jews in Israel.</li> <li>Authors found that Haredi men and women made COVID-19-related decisions based on religious and medicine-related rationalizations.</li> <li>The study highlights the need to develop better science communication models and creative strategies to tailor their message to minorities.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

(Continued)

TABLE 1 (Continued)

| Study | Author(s)/Source          | Religion                                                                      | Year | Objectives, observations, study highlights, and key findings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------|---------------------------|-------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7.    | Hill et al. (27)          | Christianity                                                                  | 2020 | <ul style="list-style-type: none"> <li>Authors investigated how religiosity affects social isolation and adherence with stay-at-home guidelines by evaluating the average distance traveled per day using location of people compiled by using mobile phone, Wi-Fi, and GPS data.</li> <li>Key findings: People in states with higher religiosity traveled longer distances and thus had higher average mobility scores in the period Feb 24 to March 2</li> <li>The study found that in highly religious states, stay-at-home directives have a lesser impact on people's mobility.</li> <li>Reductions in travel during the pandemic were smaller in more religious states.</li> <li>Religious states were more resistant to stay-at-home orders.</li> <li>The findings emphasize that non-compliance with COVID-19 restrictions in religious communities increases the risk of contracting and spreading the disease over larger distances.</li> </ul>                                                                                                                                                                   |
| 8.    | Boguszewski et al. (28)   | Christianity                                                                  | 2020 | <ul style="list-style-type: none"> <li>Authors utilized a structured questionnaire to explore how COVID-19 affected religiosity in Poland.</li> <li>Results shows that 21.3% reported devoting more time to prayer than before COVID-19-related restrictions were enacted.</li> <li>Key findings: People who were religiously involved prior to the pandemic also reported an increase in religious activity and reported increased satisfaction with their lives.</li> <li>People who reported themselves as minimally involved in religious activities experienced more anxiety about losing their job.</li> <li>There was a positive correlation between increased religiosity and misconceptions about the coronavirus.</li> <li>Individuals with higher religious activity showed less compliance with government restrictions, had more COVID-19 misconceptions, relied on informal information sources, and expressed more conspiracy theories, despite wearing masks.</li> <li>One unique observation was made in this study, that people who pray more may be less fearful of the epidemic than others.</li> </ul> |
| 9.    | Levin J and Bradshaw (29) | Christianity                                                                  | 2022 | <ul style="list-style-type: none"> <li>Data from the 2021 Gallup Values and Beliefs of the American Public Survey was used.</li> <li>Key findings: The study reported that skepticism and vaccine hesitancy were strongly associated with one's political preference and conservative religious beliefs.</li> <li>Other findings were having a loved one suffer from COVID-19 did not significantly change the respondents' beliefs.</li> <li>The researchers pointed out the potential impact of these findings on vaccine acceptance and public health efforts.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 10.   | Perry et al. (30)         | Christianity                                                                  | 2020 | <ul style="list-style-type: none"> <li>The research delves into the concept of Christian nationalism as a separate entity from religion, with the authors proposing a hypothesis and analyzing data from three waves of the Public and Discourse Ethics Survey.</li> <li>Key findings: The study reported that Christian Nationalism is positively linked to more frequent incautious behavior regarding COVID-19 and negatively associated with taking necessary precautions.</li> <li>Religious commitment was the leading factor that could predict if a person will avoid taking precautionary measures in order to prevent COVID-19 spread.</li> <li>Religious commitment promotes prosocial values and behaviors once Christian nationalism is factored out.</li> </ul>                                                                                                                                                                                                                                                                                                                                               |
| 11.   | Perry et al. (31)         | Christianity                                                                  | 2021 | <ul style="list-style-type: none"> <li>Authors analyzed data from the Public and Discourse Ethics Survey to explore the relationship between xenophobic and racist perspectives on COVID-19 and White nationalism.</li> <li>Key findings: An association between the aforementioned perspectives and White nationalism was found to persist even after accounting for various sociodemographic, religious, and political factors.</li> <li>Christian nationalism was found to be a strong predictor of White Americans holding racist views compared to other races.</li> <li>More than 55% of the white sample tested above the mean on the white nationalism scale, indicating that this is not a fringe movement.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                             |
| 12.   | Lee et al. (1)            | Islam, Judaism, Christianity (Catholicism, Shincheonji Church of Jesus, etc.) | 2022 | <ul style="list-style-type: none"> <li>Review of 58 articles examining the role of religious communities in COVID-19 spread.</li> <li>Key findings: Religious gatherings and practices played a key role in COVID-19 spread in the initial days of the pandemic.</li> <li>Vaccine refusal observed due to religious reasons.</li> <li>Religious institutions collaborated with government authorities to spread scientific knowledge about COVID-19 and helped to address vaccine hesitancy.</li> <li>Dual role of religion: both accelerating and mitigating the spread of COVID-19.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

(Continued)

TABLE 1 (Continued)

| Study | Author(s)/Source       | Religion                               | Year | Objectives, observations, study highlights, and key findings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------|------------------------|----------------------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13.   | Widiyanto et al. (3)   | Islam                                  | 2020 | <ul style="list-style-type: none"> <li>• The study explores challenges of handling COVID-19 in Indonesia. The challenges include misinformation propagated by social media.</li> <li>• Observations include conservatives embracing COVID-19 conspiracy theories and religious conservatism leading to rejection of government guidelines.</li> <li>• Author recommends cultivating a “new spirituality” that aligns with science and knowledge to combat the pandemic.</li> <li>• Authors proposes developing a “Muslim Knowledge Culture” to promote adherence to public health guidelines and overcome misinformation.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 14.   | Lorea (14)             | Christianity, Hinduism, Islam, Judaism | 2020 | <ul style="list-style-type: none"> <li>• The study examines how religious leaders had diverse responses to COVID-19 pandemic as they tried to make sense of the COVID-19 pandemic using religious knowledge.</li> <li>• In the article, the author explores how some religions have adapted to using digital devices to organize ceremonies and rituals, while others have resisted this change.</li> <li>• Key findings: Some communities modified their rituals to comply with COVID-19 guidelines (e.g., using disposable q tips for holy water, sharing <i>prasad</i> on platter), others refused to change their ways (insisting to kiss the Torah, touching Pir's shrine, drinking from shared spoon etc.)</li> <li>• Some religious leaders promoted religion-based explanations of COVID-19 (accumulation of negative <i>karma</i>) and even predict that pandemic will subside by a certain day.</li> <li>• The study emphasizes the influence of religious leaders in interpreting and rationalizing religious beliefs, while underscoring the resurgence of religion and spirituality for comfort and predictions, urging social scientists to address these shifts.</li> </ul> |
| 15.   | Pirutinsky et al. (32) | Judaism                                | 2020 | <ul style="list-style-type: none"> <li>• The study focused on the American Orthodox Jewish community in the states of New York and New Jersey.</li> <li>• Key findings: High levels of religiosity increased the risk of direct exposure to COVID-19.</li> <li>• Highly religious participants felt low levels of distress caused by the COVID-19 pandemic.</li> <li>• Highly religious participants showed high levels of compliance with government restrictions.</li> <li>• Increased trust in God and intrinsic religiosity were observed as forms of positive religious coping.</li> <li>• Utilizing positive religious coping led to better mental health.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

## 4. Narrative synthesis

### 4.1. The relationship between religious practices, beliefs, and the spread of COVID-19

The role of religious gatherings, ceremonies, and practices in contributing to the spread of COVID-19 has been noted in published literature. Researchers reported that these types of events played a significant role particularly in the pandemic's early days (1, 22–24). Though a strong correlation existed between religious activities and viral spread, it is worth noting that the study by Lee et al. (1) emphasized that religious activity could both accelerate and mitigate COVID-19. This illustrates religion's dual potential effects on public health crises. The relationship between religiosity that adhered with guidelines recommended or mandated by various government remains unclear. Some studies have found people in more religious areas or with higher levels of religiosity were less likely to comply with social distancing and stay-at-home orders (27, 32). Other studies have found some correlation between increased religiosity and misconceptions about the virus, as well as resistance to government mandated restrictions (28).

Regarding vaccination acceptance, religious beliefs had association with vaccine hesitancy, particularly when conservative religious beliefs linked with skepticism toward vaccines and overall public-health initiatives (1, 29).

The pandemic saw various religious leaders from various countries facing unique challenges in caring for their

communities. Studies showed that effective communication and collaboration with public-health authorities or local governments remained vital in promoting adherence to guidelines and dismantling misinformation (3, 26, 43). The pandemic has also caused changes in religious practices. While some individuals have turned to religion for comfort and support during these uncertain times, others have experienced a crisis of faith or questioned their beliefs (14, 28).

Given the mixed findings on the relationship between religiosity and compliance with COVID-19 guidelines, it is important for researchers to continue examining it.

### 4.2. The role of religious leaders and faith communities in coping with and mitigating the impact of COVID-19

The published literature shows the impact of the pandemic on various religious communities and the challenges they faced, whether financial, childcare disruption, fear of infection, or loss of fellowship (5, 41).

Several studies revealed the importance of religious leaders and communities adapting to COVID-19 measures to maintain a sense of belonging and foster emotional resilience among their congregations (33, 35, 37). Some studies highlight how religious communities adjusted their traditional religious ritual and practices, ultimately complying with social distancing guidelines and safety measures to prevent viral spread (6, 12, 36).

TABLE 2 Exploring the role of religious leaders and faith communities in coping with and mitigating the impact of COVID-19.

| Study | Author(s)/ Source          | Religion                                                                                   | Year | Objectives, observations, study highlights, and key findings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------|----------------------------|--------------------------------------------------------------------------------------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.    | Frei-Landau (33)           | Judaism                                                                                    | 2020 | <ul style="list-style-type: none"> <li>• Commentary discussing innovative adaptations to traditional rituals by Israeli Jewish community for social distancing compliance.</li> <li>• The adaptations were made in order to prevent the spread of COVID-19.</li> <li>• The study suggests that these alternative mechanisms may help maintain a sense of belonging and foster emotional resilience.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 2.    | Impouma et al. (34)        | Unknown                                                                                    | 2021 | <ul style="list-style-type: none"> <li>• The study is a retrospective observational cross-sectional analysis that examines whether COVID-19 preparedness and response strategies were influenced by experience gained during previous Ebola virus disease (EVD) outbreaks.</li> <li>• Primary focus on countries including Guinea, Liberia, and Sierra Leone.</li> <li>• Authors found that the rapid implementation of readiness and response measures (within weeks in COVID-19 pandemic) could be attributed in part to the experience gained from the EVD outbreak of 2014-2016.</li> <li>• Response measures included suspensions of flights and schools, restrictions on internal movement and mass gatherings, mask wearing and mandatory testing.</li> <li>• The high Case Fatality Rate (CFR), low number of tests per 10,000 population and delays in reporting and confirming cases indicated that the healthcare system was still underfunded and fragile.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 3.    | Williams et al. (35)       | Buddhism, Judaism, Islam, Hinduism, Christianity (Catholicism, Protestant, and Unity sect) | 2020 | <ul style="list-style-type: none"> <li>• Qualitative analysis based on interview transcripts with clergy in Colorado and North Carolina.</li> <li>• The interviews were conducted from October 2018 to September 2019.</li> <li>• Authors used a grounded theory approach to identify themes in the transcripts.</li> <li>• Key findings: Authors found that most clergy members held positive views on vaccines.</li> <li>• The clergy were open to the idea of vaccine advocacy and desired help from experts to address vaccines in local settings.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 4.    | Orlandi, Febo et al. (36)  | Multiple                                                                                   | 2022 | <ul style="list-style-type: none"> <li>• The study was conducted in 22 European countries.</li> <li>• The study identified an overall negative and significant association between country-level religiosity and vaccination rates.</li> <li>• Key findings: In countries where Roman Catholics are the majority religious group, the association was reversed.</li> <li>• Roman Catholics displayed a positive association, likely due to the vocal acceptance of vaccines by the Pope.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 5.    | Yezli and Khan (37)        | Islam                                                                                      | 2021 | <ul style="list-style-type: none"> <li>• Authors explored the importance of the cessation of Umrah in February 2020 by the Kingdom of Saudi Arabia (KSA).</li> <li>• The study highlights the importance of temporarily closing places of worship and suspending religious gatherings to stop the spread of COVID-19.</li> <li>• Authors examined the role of religious leaders and institutions in promoting compliance with public health measures to prevent the spread of COVID-19.</li> <li>• The study emphasizes the need for religious leaders and institutions to work collaboratively with public health officials to address the COVID-19 pandemic.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 6.    | Yezli and Khan (38)        | Islam                                                                                      | 2020 | <ul style="list-style-type: none"> <li>• Authors explored the challenges faced by the Kingdom of Saudi Arabia (KSA) administration.</li> <li>• Key findings: The KSA administration enacted strict COVID-19 social distancing guidelines despite political, economic, social, and religious challenges.</li> <li>• Authors examined the challenges and complexities of implementing such measures in a religiously conservative society.</li> <li>• The study highlights the importance of taking bold steps to halt the spread of COVID-19 in the future.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 7.    | Gautret and Al-Tawfiq (39) | Islam                                                                                      | 2020 | <ul style="list-style-type: none"> <li>• The letter to the editor compares the 2020 Olympics and Hajj Pilgrimage.</li> <li>• Authors discuss whether these events should be suspended. Authors use multiple reasons to support their argument.</li> <li>• The suspension of Umrah is highlighted as a positive step in controlling the spread of COVID-19.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 8.    | Waitzberg et al. (40)      | Judaism, Islam                                                                             | 2020 | <ul style="list-style-type: none"> <li>• Authors explored steps taken by the Government of Israel in tackling COVID-19.</li> <li>• Israel's government tailored COVID-19 protocol for religious minorities, such as Ultra-Orthodox Jews (12% of population).</li> <li>• Key findings: The Ultra-Orthodox Jews had lower access to healthcare due to several barriers and did not utilize regular media or methods of communication. They also live in tight knit communities that follow instructions of their own leaders.</li> <li>• The government-built trust among Orthodox Jewish leadership, recruited aid and charity networks, and communicated the importance of restriction measures.</li> <li>• Despite communications, Ultra-Orthodox schools and synagogues stayed open 1-2 weeks after government mandated shutdowns. Once the leaders communicated the instructions to the community, the community complied quickly.</li> <li>• As the Pandemic worsened, Army was called in to help establish quarantine, help provide food and resources to people and these strict conditions were continued in the Passover holiday.</li> <li>• Authors concluded that managing COVID-19 spread in less accessible groups requires stricter social distancing and cooperation with religious leaders; similar steps should be taken for Arab minorities facing language barriers, poverty, and upcoming Ramadan holiday.</li> </ul> |

(Continued)

TABLE 2 (Continued)

| Study | Author(s)/ Source            | Religion                                                 | Year | Objectives, observations, study highlights, and key findings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------|------------------------------|----------------------------------------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9.    | Thompkins et al. (41)        | Christianity                                             | 2020 | <ul style="list-style-type: none"> <li>• Authors documented responses to 15-min videos produced as part of Project Trust (PT).</li> <li>• The videos included pastors, public health officials, and mental health providers discussing their individual COVID-19 experiences.</li> <li>• Identified four core themes for addressing the needs of at-risk African Americans during the pandemic: ritual disruption, guideline adherence, trauma, and culture and trust.</li> <li>• Themes represented challenges faced by African American churches.</li> <li>• Discussed four action avenues for addressing these challenges and moving forward.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 10.   | Galang (42)                  | Christianity, Hinduism                                   | 2021 | <ul style="list-style-type: none"> <li>• The correspondence was written in response to A letter by Corpuz GC (2021)(40).</li> <li>• Author discussed the moral obligation of religious leaders.</li> <li>• Religious leaders have a responsibility to accept the findings of science.</li> <li>• Religious leaders should not disseminate COVID vaccine-related misinformation to their followers.</li> <li>• Dissemination of misinformation undermined people's faith in science and the vaccine.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 11.   | Osei-Tutu et al. (5)         | Christianity                                             | 2021 | <ul style="list-style-type: none"> <li>• Authors interviewed 15 religious leaders from Ghana following a ban on religious gatherings enacted by the government.</li> <li>• Key findings: The leaders identified several impacts on their congregants, including financial challenges, disruption to childcare/training, fear of infection, decline in spiritual life, and loss of fellowship and community.</li> <li>• The leaders approached the challenges using several methods, including instilling hope, and sustaining faith, sermons on repentance, and implementing hygiene protocols and COVID-19-related stigma sensitization.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 12.   | Sulkowski et al. (6)         | Christianity                                             | 2020 | <ul style="list-style-type: none"> <li>• Authors conducted in-depth interviews with 12 priests and pastors of churches in Poland that were conducted from the day the Government announced the COVID-19 epidemic in Poland.</li> <li>• Key findings: Many were ready to modify their worship practice, while others suspended or reduced them depending on ecclesiology. Some even asked for more drastic measures.</li> <li>• Some churches still considered the possibility of maintaining services while following precautions, others were more decisive in suspending them.</li> <li>• The clergy were not willing to change worship itself (like stopping communion distribution) but were open to modifying it by giving communion wafer in hand instead of mouth and pouring wine in individual goblets.</li> <li>• Some clergy saw the COVID-19 pandemic because of sin/human degradation, they all called for helping the fellow human, the vulnerable elderly and healthcare workers.</li> <li>• Many clergy utilized the internet to share religious information, sermons, and meditations. While some used the state media, others had their own websites and some utilized Facebook and YouTube. Some did not use social media.</li> <li>• The Churches cooperated to hold joint services and invited professionals to disburse information on the COVID-19 pandemic.</li> <li>• Some clergy endorsed the state's decisions while others saw themselves as a regular person following the law for their community.</li> </ul>                                          |
| 13.   | Weinberger-Litman et al. (9) | Judaism (Modern Orthodox Jewish)                         | 2020 | <ul style="list-style-type: none"> <li>• Online questionnaire-based study conducted in March 2020 among Modern Orthodox Jewish community in NY and CT, the first quarantined religious community in these states.</li> <li>• Key findings: Significantly high level of religious commitment observed (56.8% reporting religion as "very important" and 25.7% as "center of my world"). Religious community leaders organized various types of support for members as follows:</li> <li>• Tangible supports food delivery.</li> <li>• Social support like calling the elderly to check up on them.</li> <li>• Information support about the quarantine</li> <li>• Religious support via online religious meetings and rituals</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 14.   | Begović (10)                 | Christianity (Orthodox and Catholic), Judaism, and Islam | 2020 | <ul style="list-style-type: none"> <li>• Examined COVID-19 restrictions on religious activity in Bosnia and Herzegovina, with varied responses from religious communities: The responses of the religious community were as follows:</li> <li>• Key findings: The Islamic community utilized their central leadership to communicate to their members to strictly follow state guidelines and adapted its religious activity to COVID-19 restrictions.</li> <li>• Religious rituals like Friday prayer and Ramadan were conducted with close adherence to COVID-19 restrictions.</li> <li>• The Catholic Church exhibited a decentralized response, allowing dioceses to interpret guidelines individually, resulting in varied compliance among leaders – some followed guidelines and granted forgiveness for non-attendance at masses, while others publicly opposed restrictions and demanded in-person attendance.</li> <li>• The Orthodox church showed less determination in limiting church activity and following guidelines, some dioceses agreed to stick to state regulations while other chose to ignore them, some blamed the people for attending religious ceremonies in violation of state restrictions.</li> <li>• The Jewish Community suspended religious gatherings, and a network of volunteers was created to help the elderly with food and medicine.</li> <li>• Authors concluded that while all religions could justify restrictions through religious law and theology, some struggled to reconcile state regulations with religious autonomy.</li> </ul> |

(Continued)

TABLE 2 (Continued)

| Study | Author(s)/ Source  | Religion                                   | Year | Objectives, observations, study highlights, and key findings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------|--------------------|--------------------------------------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15.   | Oxholm et al. (12) | Christianity, Buddhism                     | 2020 | <ul style="list-style-type: none"> <li>• Authors conducted interviews and analyzed Facebook and online news media, examining the response of religious leaders to COVID-19 restrictions both before and after level 4 lockdown.</li> <li>• Key findings: Many leaders endorsed internet resources to virtually conduct religious worship.</li> <li>• Some communities made this transition seamlessly, but others found certain aspects like shared communion difficult.</li> <li>• Many leaders recognized that religious practices increased the risk of COVID-19 transmission, leading to event cancellations, but individual concerns persisted, such as a shared communion cup causing a transmission, skepticism about the threat, and lockdown violations by door-to-door proselytizing.</li> <li>• Religious community-run food banks also adapted their practices to comply with COVID-19 guidelines.</li> <li>• The study concluded that since the event of communion cup sharing, religious communities took steps to address COVID-19 transmission in agreement with the state response to prioritize the welfare of their communities.</li> </ul> |
| 16.   | Ting et al. (7)    | Christianity, Islam, Hinduism and Buddhism | 2021 | <ul style="list-style-type: none"> <li>• Authors conducted a 10-15 min long online survey using a mixed method research design with cross sectional data as part of a larger national project. Qualitative analysis revealed Religion as a double-edged sword with the following findings.</li> <li>• Key findings: Higher levels of religiosity (both internal and external) led to lower level of stress during the lockdown. While internal religiosity led to decreased stress from the loss of control, external religiosity may lead to increased stress of being infected, likely during religious gatherings.</li> <li>• Lockdown and Governmental policies affected the religions differently, with Muslim groups reporting the highest confidence as the COVID-19 information was printed in Malay while Buddhism groups were affected the most due to lockdowns.</li> <li>• Authors offered recommendations: Religious communities can be encouraged to participate in prevention of COVID-19 pandemic. Religious leaders should be engaged in planning such programs.</li> </ul>                                                                   |
| 17.   | Counted et al. (8) | n/a                                        | 2020 | <ul style="list-style-type: none"> <li>• A study on Colombians and South Africans during homebound restrictions due to COVID-19 revealed that positive religious coping was associated with higher levels of wellbeing in both populations.</li> <li>• Authors reported as association between trait hope and wellbeing was moderated by positive religious coping among Colombians and negative religious coping among South Africans.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

Other studies revealed the importance of collaboration between religious leaders, institutions, and public health officials in addressing the pandemic (37, 42). Still others revealed the important role religious leaders and institutions have played in upholding compliance with public-health measures and providing various support services (9, 10). Overall, most published studies underscore the need for religious leaders to accept scientific findings and resist disseminating COVID-19 and vaccine-related misinformation (42).

## 5. Discussion

The evaluated studies highlight the complex relationship between religion, religiosity, and the COVID-19 pandemic. Religious gatherings and activities played significant roles in the spread of COVID-19 across the world, as evidenced by the reviewed published studies (1, 3, 22–25, 27, 29–32). The literature shows the role of religious activity in amplifying the spread of COVID-19, through non-wearing of masks, non-adherence to social distancing, and at times through the promotion of misinformation. While some studies have suggested religion as a risk factor for contracting COVID-19; other studies identify religion as a positive source of coping and resilience (1, 26, 32).

The ravages of the COVID-19 pandemic led to existential crises in many, with some religious believers finding meaning by leaning into apocalyptic narratives, which some of the secular also did (20). Viewing the pandemic as an act of a superior being, certain religious

leaders and organizations refused to change their group rituals and ceremonies. Several pastors expressed the belief that only God would decide when someone died and not the government, and thus refused to stop holding packed church services (44). Such religious defiance and harmful-belief promotion ultimately led to a rejection of government recommended or mandated COVID-19 guidelines, increasing the virus's transmission among the masses (1, 3, 27, 28).

In certain instances, both governments and religious leaders have been criticized for their handling of the pandemic. For example, during the second wave of COVID-19 infections in April 2021 in India, the decision to continue with the annual Kumbh Mela, a pilgrimage that attracts over nine million people, was deemed irresponsible by some public health experts. Despite concerns raised regarding the potential spread of the virus, minimal precautions were taken, and pandemic guidelines were not strictly enforced. These included a lack of social distancing and wearing masks. Such actions have been viewed by some as further contributing to the crisis (21). This led to what some have called as a “massive superspreader event” (45). Unfortunately, no quarantine was enforced nor was contact tracing imposed on the returning pilgrims. This incident highlights how faith and distrust of science can lead to crisis (46). In the Middle East, similar incidents were reported, with increased spread associated in “Qom with Jewish and Shi’ite communities” with religious practices and travel to holy places of their respective countries (23).

In West Africa, the COVID-19 crisis was simply seen by the population as an extension of the Ebola crisis (34). What the



Ebola crisis taught may have helped in managing the COVID-19 response, but persisting apocalyptic narratives here also played a role in viral spread (34). When COVID-19 reached Tanzania, that country's president stated that only faith in God and quack treatments like steam inhalation would defend them from COVID-19. He refused to enforce a lock down, and instead rubbished test kits, vaccines, and masking (47).

The pandemic placed many religious and psychospiritual communities in difficult positions, forcing them to make a difficult choice over whether to follow health regulations substantially, partly and not at all, and to keep pursuing their cultural norms, regarding funerals and other sanctified gatherings. In Brooklyn, New York's Hasidic Jewish community, doctors estimated that hundreds of Orthodox Jews died due to participating in super-spreading events such as funerals (48). Funeral restrictions also impacted other religions. Hindus, for example, who commonly cremate the bodies of loved ones in holy sites such as Varanasi, India, have had their travel restricted due to the pandemic. Culturally, these restrictions disrupted an important ritual, one that draws large families together in the throes of cathartic mourning (48). Here, tightly wrapping the bodies of victims of COVID-19 did prevent transmission, but also prevented the victim's families from saying their last goodbyes according to their religious beliefs (48).

Islamic cultures also experienced COVID-19 limitations to their tradition of burying their dead in a timely manner. In Iraq, burials were delayed for days, causing distress among the deceased's loved ones for their inability to provide a traditional funeral (48). The large number of coronavirus deaths also impeded funeral practices, since family members who were recently running from pillar to post to obtain scarce oxygen and a hospital bed, now had to struggle to secure burial plots or space in a funeral home to perform the final rites (49).

Some religious leaders, however, found creative solutions. For example, in the Jewish community, Rabbi Avraham Berkowitz decided to attend a family funeral (and set an example, perhaps) safely distanced in his car (50). Some priests started giving blessings from the hallway or over the telephone, while some funeral homes started drive-in funerals, with others reviving old traditions of bowing to a hearse when it passed by their home. Shivas were organized via video conference by the Jewish community, while Han Chinese live-streamed their tomb-sweeping ceremonies rather than visiting the tomb of their loved ones in person (51). A mixed method review by Burrell et al. (52) revealed that restrictions on funeral practices did not necessarily entail poor outcomes or experiences for the bereaved. Rather, they seemed to add meaning to the occasion and strengthened the connections mourners felt, as they played a much more critical role (52).

Despite these challenges, religious leaders have recognized their unique role in promoting healthy practices, communicating scientific information to their communities, and helping dispel myths and inaccuracies that contributed to the spread of COVID-19. Religious communities have had to encourage people to take precautions, accept vaccinations, adapt, and find innovative ways to continue their practices while minimizing the risk of infection (33, 35, 36, 39–42, 53).

Religion's skepticism over the COVID-19 vaccine coupled with the new technologies being used to practice religion gradually seemed to fade. More in-depth studies found the association

between resistance and negative attitude toward vaccination most pronounced in religiously conservative communities (29, 35, 54).

Despite the myriad challenges, several examples appear where religious and community leaders issued guidance based on scientific recommendations and thus adapted their practices in response to the pandemic, changing the implications of these adaptations for public health outcomes. For example: The Catholic Church's Pope Francis loudly and globally professed support for the vaccine (42, 53). While countries with Roman Catholics as the majority religious group displayed a positive association between religiosity and vaccine rates (36). In some regions, religious leaders postponed religious events or utilized alternative modalities to maintain traditions and rituals in a COVID-friendly manner. In Saudi Arabia, the Muslim pilgrimage to the holy sites in the Kingdom were restricted, and a new e-Visa program was devised to ban inbound travel of persons from coronavirus-affected countries (37, 38, 55). In similar fashion, Jewish religious leaders adapted their manner of religious prayer by praying through a "balcony" minyan while conducting online havrutas using video conferencing, and virtually broadcasting Passover ceremonies (33). Programs such as Project Trust have helped religious leaders promote health in ways sensitive to their cultures and provided accurate information about public and mental health during the COVID-19 pandemic (41).

The complex relationship between religiosity, cultural values, and public-health decisions has spurred healthcare professionals and other stakeholders, including religious leadership and policymakers, to examine these factors and formulate effective strategies while promoting cooperation among religious communities to ensure adoption of proper procedures or at least the necessary Standard Operating Procedures (SOPs) to mitigate viral spread (36).

Certainly, religious leaders bear significant influence on the perceptions and behaviors of their followers and congregations, as evidenced by higher country-level religiosity leading to lower vaccination rates. In contrast, Roman Catholics showed the opposite trend, mostly due to the Pope's open advocacy for vaccines. This clearly shows the leveraging role religious leaders can assume in influencing the perceptions and behaviors of their followers in periods of public-health crisis. There is a need for a more-comprehensive approach to science communication, one that considers the needs and perspectives of religious communities in the context of public-health crises (1, 26). As we continue to navigate the challenges of COVID-19 and health crises certain to come, what is essential is considering the role of religious practices and beliefs in either spreading or mitigating the impact of infectious diseases (1, 22–27, 32). Future research should more deeply explore the religion's potential to promote wellbeing and resilience during public-health crises and derive the implications of this for public-health policy and practice (8, 11, 32).

Our discussion considered religion's positive as well as negative impacts during the COVID-19 epidemic. Understanding the complicated relationship between religious practice, belief, and public health is necessary for effective policymaking. It is important to include religious leaders and communities in encouraging compliance to health guidelines, and further, to better understand and promote the role of religion in maintaining wellbeing and resilience during health crises.



As we look ahead to the future, examining our current public health situation raises some pertinent questions. How can religious-based approaches help strengthen adherence to measures such as vaccinations and mask usage? To what degree will technology and virtual platforms impact how people practice religion going forward — is there potential for lasting effects on faith communities and individual believers alike? Also, it's crucial to consider how religion can play a role in shaping public health policies and regulations. This might involve studying how religious organizations and leaders contribute to creating, implementing, and evaluating these policies, and also discovering the most suitable methods to take religious perspectives into account when planning public health initiatives. These are some pressing research topics worth exploring in future to gain deeper insights into ways that religious institutions play critical roles during this pandemic period.

## 6. Conclusion

The COVID-19 pandemic has had a significant impact on people globally for the past 3 years, with vaccine hesitancy greatly hindering efforts to curb its effects. To combat this, collaborative efforts among religious leaders, governments, and scientists remain crucial to building trust and promoting vaccine uptake. It is essential to recognize that effective communication strategies and direct channels are necessary to reach and ease the fears of vaccine-hesitant populations, especially within those communities with strong or strict religious and psychospiritual beliefs. Tailored messaging that is culturally and religiously sensitive has been shown to be more effective in reaching these populations. Religious leaders and institutions can play critical roles in disseminating accurate and evidence-based vaccine information. For instance, faith-based advocacy can help reach certain vaccine-hesitant populations in religious communities. What is important to acknowledge and transcend, however, are the challenges and limitations of such efforts, for political or ideological barriers may exist between certain religious groups and governments that could hinder collaboration.

More generally, governments should concurrently take proactive measures to ensure health safety, equal access to healthcare, and non-discrimination across all communities. Collaborative efforts among all stakeholding groups—religious, scientific, healthcare, and governmental—are necessary to ensure successful vaccination campaigns to curb the spread of pandemics, COVID-19 or those of the future. To this end, it is crucial to survey and provide specific examples of successful collaborations between religious leaders, governments, and scientists to promote vaccine uptake. These should include case studies and real-world examples of faith-based advocacy efforts that have successfully reached vaccine-hesitant populations. Only through such collaborative efforts, can we ensure that all communities receive accurate information and access to vaccinations.

## 7. Limitations

One limitation of this review paper is that it focuses mainly on challenges faced by religious communities during the COVID-19 pandemic without exploring other factors that may contribute to vaccine hesitancy or resistance. This paper also focuses primarily on examples from the Western, Arabs and African contexts, which may limit the generalizability of the findings to other regions or cultural contexts. Additionally, while this paper highlights the importance of engaging religious leaders in promoting vaccination acceptance, it does not explore potential challenges or barriers to such engagement. Our methodology follows a systematic approach, sharing similarities with established guidelines such as PRISMA or Cochrane, but does not strictly adhere to these guidelines. However, our review maintains rigor and transparency, which are key elements of a reliable review process.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

## Author contributions

SAh, TB, and GA designed the study and developed the original protocol. SAh and LJ assisted with the initial screening of papers, data extraction, and the literature search. VS, LJ, and SAY contributed to writing the manuscript, including the methods section and synthesis of studies, and also participated in the interpretation of results. LJ, AB, SAY, and NM were involved in data analysis, interpretation of results, and writing several sections of the manuscript. MT, GG, and AB contributed to writing the discussion and conclusion sections. LJ and SAY contributed to writing the results, discussion section, and references. All authors contributed to the article and approved the submitted version.

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## Conflict of interest

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

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# Involuntary psychiatric treatment during the COVID-19 pandemic. An international qualitative study

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**Background:** During the COVID-19 pandemic, studies report that in the first few months of the lockdown there was a decrease in requests for mandatory psychiatric treatment, while, in contrast, following the second wave, the number of cases increased. This study investigates the use of compulsory psychiatric treatments internationally in the first and subsequent phases of the pandemic.

**Methods:** Sixteen key people were interviewed: eight mental health care professionals and eight scholars in Italy, Greece, China and Chile. Participants were asked to discuss their experience of the motivations, diagnoses and management of patients undergoing an involuntary psychiatric hospitalization.

**Results:** The analysis through Grounded Theory highlighted four themes: (a) the culture of psychiatric care services, (b) the effect of the pandemic on involuntary hospitalizations, (c) exceptional management of hospitalization, and (d) policies and suggestions for more inclusive mental health treatments.

**Conclusion:** During the first wave, respondents reported a decrease in the use of involuntary treatments, while a gradual increase was seen in the following months. Italy extended compulsory psychiatric treatment to a group of new users, including young people and adolescents with acute crises; in other contexts, the main users are chronic psychiatric patients.

## KEYWORDS

mental health care, involuntary admission, psychological distress, psychological intervention, COVID-19

## 1. Introduction

The COVID-19 pandemic has seriously affected the daily lives of the global population, heavily compromising the physical and psychological well-being of the whole world and placing a strong burden on Public Health Care (1–3). Recent psychological and psychoanalytic studies on the emotional effects of COVID-19 (4–8) show that living with the pandemic has led to tiredness and uncertainty, derived from not being able to count on the usual certainties based on an order that guarantees the predictable and certain functioning of a series of organizational and contextual components. In addition, the loss of confidence in the health system and a loss of credibility concerning the regulations issued by the institutions has generated a serious sense of anomie. The various pandemic waves have undoubtedly caused a pervasive feeling of anxiety about being infected, and the drastic reduction in socialization experiences due to virus containment measures have certainly increased the risk factors for mental distress in the general population, as well as in people from the most fragile sections of society, such as those with

pre-existing psychiatric diagnoses or those suffering from relational and behavioral disorders (3, 5, 9–11).

Recent scientific papers show that psychiatric and emotional disorders were significant risk factors during the pandemic in terms of physical and mental health (5, 11); people suffering from psychiatric disorders seem to be at high risk of Infection due to pre-existing disorders, unhealthy lifestyle, cognitive deficiency or reduced level of consciousness of the risk (5, 10, 12). Data on access to mental health services suggest a significant increase in mental health consultations (including telephone consultations and e-consultations) (13, 14), an increase (15) certainly attributable to a rise in the number of cases of acute crisis in old and new users as a consequence of the experiences of anguish and isolation resulting from the pandemic (9, 16), and of the weakening of community mental health care networks.

Regarding the use of mandatory psychiatric treatments during the first year of COVID-19 pandemic, early studies (17, 18) indicate a reduction in the number of compulsory psychiatric treatments during the first wave of the pandemic, unlike in the second, when they increased again. A slight decrease of treatments are not clearly attributable to a reduction in acute crises, notwithstanding contextual variables including a greater tolerance on the part of family members who preferred not to report acute cases to avoid referrals to hospital structures for fear of exposing themselves to the risk of infection from the health care or paramedic staff, and the temporary closure of psychiatric hospital wards in certain countries (especially in Latin America) most affected by the pandemic, or unprepared to face it. Data also indicate an increase in the average length of hospital stay during the period from March to June 2020 compared to the previous year, probably due to the difficulty in guaranteeing a “safe” return home for the patients (17, 19) a condition that in some cases violates the principles of brevity and transience that characterize compulsory treatments. The studies carried out so far on the progress of compulsory psychiatric treatments during the pandemic (17–26) have been the first appreciable attempt by scholars and mental health professionals to monitor and make sense of what they witnessed in terms of the mental health of the population while the pandemic was ongoing and gradually advancing around the world.

## 1.1. The current research

The aim of this study is to investigate the topic of mental health interventions following the onset of emergency situations and acute crises that led to hospitalizations during the COVID-19 pandemic. The objective of this research is to collect information on the use and trend of mandatory psychiatric treatments during the first two waves of the COVID-29 pandemic in different areas of the world that differ in the degree of progress of territorial psychiatric reform through (1) the direct experiences of professionals (psychiatrists and clinical psychologists) and (b) the studies and considerations of key eminent local scholars in the fields of clinical psychology, psychiatry and mental health policy.

The specific aim are: (a) to understand whether and how the pandemic has increased the practice of involuntary treatments, and whether the emergency produced by the spread of COVID-19, (b) to value the capacity (in term of resource and culture of psychiatric intervention) of the different health systems to manage and process a user when was requested an immediate intervention, (c) explore any

extraordinary measures put in place in psychiatric wards or hospitals for the treatment and rehabilitation of patients subject to involuntary treatment, and (d) to consider the ethics of mandatory psychiatric treatments (25) during the pandemic globally.

## 2. Materials and methods

### 2.1. Participants

The participants were sixteen ( $n = 16$ ) key people in the field of compulsory psychiatric hospitalizations during the pandemic. Specifically, eight (8) university professors and eight (8) mental health professionals were interviewed. Participants were selected from people the researcher's knew and through a snowball sampling strategy. The interviewees were specifically selected from four different countries – Italy, Greece, Chile and China (Hong Kong) – in order to gain an understanding of their experiences regarding a global phenomenon such as the pandemic. In Italy, (a) two psychiatrists director of a department of mental health in the Friuli Venezia Giulia area were interviewed, and (b) a psychiatrist-psychoanalyst director of a mental health unit in a district of Rome, (c) a psychiatrist working in Psychiatric Unit “SPDC” of a public Hospital in Naples and (d) a professor of clinical psychology in Center Italy were interviewed. In Greece, (e) one university professors of psychiatry, (f) a professor of clinical psychology, (g) a psychiatrist from a psychiatric hospital in Thessaloniki and (h) a psychiatrist from a psychiatric hospital in Athens were interviewed. In Chile, (i) two university professors of Clinical Psychology and (l) two psychiatrists from a psychiatric hospital in Santiago de Chile were interviewed. In China, (m) three university professors of Mental Health Policy in the district of Hong Kong were interviewed. There were six women and ten men. The sampling was completed when the theoretical saturation of the categories that emerged during the interviews in relation to the research question was reached.

### 2.2. Instrument for data gathering

The data was collected through an area-focused narrative interview. The choice to gather data according to interviews allow to capture people making sense of their social experience and of their own role in it (27–29). In last decades several method has been developed to realize narrative data analysis according both to bottom up strategies (30–33) and top down strategies (34). Our approach was informed to grounded theory (35, 36) specifically we developed an area-focused narrative interview built in both a top-down (theoretical) manner, starting from emerging topics in the literature, and a bottom-up method starting from the researcher's experience in the field. The interview explored the following topics: (a) the functioning and use of mandatory psychiatric treatment in their country, (b) the use of mandatory psychiatric treatments during the pandemic, including changes in the number of admissions and causes of mental illness, and the management of patients and vulnerable groups, and (c) proposals to reduce involuntary psychiatric admissions. The questions allowed participants to express their own point of view and the associations connected with what was requested as much as possible. The researcher's interventions were limited to encouraging



the participants to continue talking in moments of silence and embarrassment. In Chile and Greece, the interviews took place in pairs (a psychiatrist together with a university teacher) to deal with linguistic and cultural mediation problems. The interviews were carried out in English and Italian.

## 2.3. Procedures

The interviews were carried out between July and August 2021; the participants were contacted by email and telephone, and appointments were made in locations that were convenient for them. The interview that took place in Rome was carried out in-person at one of the workplaces of the interviewees. The other interviews were conducted online. The average duration of the interviews was approximately 90 min. The interviews were conducted by an expert interviewer with previous experience in the field of qualitative research. After establishing contact with the participants, the researcher obtained informed consent from them after explaining the objective of the research, how the data would be shared, and how anonymity would be ensured. The entire procedure was approved by the university ethics committee.

## 2.4. Data analysis

The collected interviews were transcribed verbatim, and subsequently analysed using the Grounded Theory Method (37, 38) with the help of Atlas.ti software (39) for the analysis of textual data. The analysis process took place in three phases through bottom-up interpretative models in the direction of an ever-greater abstraction (40). The analysis was conducted by a researcher with direct experience and training in the area of qualitative research in mental health and clinical psychology. The data were coded and categorized through a constant comparison of the research questions with the gradual emergence of meanings through the data. The hypotheses regarding the relationship between the codes, the potential categories and any sources of bias have been included in the comments. During the entire process of reading and searching for meaning in the data, a reflective method and a bottom-up approach were used that directed attention to the subjective experiences within which it is embodied, giving meaning to the participants' experience (40). In the first phase (open coding), 25 codes were assigned; in the second phase (axial coding), the number of codes was reduced (to 10 codes) through a criterion of similarity of meaning in eleven categories. Finally, in the third phase (selective coding) 4 categories were further grouped through an inductive process into more abstract macro-categories of meaning (themes).

## 3. Results

The results of the qualitative study are condensed into four key themes. These are: (a) *the culture of psychiatric care services*, (b) *the effect of the pandemic on involuntary admissions*, (c) *exceptional management of hospitalization in order to reduce the spread of infection*, and (d) *policies for more inclusive mental health care*. The themes are presented and argued below. For each theme, a table with the most

relevant sentences (quotations) extracted from the interviews with the key characters has been added to support the discussion and the interpretation of results.

### 3.1. (a) The culture of psychiatric care services – first theme

The first theme immediately highlights the characteristics that distinguish the different cultural models of intervention in the confrontation of mental illness. In recounting how the healthcare system deals with cases of acute crisis during the pandemic, the interviewees highlighted and highlighted the models within which involuntary treatments are implemented and the conception of the person affected by mental illness. Territorial reforms of national psychiatric systems are in various stages in different countries. In Chile, as in Greece, the reform has not been completed, there are mixed systems, there are still asylums converted into modern psychiatric hospitals even if they use an intervention model that is no longer purely of the asylum type, there is still a stigma towards person who manifests mental distress and the lack of a mental health prevention perspective. In Greece, the number of involuntary psychiatric treatments exceeds the number of patients treated voluntarily, and it has the highest rate of compulsory psychiatric treatments in Western Europe (41–45). In Italy, on the other hand, a reform of the psychiatric system, starting in the 1970s, has largely been implemented thanks to the Basaglia reform (46, 47). The situation in Hong Kong is very different from the others; although it is now part of China, the psychiatric model used is the one adopted in the UK. There are many differences between this city and the rest of China (see Table 1).

### 3.2. (b) The effect of the pandemic on involuntary hospitalizations – second theme

The second theme collects information about access to mandatory psychiatric treatments in the countries under consideration. The trends proposed here are the result of the experience of the professionals in service during the period explored and of the preliminary studies carried out by the scholars at the universities of the community to which they belong.

All respondents agree that in the first phase of the pandemic, the number of involuntary patients decreased, and then increased in the following months globally. In countries such as Chile and Greece and China, the people who underwent forced hospitalization were people suffering from serious problems and chronic psychiatric disorders, while in Italy also people suffering from depression or anxiety crises. In all contexts analyzed, it emerges that people subjected to compulsory psychiatric treatment were often people who lived alone and could not count on assistance from family members, further increasing the sense of feelings of despair and loneliness. In addition, Italian mental health professionals also report that even young people who have had a first acute crisis during the pandemic have resorted to compulsory psychiatric treatment, and therefore not only chronic patients.

Another factor that the interviewees identified as having contributed to the onset of emergency situations was the suspension of all prevention and territorial assistance activities carried out in

**TABLE 1** First Core Category “The culture of psychiatric care services” with relative descriptive quotations from participants.

|                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a) The culture of psychiatric care services | “In Thessaloniki there are 8 psychiatric units: 5 belonging to psychiatric hospitals, 3 are psychiatric units in general hospitals and 3 are in universities. Usually, involuntary patients will end up going to psychiatric hospitals, while voluntary patients will go to clinics” (Professor of Clinical Psychology Thessaloniki, GR).                                                                                                                                                                                                                                                                                                                  |
|                                              | “In Chile we have a mixed form of care, there are still 4 psychiatric hospitals and some psychiatry wards in general hospitals. In the last year, a reform is accelerating the closure of the former asylums” (Psychiatrist, CL).                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                                              | “Data show that around 73% of people evaluated in emergency clinics come voluntarily. Among them, 67% are evaluated and only 29% hospitalized. Among the involuntary patients: around 88% are hospitalized while 9.5% are only evaluated. There is a big difference among clinics as some hospitals tend to hospitalize everyone” (Professor of Clinical Psychology Thessaloniki, GR).                                                                                                                                                                                                                                                                     |
|                                              | “Here in Friuli Venezia Giulia, the place where Basaglia operated, we have a community-based intervention model, so it is very difficult to carry out mandatory psychiatric treatment, there are home teams that go and reside at the psychiatric patient’s home until the urgency is over” (Psychiatrist, Friuli Venezia Giulia, IT).                                                                                                                                                                                                                                                                                                                     |
|                                              | “In Rome there is a psychiatric model that over the years has developed and nourished itself from a system that was organized starting from the Basaglia reform that established a form of community assistance with mental discomfort. Furthermore, the presence of psychoanalysis within the working groups of professionals made us think that behind every involuntary hospitalization there is a family problem. For us, our users are not just hospitalized people. In our centers there are psychological bonds between family members, psychiatrists and hospitalized people, this allows us to treat family discomfort” (Psychiatrist, Rome, IT). |

person by the mental health worker, this abruptly interrupted home care and inhibited all consultative activities such as psychotherapy, psychological counseling, drug monitoring, etc.

It should also be noted that in some situations, such as in Chile and China, the mental health centers were closed for a few weeks, while in Italy and Greece, after the first days of disorientation, face-to-face activities were replaced by of e-mental health care (see [Table 2](#)).

### 3.3. (c) Exceptional management of hospitalization in order to reduce the spread of infection – third theme

*Concerning the organization of the patients’ hospitalization within the psychiatric ward, the risk of contagion, the interviewees report, has required a major reorganization of the accesses and reception of psychiatric patients. Everyone agrees on the fact that the period of hospitalization has usually been longer than normal, this because on the one hand the families of origin were reluctant to welcome into their home a patient who had been hospitalized in a hospital, where the risk of contagion was certainly greater, on the other hand, testing the patient during the access and hospitalization period made the treatment path longer. Furthermore, in other cases it has happened that patients tested positive at the time of admission or have contracted the COVID-19 virus in the ward, making the period of hospitalization much longer. In addition, in order to minimize the risk of contagion in the hospital new specific role and strategies for a safer management of patients were establish. First, it was necessary to undergo a molecular test upon admission and to live in isolation for a few days before the response, the management was complicated for some people with severe diagnosis who did not understand the need to be isolated awaiting test results. For infected people, as in Italy, special areas were set up within the hospital psychiatry departments (within general hospitals), in other situations, however, patients were placed in general hospitals, because psychiatric hospitals did not guarantee adequate treatment for lung infection caused by the virus. On the other hand, in China, positive patients have been placed in “other” structures, other than psychiatric or general hospitals, thus increasing their experience of isolation and alienation (see [Table 3](#)).*

### 3.4. (d) Policies and suggestions for more inclusive mental health care – forth theme

The future of health policies for mental health, according to the interviewees, features some priorities across the different cultures of existing mental health services. In the first instance, one of the interviewees suggested the construction of mental health centers in different areas of their country, particularly in rural areas and islands, as a strategy to improve patient care. This was in Greece, where reform around the locations of mental health centers is still incomplete. According to the Greek expert, decreasing the concentration of psychiatric patients and involuntary psychiatric treatments in some hospitals in large cities such as Athens and Thessaloniki would allow better patient management and less crowding of urban psychiatric hospitals (45). A second and long-standing problem that respondents highlighted is the underfunding and scarcity of human resources within the mental health area. In particular, one of the interviewees indicated that one improvement would be to reduce the gap between public and private and allow even the poorest segments of the population to access the same treatments. An Italian interviewee hopes for greater funding from the state, which currently spends only a small portion of its budget on mental health. Another important point was the need to create a future for people with mental illness. In particular, there is a need to create a real strategy to reintegrate those with mental illnesses, especially young people, back into society. In many countries, there are no strategies for entering the world of work, and no policies are planned for the reintegration of people suffering from mental illness. The mentally ill are often considered unable to work, but this is a concept that should be changed, and the policy should provide preferential routes to work placement after hospitalization in the mental wards. This suggests a focus is needed on the training of psychiatric, nursing and psychological staff who work within mental health centers. If there are realities where positive models of intervention have been tested (48), these should be disseminated beyond the local reality (see [Table 4](#)).

TABLE 2 Second core category “The effect of the pandemic on involuntary admission” with more descriptive quotations from participants.

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (b) The effect of the pandemic on involuntary admission | “During the pandemic, we noticed a difference between the first four months of the pandemic and then the following months: March–June 2020: There were very strict rules in Greece and people were complying with regulations. During this time, admissions rate dropped to nearly 0%, including involuntary admission. After Summer 2020: Once people started getting used to the pandemic, numbers started rising again and we went back to our number admissions rates (60% involuntary admissions)” (Psychiatrist, Thessaloniki, GR). |
|                                                         | “We did not notice any connection between the Covid-19 crisis and delirious people. However, it is probably too soon to see the repercussions that the pandemic must have had people’s mental health. In any case, it is likely that the current situation will trigger different disorders like anxiety and depression” (Psychiatrist, Athens GR).                                                                                                                                                                                       |
|                                                         | “Another problem is about the shame associated with mental illness and often people or their family members prefer patients to be admitted far from their house” (Professor of Clinical Psychology Thessaloniki, GR)                                                                                                                                                                                                                                                                                                                      |
|                                                         | People who have undergone compulsory psychiatric treatment are often people who live alone and cannot rely on family resources.                                                                                                                                                                                                                                                                                                                                                                                                           |
|                                                         | “According to a study conducted before the pandemic, we noticed a difference between patients admitted voluntarily and those involuntarily. The first ones are usually married or living with someone or in a community; while patients admitted against their will are usually living alone, not married, are usually men and show aggressive or psychotic behavior. Age does not seem to be an interesting factor” (Professor of Clinical Psychology Thessaloniki, GR).                                                                 |
|                                                         | “We had very strict rules and no visitors were allowed. Unfortunately, as we did not have public Wi-Fi, only people with their own devices could easily contact their relatives. Also, some psychiatric patients are not allowed to keep their phones so that was harder for them to contact their relatives. To cope with this situation, we increased instances in which patients could have access to their phones and talk to their relatives” (Psychiatrist, Thessaloniki, GR).                                                      |

TABLE 3 Third core category “exceptional management of hospitalization in order to reduce the spread of infection” with more descriptive quotations from participants.

|                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (c) Exceptional management of hospitalization in order to reduce the spread of infection | “We worried that schizophrenic patients would not cope well with Covid-19 regulations, especially with Covid-19 tests. However, patients seemed to cooperate well, even psychotic people who usually are paranoid and do not like to be touched” (Psychiatrist, Athens, GR).                                                                                                                            |
|                                                                                          | “During the second wave of the pandemic, we had two rooms (one for female and one for male) in which incoming patients would be put in quarantine until their Covid-19 results were available. In case of positive test results, those patients with no symptoms would be moved to another department, while those with symptoms would be sent to Covid-19 hospitals” (Psychiatrist, Thessaloniki, GR). |

## 4. Discussion and conclusions

The research has highlighted some key aspects of the use of mandatory psychiatric treatments during the COVID-19 pandemic. The interviewees provided some details on the health policies in force in the areas they belong to and, in other cases, information on the field about their direct experience in the psychiatric services of the national health system. This has made it possible to trace the boundaries and the socio-cultural framework within which psychiatric intervention and the treatment of patients in critical situations have been conceived and implemented in an unprecedented anomic condition, such as the spread of the COVID-19 Pandemic.

First of all, we saw a decrease in involuntary treatments during the first months of the pandemic; this is transversal data confirmed by all the interviewees. This phenomenon should not be read superficially. It is possible that during a period of hard lockdown, families were more tolerant of the mental illness of one of their family members, for fear of getting infected by coming into contact with health personnel or while gaining access to hospitals. In fact, the fear of coming into contact with the health system led to a reduction in psychiatric hospitalizations in general in the months of March and April, and consequently also involuntary hospitalizations. The decision not to hospitalize people who had previously suffered from mental illness was a choice of both families and health personnel to reduce the risk of contagion among the population. It is also probable that disadvantaged people could still count on their own resources, not yet drained by the exhausting prolongation of the pandemic. In the following months, starting from summer 2020, the trend seemed to return to the levels prior to the pandemic. In Greece, we are told a

slight increase in involuntary hospitalizations has been registered when compared to those of 2019. This is most likely due to an easing of safety measures and less fear of contagion.

Another interesting topic concerns the causes of hospitalization. Here, differences emerge between the countries and the local realities to which the interviewees belong. In Greece and Chile, for example, our interviewees reported that the people who were involuntarily hospitalized were those suffering from severe psychiatric disorders, such as schizophrenia and paranoid and bipolar personality disorders. There was no difference between before and after the pandemic, as only people suffering from severe mental illness, very often already known to family members or local health personnel, are involuntarily admitted. In these countries, the emergence of new psychopathologies and other causes during the pandemic is not highlighted. The consideration that derives from this is that, in this conception, mental distress coincides with a severe psychopathology that affects the body and mind of a person, and the person is identified with his or her own psychopathology. On the other hand, the two psychiatrists interviewed in Italy speak of the use of compulsory involuntary treatments not in relation to a severe psychopathology of a person, but of critical events in general which then triggered the use of hospitalization. These events include the discomfort of living all together with the family during the lockdown which, for people who were not used to sharing close family relationships in confined spaces, during the pandemic resulted in attacks of violence against themselves and members of the family or community. This difference between Italy, Greece and Chile speaks to us of the differences in the conception of mental illness between the different countries. In Chile and Greece, the psychiatric reform has not yet been completed, so a conception of mental distress

TABLE 4 Fourth core category “Policies and suggestions for more inclusive mental health care” with more descriptive quotations from participants.

|                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (d) Policies and suggestions for more inclusive mental health care | A big problem is that our hospital accepts patients from half of Greece as some regional hospitals still do not accept involuntary patients. Larger mental health centers should also be opened in rural areas of Greece and on the numerous islands of Greece.” (Psychiatrist, Thessaloniki, GR).                                                                                                            |
|                                                                    | “The health system should hire new staff, here in Italy the National Health System spends only 3% of its budget on mental health, they must hire qualified personnel, psychiatrists and psychologists ready to use a non-medical treatment model and based on rehabilitation intervention and psychotherapy” (Psychiatrist, Friuli Venezia Giulia, IT).                                                       |
|                                                                    | “The big problem is the gap between the public and private systems, here in Greece many professionals are conniving with the current system, we need to fight, create alarmism and give the poor a chance. Here the marginal bands are abandoned to themselves, more funding is certainly needed”(Professor of Psychiatry, Athens, GR).                                                                       |
|                                                                    | <i>“The biggest problem is giving people suffering from psychiatric distress a future. The question of finding a job for them is crucial to their development. Whenever I can, I try to convince the shopkeepers to hire some of my former users, especially if they are young, but you understand, this must be a goal of the state, not left to the goodwill of psychiatrists”(Psychiatrist, Rome, IT).</i> |
|                                                                    | <i>“It would be useful for a psychiatric model of community to spread throughout China, it will be very difficult, but we hope that the new generations of professionals will be able to spread a humanized psychiatric culture, the role of universities will be fundamental for this purpose (Professor of Mental Health, Hong Kong).</i>                                                                   |

as a psychopathology persists; a concept of mental distress as a failure of the relationship between contextual dimensions, social relations and the individual is still developing. Italy, on the other hand, has been the protagonist since the 1970s of a very profound reform of both the national psychiatric system, which has led to the complete closure of asylums, and the concept of psychiatric discomfort, which has moved from an organicistic dimension to a dimension of psycho-socio-relational. In Italy, it was possible to identify a new discomfort that emerged during the pandemic, a discomfort that seems to have affected the youth segment of the population, who saw themselves deprived of their future, their relationships with peers, and their chance to attend school or university. A conflict has emerged between youth culture and family culture, experienced by the young people in an obligatory and asphyxiated way during this period. Another issue concerns the management of patients who are involuntarily hospitalized in psychiatric structures. In Italy, there were no psychiatric wards for people affected by COVID-19. Rather, in each ward, distinct spaces of isolation were organized for the first days of hospitalization to find out the outcome of COVID tests. In other contexts, such as in Chile and Greece, some specific areas of psychiatric hospitals were used as COVID-19 wards, where infected people spent part of their hospital stay if positive. In these last two cases, the segregation of psychiatric patients who were separated within the psychiatric structure was certainly greater. On the other hand, in all the situations analysed, there was a lack of staff to manage the admission and hospitalization of patients.

At the end of the interviews, the participants were asked to indicate the objectives that, in their opinion, the psychiatric services of their country should pursue to improve the management of mental distress and reduce the number of people having mandatory psychiatric treatments. It was interesting to note that each reality was expressed differently, but their wishes were similar: to increase the number of psychiatric structures, to increase the number of professional staff within the psychiatric system, and to increase financing of mental health.

Another central point that can guide the development of the psychiatric systems analyzed concerns the models through which mental distress is read and interpreted. Without a model that understands the emergence of mental suffering within relationships, we are destined to make mental illness chronic. Reform of the

psychiatric system should concern the possibility of intervening in specific contexts and reducing the risk for vulnerable groups of the population, such as immigrants, the poor, and young people. In conclusion, we would like to make a final reflection on the subject of compulsory psychiatric treatments. One wonders whether intervening in these cases necessarily corresponds to a forced hospitalization in a psychiatric facility or if it is possible to carry out other types of treatment, for example by carrying out a home intervention over a medium-short period (days or a few weeks). Forced hospitalization is a violent tool for those who are subjected to it, and often the patient's rehabilitation measures do not allow them to find a home with their family that can accommodate them once hospitalization is over (49–51). The hope for the future is to be able to nourish and nurture a global model of community mental health intervention (52) by training professional staff in a holistic conception of mental distress and social stigma (53–55), also educating society to request and integrate psychiatric and psychosocial interventions (56) with support from the third sector, ensuring the continuity of care in the family and community after discharge from hospitals.

## 5. Limitation

This research certainly has important limitations, of which the reader should be aware. The first limit certainly concerns the small number of participants, it was not easy to find participants during the sampling period, many universities were closed, many professionals were difficult to find internationally via email, although efforts in this direction have been made. The second limitation concerns the difficulty of finding professional personnel in the field of mental health in China, despite our great interest, we have not received further interest from mental health professionals to join this study in that moment; in fact it was difficult to find personal information of professionals through the web due to language barriers. Unfortunately, local scientific literature is still scarce (57–59), there are no studies or data on mandatory psychiatric treatments in China or that collect experiences of mental health professionals. Another limitation concerns the fact that this exploratory study does not specifically concern mental health in childhood or adolescence (56). Another limitation concerns the generalizability of the data, the



results of this study are to be understood exclusively in relation to a specific non-replicable historical moment and that the experiences of the key people involved are to be considered as subjective narratives not attributable in general to universal contexts. Finally, another limit concerns the choice of countries to compare, a choice dictated by availability within the acquaintance of the authors and the desire to compare different continents (Europe, Asia and South America), with great divergence on the treatment of mental illness and in the advancement of a territorial reform of mental health treatment; this choice could certainly have concerned other National contexts.

## Data availability statement

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

## Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee of LSE - London School of Economics and Political Sciences (Ref. 28888 - 2021). The patients/participants provided their written informed consent to participate in this study.

## Author contributions

AC and MK contributed to conception and design of the study. AC organized the database, performed the analysis, and wrote the

first draft of the manuscript. MK supervised the manuscript. All authors contributed to the article and approved the submitted version.

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

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# Behind the scenes of the healthcare COVID-19 pandemic crisis: potential affecting factors of healthcare work sustainability in Romania during 2020–2022

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**Aim:** The COVID-19 pandemic represented a great disturbance for medical systems around the world, putting medical personnel on the front lines of the fight against the SARS-Cov2 virus. This fight was particularly impactful in countries with medical systems already facing various challenges, including Romania; where the pandemic unfolded in five waves that severely affected the psychological and physical well-being of medical professionals in terms of overload and continuous exposure to health threats. Against this background, our research aims to identify the mediating role of potential affecting factors of healthcare work sustainability during the change-related uncertainty conditions generated by the COVID 19 crisis. Dynamics and relations of nine carefully selected constructs were tracked along all five pandemic waves in Romania, which span from March 2020 to April 2022. The tested variables and constructs are perception of healthcare workers of their own state of health, their workplace safety, the work–family conflict, the satisfaction of basic needs, the work meaningfulness and work engagement, patient care, pandemic stress and burnout.

**Methods:** This cross-sectional study is based on an online snowball sampling of 738 health workers from 27 hospitals. Panel research is limited to a maximum of 61 respondents for two successive waves. The analytical part is built on means comparison of analysed variables between all five pandemic waves and an in-depth model to explain the relationships between the variables.

**Results:** The results indicate statistically significant correlations between the perception of health risks and all selected factors excluding patient care, which seems to be above the own health perception. The factors' dynamics was followed along all five pandemic waves. The developed model identified that one's health status satisfaction is a mediator of the family–work conflict and, together, of work engagement. In turn, work engagement plays a significant role in satisfying basic psychological needs and supporting work meaningfulness. Also, work meaningfulness influences the satisfaction of basic psychological needs.

**Discussion:** Health workers with higher levels of positive perceived health are better at managing pandemic stress, burnout effects and work–family imbalances. Adaptive behaviors and attitudes towards COVID-19 pandemic threats could be identified in later pandemic waves due to the progress in terms of medical protocols and procedures.

## KEYWORDS

COVID-19, medical staff, cross-sectional survey, panel study, SEM, health perception, work engagement and meaningfulness

## 1. Introduction

The COVID-19 pandemic caused by the SARS-CoV-2 virus appeared in China in December 2019 and spread rapidly throughout the world (1). The disease recorded 525,467,084 confirmed cases and more than 6,285,171 deaths between March 2020 and May 2022 (2), putting humanity in front of an unprecedented health policy crisis (3). The classic sanitary control measures (i.e., social distancing and wearing a gauze face mask), which were introduced with great difficulty by doctors such as Max C. Starkloff aiming to limit the spread of the Spanish flu in 1918 (4), were complemented in modern times by appropriate new treatments and vaccines, which could trigger possible adaptive behaviors and attitudes of medical personnel towards COVID-19 threats in successive pandemic waves.

In Romania, the first case of SARS-CoV-2 infection emerged on February 26, 2020 (5), and by April 2022 the total number of deaths caused by the COVID-19 disease raised to 65,486 (6, 7) (Table 1).

Being confronted with periodic increases in the number of infected people, hospitals faced both an overload, and the contamination of the medical staff. Moreover, in certain hospitals, the number of medical personnel was reduced due to redistribution to the areas most affected by COVID (e.g., Marius Nasta Hospital, Bucharest) (8). An immediate consequence was the mental and physical overload of the medical staff remaining active in the source hospital (9).

## 2. Research background

Our research is embedded in the behavioral adaptability theoretical background at the individual context-specific level (10, 11).

In the last decades, extensively investigations have been conducted by scholars in the field of adaptability at the individual level (12–18).

Doron (19) defines adaptation as a “dynamic process of change, in order to find balance with the environment and assuming the ability to learn.” In the same way, Gorgos (20) believes that adaptation is an “active, dynamic and creative process, which requires a permanent

effort made through the processes of integration and regulation, which makes possible the optimal use of functional reserves, as well as their restoration during the period when the demand ceases.” At the same time, adaptation facilitates the elimination or change of conditions that create problems; perceiving the control of the meaning of the experiences in such a way as to neutralize their problematic character; keeping the emotional consequences of problems within controllable limits (21, 22).

Kiymaz (23) stated that “our brain and body react physiologically and behaviourally to adapt to a social and physical environment that can put your life in danger” ((23), p 1163). In the process of psychosocial adaptation, the individual tends to achieve a harmony between living conditions and internal or external activity. As this harmony is achieved, the degree of adaptability of the individual increases. Psychosocial adaptation also appears as a means of protecting the individual, with the help of which one relaxes and eliminates internal psychic tension, restlessness, destabilizing states (24).

The COVID 19 crisis generated a large amount of change-related uncertainty (25) most dramatically affecting the health professionals put on the front lines of the fight against the SARS-CoV-2 virus. During the COVID 19 pandemic crisis, the medical staff was constantly faced with mighty challenges related to limited resources (26), longer shifts, disturbances in the balance between professional and private life, sleep impairment, and major changes in their working environment (27–29). As changes in the working environment increased dramatically during the COVID 19 crisis, the stress levels also increased. Neuroscience studies ((30), p 384 (31)) show that under increased stress levels, both creativity and the ability to sustain high-level thinking decrease. Stressors have an impact on creative problem-solving skills in difficult situations, so that the ability to multitask is reduced.

Health workers underwent several dramatical changes in their lifestyle, living with the constant fear of contamination, sleep shortening, behavioral changes (32). As a direct consequence, an increase in mental problems has been measured in an abundance of

TABLE 1 The highest daily number of COVID-19 cases per wave in Romania (source Ministry of Internal Affairs and Ministry of Health, 2020–2022).

| Pandemic waves                   | Variant of SARS-CoV-2 | New daily cases | People hospitalized | People hospitalized in (intensive care units) | Deaths |
|----------------------------------|-----------------------|-----------------|---------------------|-----------------------------------------------|--------|
| Wave 1 (March–May 2020)          | Alpha                 | 362             | –                   | 247                                           | –      |
| Wave 2 (September–December 2020) | Alpha Beta            | 10,260          | 12,133              | 1,130                                         | 171    |
| Wave 3 (March–May 2021)          | Gamma                 | 6,651           | 14,165              | 1,531                                         | 237    |
| Wave 4 (September–December 2021) | Delta                 | 18,863          | 20,962              | 1902                                          | 574    |
| Wave 5 (January–March 2022)      | Omicron               | 40,018          | 11,884              | 1,169                                         | 215    |

publications investigating the complex ways in which medical personnel were psychologically affected (29, 33). In the context of COVID-19 pandemic, the most frequently recorded consequences were anxiety, stress due to overwork, frustration, discrimination, isolation, lack of contact with family members, pressure and exhaustion due to high risk of infection and inadequate protection against contamination, post-traumatic stress disorder, psychological distress and depression, sleep disorders, and fear (28, 34–49).

According to other studies, during COVID-19, the possibility of infecting family and friends traumatized medical workers (50) and diminished the level of their psychological well-being that contributes to safety, happiness, satisfaction and increased work performance (51).

Therefore, the burnout increased by 25–30% compared to the period before the pandemic (52, 53), and the most prominent sources of burnout were the cumulative work tasks, uncertainties caused by the pandemic, work-family imbalance and strained relationships at work (54). Taylor (49) mentioned, referring to a study on natural disasters and making a correlation with the COVID 19 pandemic crisis, that 10% of people who have gone through traumatic events, in the context of increased emotional stress and social problems, can immediately or later develop severe psychological problems, such as post-traumatic stress disorders, anxiety disorders, restlessness, sleep disorders, mood disorders.

On the other hand, support, job satisfaction, and an improvement in the self-esteem of medical personnel, were listed as protective factors against burnout (55), showing that the pandemic had serious implications for patient care and job satisfaction (56). The association between the doctor's burnout scale with work involvement and the quality of care given to patients is important for highlighting the general efficiency of medical service providers (57–59).

Designed against this background of pandemic induced uncertainty, our study aims to identify potential affecting factors in physicians' work sustainability during the COVID-19 pandemic in Romania in terms of health workers' perception-related variables (their own state of health), perceived threat of COVID-19 (pandemic stress), work-family conflict, patient care, work engagement, meaning of and commitment to work, satisfaction of basic psychological needs, as well as psychological and professional burnout of healthcare professionals during the COVID-19 pandemic, at the level of 27 hospitals in Romania.

An important attempt is to identify possible relationships between the nine tested constructs and adaptive behaviors and attitudes towards COVID-19 pandemic threats due to the progress of medical protocols, from the way the tested factors fluctuated during the 5 pandemic waves, both at the level of the independent samples and among the subjects in the panel. An in-depth structural model was built to explain the relationships between the selected constructs.

## 3. Methodology

### 3.1. General approach

This study undertakes a cross-sectional approach, applying repeated surveys with different respondents in each wave on a total of 738 subjects. This is complemented by a panel-oriented approach (participants who responded in two successive pandemic waves), totalling a maximum of 61 respondents per successive waves.

Participants were recruited from the medical personnel of 27 hospitals in Romania. These professionals were involved in the fight against the pandemic along the five waves, beginning in May 2020 and ending in April 2022. We applied the on-probability snowball sampling technique (60), sharing the questionnaire online for voluntary participation. Respondents were asked to read and agree to informed consent and the statement regarding the processing of the data collected through the survey. Upon request, additional information was made available for respondents *via* email.

### 3.2. Measures

#### 3.2.1. Risk perception

The questionnaire investigated the perception of various risks to which participants are exposed, the work-family conflict, the satisfaction of basic needs, the work meaningfulness and work engagement, patient care, pandemic stress and burnout. This section describes the operationalisation of these aspects. The measuring of *risk perception* focused on the level of perceived state of health, perceived safety versus workplace insecurity, the perceived level of danger, and the existence of an "unhealthy" environment (e.g., with risk of injury, death, health damage) during the SARS-CoV-2 pandemic. An example of an item is: "Describe your workplace in relation to the crisis generated by the Coronavirus pandemic: Dangerous, Safe, Risky, Unhealthy, Uncertain, Risk of death." Answers were scored on a 5-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree).

#### 3.2.2. Work-family conflict

Work-family conflict was measured with the Work Family Conflict Scale proposed by Carlson and Kacmar (61). The scale is based on six dimensions of conflict, resulting from the combination of three forms of work-family conflict (time, strain, and behavior), and two directions of work-family conflict (work-family interference and family-work interference). In the current study, only 6 items of the Work-Family Conflict Scale were used, considering only 2 dimensions of the scale: time based on work-family interference, and strain based on work-family interference. The current study aims to highlight the impact of the activities carried out by medical personnel at work on their family, as well as the state of tension and stress resulting from this interaction (e.g., "Work keeps me away from my family for too much time," "The time I spend at work does not allow me to participate enough in family activities," "When I get home from work, I am too tired to participate in family activities," "It happens that the stress at work also affects me at home, so that I can no longer do what I like or what I enjoy"). All items are scored directly and involved responses on a five-point Likert scale, from 1 (never) to 5 (always).

#### 3.2.3. Work engagement

Work engagement was measured with the short version of the Utrecht Work Engagement Scale (UWES-9) (62, 63), which refers to three factors of work engagement, with three items each: vigor (e.g., "When I wake up in the morning, I feel like going to work"), dedication (e.g., "I am proud of the work I do"), and absorption (e.g., "I am fully involved when I work"). All the items are scored directly, on a 7-point Likert scale, from 0 (never) to 6 (always).



### 3.2.4. Basic psychological needs satisfaction

Basic needs satisfaction was measured using the Basic Psychological Needs Satisfaction Scale and the Frustration Scale (64). The three subscales focus on autonomy (e.g., “At work, I feel a sense of choice and freedom in the things I undertake”), competence (e.g., “I feel confident that I can do things well at work”), and relatedness/referring to the extent to which a person feels connected with and valued by others (e.g., “I feel that people who care at work care about me too”). Each of the three subscales was assessed *via* satisfaction questionnaires with 4 directly scored items on a seven-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). Thus, participants report the extent to which their three basic needs were met in the last weeks at work.

### 3.2.5. Work meaningfulness

Work meaningfulness was measured with the Work inventory and the Meaningful work scale (65), which introduces three components of meaning at work: positive meaning (e.g., “I have a good sense of what makes my work meaningful”), gaining meaning through work (e.g., “My work helps me understand myself better”) and better motivations (e.g., “I know my work makes a positive difference in the world”). The directly scored items required answers on a five-point Likert scale, from 1 (absolutely not true) to 5 (absolutely true).

### 3.2.6. Patient care

Patient care was measured with the Patient Care scale (66), an 8-item scale that investigates suboptimal patient care practices (five items, e.g., “We did not fully discuss treatment options.”) and patient care attitudes (three items, e.g., “We paid little attention to the social or personal aspects of the illness impact.”). All the items were scored directly, on a 5-point Likert scale, from 1 (never) to 5 (weekly).

### 3.2.7. Pandemic stress

Pandemic stress was measured with the corresponding Stanford Acute Stress Reaction Questionnaire – SASRQ, which was developed and validated by Cardena et al. (67) to assess psychological symptoms experienced following a traumatic episode. The SASRQ instrument investigates dissociation (e.g., subjective feeling of numbness, detachment and lack of emotional responsiveness, reduced awareness of the environment, derealization, depersonalization, and dissociative amnesia - 10 items), reexperiencing trauma (6 items), avoidance (6 items), hyper anxiety (6 items), anxiety and impairment of functioning (2 items). The questionnaire was initially applied in the context of natural disasters (floods), but we adapted it to fit the context of traumatic episodes related to the COVID-19 pandemic crisis. All the items are directly scored, on a 6-point Likert scale, from 0 (“I have not experienced/experienced the respective condition.”) to 5 (“I have experienced the respective condition very often.”). This scale was introduced in the research design starting with the second pandemic wave, to measure if new waves lead to an increase in the stress felt by medical professionals.

### 3.2.8. Burnout

The Burnout Scale [22-item *MBI - Maslach Burnout Inventory* (68)] was originally developed to measure burnout as a specific type of response to occupational stress among human service professionals. We used the 9-item short version of the Maslach Burnout Measurement Inventory (69, 70), with three subscales (exhaustion,

cynicism, and inadequacy, including feelings of overwhelming emotional exhaustion, feelings of cynicism and detachment from the workplace defined as depersonalization, and a sense of ineffectiveness and reduced personal fulfilment). Each subscale has 3 directly scored items, measured on a 7-point Likert scale, from 0 (never) to 6 (daily). This scale was introduced in the research design starting with the third pandemic wave, to test whether the persistence of the pandemic waves leads to various degrees of professional exhaustion.

We tested the reliability of the structure by assessing the internal consistency of all applied scales using Cronbach's alpha. The Cronbach's alpha of each construct was higher than the recommended level of 0.7.

## 3.3. Data collection

The data was gathered online during the five pandemic waves using Google Forms for each of the corresponding five rounds, and mainly came from Bucharest (425) and the neighbouring counties: Ialomița (152), followed by Brăila (77), Galați (10), but also from other counties such as Bacău (6), Teleorman (6), Constanța (5), Tulcea (5), Sibiu (5), Călărași (5), Giurgiu (4), Argeș (3), Bihor (2), Neamț (2), Vaslui (2), Olt (2), Brașov (2), Timiș (2) (Figure 1).

The first survey took place between March and May 2020, with a total of 216 healthcare workers. The second round of data collection unfolded in September 2020–January 2021, with 121 respondents, of which 18 subjects were on the panel (i.e., those who took part in the survey in two successive pandemic waves, namely waves 1 and 2).

The third survey took place from February to May 2021, focusing on 195 respondents, with only 6 participants in the panel between waves 2 and 3 (i.e., 9.37% of wave 2, and 3.09% of the third wave).

The fourth round of data collection took place between September and December 2021, and 68 healthcare workers completed the survey, of whom 6 were included in the corresponding panel (i.e., those who repeated in waves 3 and 4). They accounted for 3.09% respondents from the third wave, and 8.82% of respondents from the fourth wave.

The final stage of data collection unfolded between January and March 2022: 138 healthcare workers completed the survey and 31 were panel respondents (i.e., subjects who repeated in waves 4 and 5, respectively 45.58% of respondents from the fourth wave, and 22.46% from the fifth wave). At large, the number of people who participated in the survey in at least two successive pandemic waves (panel participants) reached 61 respondents (respectively 8.26%).

## 3.4. Analytics

Analytical procedures were computed using the IBM® SPSS® Statistics and Jamovi v1.6.23 softwares (71). The computation procedures focused on absolute and relative frequency, means, standard deviations, and normality indicators (i.e., skewness and kurtosis). We calculated the bivariate Pearson correlations ( $r$ ) across the study variables, following Cohen's (72) benchmarks for interpretation: weak correlation ( $r < 0.3$ ), moderate correlation ( $0.3 < r < 0.55$ ), strong correlations ( $r > 0.5$ ).

The analyses relied on two non-parametric statistical hypothesis tests. The Mann–Whitney U test was applied to explore perception differences at the level of cross-sectional samples during the five



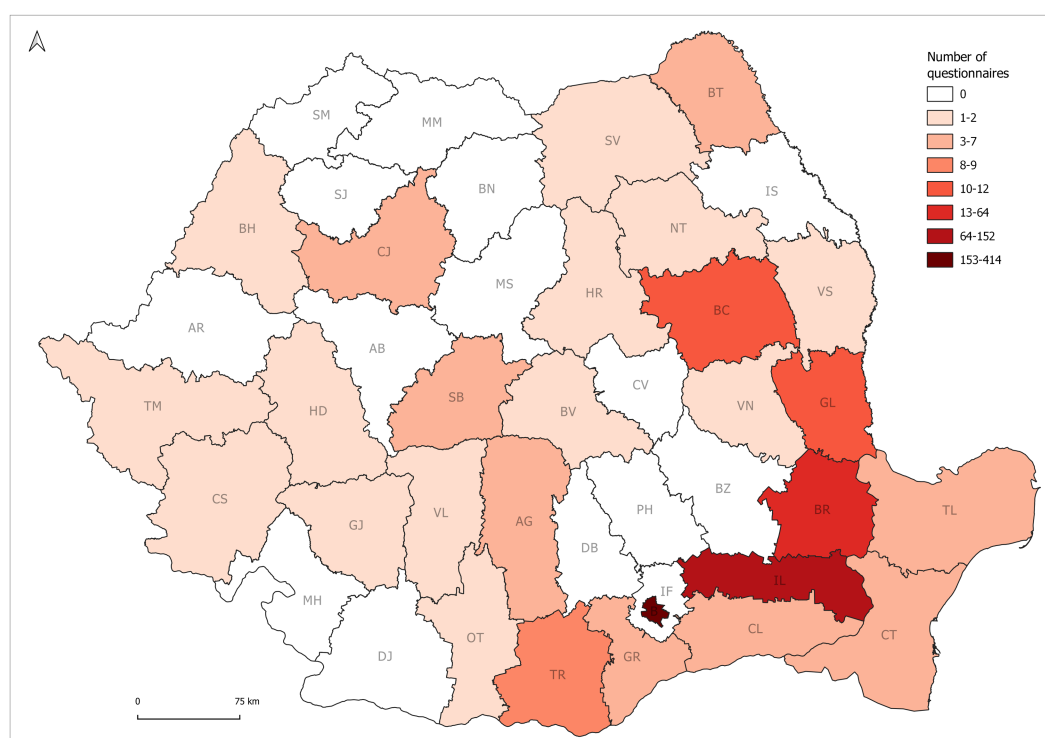


FIGURE 1  
Geographical distribution of respondents.

pandemic waves. The Wilcoxon signed rank test was applied for the comparative analysis of health status perception of medical staff participating in two consecutive waves.

Using nonexperimental data, causal relationships were examined with path analysis using the Jamovi open software. We developed a model of hypothesized causes in order to test the coping role during the COVID-19 pandemic of health workers' perception regarding their own state of health in relation with work engagement, family-work relations, basic psychological needs satisfaction, and work meaningfulness. The constructs and their indicators were specified and estimated, followed by structural relationships in the model, which were obtained using the same steps. Further on, the hypothesized model of relations was statistically tested to determine the extent to which it was consistent with the data. We first applied the path analysis to test the initial hypothesized model. Next, the latent variable structural equation modelling - SEM was applied to accurately identify the relationships in the system.

The SEM comprises both a measurement model and a structural model. It was used to analyse the relationships between observed variables (derived directly from measurements) and latent variables (constructs that can be measured indirectly by determining their influence on the responses of the measured variables) (73–77). The applied methodological steps were: (1) model identification, (2) parameter estimation, (3) model-fitting, (4) model redefinition, and (5) interpretation of results. In the case of SEM, we followed the five step-model specification, firstly defining the independent and dependent variables; and continuing with the same next steps. We used standardized coefficients to increase comparability and to make inferences regarding the strength of identified relationships (i.e.,

variables with mean=0 and standard deviation=1). The fit of the model to the field data was measured using the chi-square test (78), the comparative Tucker-Lewis Index [TLI; (79)], the comparative fit index [CFI; (80, 81)], the root mean square error of approximation related to the residual in the model [RMSEA; (82)], and the standardized root mean squared residual (SRMR; 75, 76, 83).

## 4. Results

### 4.1. Sample

The 738 completed questionnaires that resulted from the data collection phase showed that the sample is dominated by women (74.5% respondents, mirroring the predominantly female structure of the health personnel in Romania, with 70.5% women among doctors in 2020). Participants with ages of 40–49 years totalled 42.68% of the sample. Most of the medical staff graduated from post-secondary schools (46.61%), and only a third from college (29.40%). The other study levels were represented as follows: postgraduate studies (14.76%), secondary education (7.99). These numbers also indicate the age structure of specific occupations in the medical sector: respondents aged up to 20–29 years mainly have secondary education (post-secondary school); 10.70%, having the lowest average period of employment 0–1 year (20–29 years) (Table 2).

Respondents aged 40–49 years have the highest share (24.12%) in the category of post-secondary school. The lowest weight of those with secondary school education (2.43%) is in the age category 50–59 years. Results underline that the positions that do not require specialized

TABLE 2 Frequency distribution of socio-demographic characteristics on research waves.

| Variables               |                                               | Total (738) | Wave 1 (216) | Wave 2 (121) | Wave 3 (195) | Wave 4 (68) | Wave 5 (138) |
|-------------------------|-----------------------------------------------|-------------|--------------|--------------|--------------|-------------|--------------|
| Gender                  | M                                             | 25.61       | 30.60        | 29.00        | 24.10        | 25.00       | 21.74        |
|                         | F                                             | 74.39       | 69.40        | 92.00        | 75.90        | 75.00       | 78.26        |
| Education               | Secondary education                           | 7.99        | 15.30        | 8.20         | 3.60         | 2.94        | 5.07         |
|                         | Post-secondary studies                        | 46.61       | 42.60        | 43.00        | 62.10        | 48.52       | 39.85        |
|                         | University studies                            | 29.40       | 28.70        | 31.40        | 25.10        | 33.82       | 32.60        |
|                         | Postgraduate studies                          | 14.76       | 13.40        | 17.40        | 9.20         | 14.70       | 22.46        |
| Position                | Caregiver, nurse, stretcher bearer, registrar | 21.54       | 9.40         | 9.10         | 8.10         | 23.53       | 28.26        |
|                         | Medical assistance, paramedic                 | 73.57       | 71.76        | 67.76        | 74.36        | 75          | 63.04        |
|                         | Doctor                                        | 5.82        | 19.00        | 23.20        | 5.60         | 1.47        | 2.90         |
| Age                     | 20–29 years old                               | 10.70       | 10.70        | 9.10         | 7.10         | 8.82        | 18.11        |
|                         | 30–39 years old                               | 26.83       | 30.10        | 45.50        | 15.10        | 17.64       | 26.81        |
|                         | 40–49 years old                               | 42.68       | 44.10        | 37.30        | 49.40        | 51.47       | 32.20        |
|                         | 50–59 years old                               | 18.43       | 14.40        | 8.30         | 27.80        | 17.64       | 21.74        |
|                         | >60 years old                                 | 1.35        | 1.00         | –            | 1.00         | 2.94        | 1.44         |
| Professional experience | 0–1 years                                     | 5.01        | 4.20         | 2.50         | 5.60         | 2.94        | 8.69         |
|                         | 1–3 years                                     | 10.56       | 9.30         | 18.20        | 8.70         | 5.88        | 10.87        |
|                         | 3–5 years                                     | 17.47       | 14.81        | 25.60        | 16.49        | 13.23       | 18.11        |
|                         | >10 years                                     | 66.93       | 71.80        | 53.70        | 69.20        | 77.94       | 62.32        |

studies (unqualified) in the medical system are occupied by young people, who are in the early stages of employment, look out for new job opportunities and are less likely to fill their current position for long periods. The best represented professional categories in this study were nurses (68.29%) and doctors (18.56%), the rest of 13.13% being paramedics, stretcher bearers, and registrars. However, these percentages change from one pandemic wave to another.

Medical doctors represented only 1.47% of the participants who completed the survey during the fourth wave, they were best represented in the second wave (23.20%) (Table 2).

Regarding seniority at work, the most numerous were people with seniority >10 years, followed by seniority of 3–5 years, most of them being medical assistants, followed by doctors.

## 4.2. Descriptive statistics

Overall, the distribution of answers by pandemic waves is relatively balanced, but there are also particularities that need to be considered: medical assistants provided the most answers in the 4th pandemic wave (75%), and doctors in the 2nd wave (23.20%).

The descriptive analysis (Table 3) shows that the highest values in terms of the mean of work - family conflict scale were recorded during the 2nd and 4th pandemic waves, while the means regarding the satisfaction of basic psychological needs, the perception of the personal state of health, meaning of and commitment to work have higher values in waves 1 and 3. Workplace engagement and the

perception of the workplace achieved higher values in waves 2 and 3. Patient care has higher values in the first two waves, and professional burnout has higher values towards the end of the pandemic, during waves 4 and 5. On the other hand, stress associated with COVID surged during the middle of the pandemic, in waves 2 and 4.

## 4.3. Inferential results

Inferential analysis tested the importance of one's own state of health in relation to all selected factors and the dynamics of these variables during the five pandemic waves, both at the level of independent samples and in the panel study, to identify possible adaptive behaviors and attitudes towards the COVID-19 pandemic threats. The path analysis and the latent variable structural equation modelling - SEM were applied to explain the relationships between the selected constructs.

### 4.3.1. Health perception

The fundamental hypothesis is that, in the context of the COVID-19 pandemic, perception of one's own state of health is pivotal for the perception of all other considered variables: the perception of the specific risks at work, the felt state of pandemic stress, satisfaction of basic psychological needs, meaning of and commitment to work, patient care, but also of the conflict between work and the family life.

This set of working hypotheses are supported by significant direct and indirect proportional correlations (with various degrees of

TABLE 3 Descriptive analysis on research waves.

| Scale (no respondents)                                   | Total mean (SD) | Wave 1 mean (SD) 216 | Wave 2 mean (SD) 121 | Wave 3 mean (SD) 195 | Wave 4 mean (SD) 68 | Wave 5 mean (SD) 138 |
|----------------------------------------------------------|-----------------|----------------------|----------------------|----------------------|---------------------|----------------------|
| Perception of the personal state of health (738)         | 7.57 (1.69)     | 8.07(1.28)           | 7.09 (1.93)          | 7.64 (1.44)          | 6.75 (2.08)         | 6.97 (1.88)          |
| The perception of the workplace (738)                    | 34.67 (7.12)    | 30.7 (6.92)          | 33.0 (6.42)          | 32.9 (6.30)          | 33.3 (5.79)         | 30.5 (6.61)          |
| Work–family conflict scale (738)                         | 21.67 (6.09)    | 19.8 (6.47)          | 22.2 (5.69)          | 22.5 (5.72)          | 22.9 (5.78)         | 22.4 (5.96)          |
| Workplace engagement (738)                               | 42.26 (8.60)    | 4.36 (8.52)          | 41.8 (8.24)          | 43.1 (8.28)          | 40.0 (8.33)         | 40.5 (9.18)          |
| Scale of satisfaction of basic psychological needs (738) | 66.78 (12.72)   | 68.7 (12.7)          | 65.9 (13.5)          | 67.5 (11.4)          | 65.1 (12.5)         | 64.3 (13.5)          |
| The work and meaningful inventory (738)                  | 42.01 (5.79)    | 42.4 (5.66)          | 41.9 (6.24)          | 42.4 (5.45)          | 41.3 (5.64)         | 41.3 (6.13)          |
| Patient care (591)                                       | 21.11 (5.55)    | 19.8 (8.71)          | 20.4 (8.89)          | 18.5 (9.09)          | 17.0 (9.74)         | 10.7 (6.04)          |
| Stanford acute stress reaction questionnaire (555)       | 53.67 (36.94)   | 7.0 (22.1)           | 55.4 (38.2)          | 48.2 (33.5)          | 62.5 (39.1)         | 57.5 (38.1)          |
| Maslach burnout inventory (415)                          | 21.28 (12.92)   | –                    | 2.18 (6.68)          | 19.1 (12.6)          | 24.2 (12.9)         | 23.2 (13.2)          |

strength) between the perception of one's state of health and almost all other variables, with one exception (Table 4). Patient care seems to be above the own health perception, but it is significantly, moderately negatively correlated with stress reaction, and significantly, weakly negatively correlated with burnout (Table 4).

Health workers with higher levels of positive perceived health are better at managing pandemic stress ( $-0.328$ ;  $p = 0.001$ ) and burnout effects ( $-0.265$ ;  $p = 0.001$ ). In the same acceptance, a positive health perception balances family-work conflicts ( $-0.283$ ;  $p = 0.001$ ) and negative workplace engagements ( $-0.163$ ;  $p = 0.001$ ). Work engagement is also negatively correlated with burnout ( $-0.453$ ;  $p = 0.001$ ) and pandemic stress ( $-0.282$ ;  $p = 0.001$ ).

Perceived health and work engagement are positively correlated with the satisfaction of basic psychological needs ( $0.271$ ,  $p = 0.001$  and  $0.690$ ;  $p = 0.001$ , Table 4). The perception of workplace highly positively correlates with the work versus family conflict, drawing attention to the fact that the workplace fulfils the function of a second family ( $0.501$ ;  $0.0001$ ). Intuitively, the meaning of work negatively correlates with the effects of burnout ( $-0.335$ ;  $p = 0.001$ ).

These results are best expressed among doctors, who display high levels of meaningful work and work engagement. Such positive attitudes towards work are shown by the following percentages: 50.73% of responders are highly involved in their work, 36.02% being excited when they work, 30.88% state that they want to go to work when they wake up in the morning, 28.67% are happy when they work intensively, and 11.76% of the doctors answered that they are full of energy at work.

In terms of work significance, 59.55% of the medical personnel declared that they have a career full of significance, 57.35% of doctors stated that their work has a positive impact in the world. Also 50.73% know the significance of their work and 48.52% recognize the contribution of their work to the meaning of life.

### 4.3.2. Dynamics of health perception

An important task of our research was to capture the dynamics of health perception ("How satisfied are you with your state of health?") during the 5 pandemic waves, both at the level of independent samples (based on the Mann–Whitney U test) and in the panel study (*via* the Wilcoxon signed rank test).

Results summarized in Table 5 (the value of  $p$  associated with the Mann–Whitney U test is listed) show statistically significant differences in terms of health assessment scores between the first wave and the other four waves, and between wave 3 and the next two ones, as described below.

Certain adaptive behaviors and attitudes towards the COVID-19 pandemic threats are visible during waves 2, 4 and 5 (Mann–Whitney U test  $p < 0.05$ ). Respondents acknowledge that they have coped better with latter pandemic waves due to the progress in terms of medical protocols and procedures. At the beginning of the pandemic there was some lack of confidence and a high degree of scepticism regarding the perception of one's own health state. Also, waves 1 and 3 are significantly different from waves 4 and 5 (Table 5A). A decrease in the satisfaction level regarding the state of health can be observed during the last two pandemic waves, compared to the onset of the COVID-19 pandemic (wave 1). However, it should be highlighted that the maximum values of health state declared in the self-assessment at the beginning of the pandemic may be the result of a cognitive dissonance effect, which is a psychosocial phenomenon of denying a possible personal vulnerability (84). The perception of one's own state of health fluctuates from wave to wave, maintaining lower values than in the initial state. Thus, although the medical personnel was confronted with a shortage of knowledge on adequate mitigation procedures and treatment protocols during the first pandemic wave, they displayed a compensatory overconfidence in their own state of health (85), which may have helped the fight against the virus. The lower values related to one's own health state recorded during the 2nd

TABLE 4 Correlation Pearson.

| Correlations                                       |                     | How satisfied are you with your state of health? | The perception of the work place | Work–family conflict scale | Workplace engagement | Scale of satisfaction of basic psychological needs | The work and meaning inventory | Patient care | Stanford acute stress reaction questionnaire | Maslach burnout inventory |
|----------------------------------------------------|---------------------|--------------------------------------------------|----------------------------------|----------------------------|----------------------|----------------------------------------------------|--------------------------------|--------------|----------------------------------------------|---------------------------|
| How satisfied are you with your state of health?   | Pearson Correlation | 1                                                | −0.163**                         | −0.283**                   | 0.298**              | 0.271**                                            | 0.196**                        |              | −0.328**                                     | −0.265**                  |
|                                                    | Sig. (2-tailed)     |                                                  | 0.000                            | 0.000                      | 0.000                | 0.000                                              | 0.000                          | 0.117        | 0.000                                        | 0.000                     |
|                                                    | N                   |                                                  | 525                              | 525                        | 525                  | 525                                                | 525                            | 416          | 384                                          | 304                       |
| The perception of the workplace                    | Pearson Correlation |                                                  | 1                                | 0.501**                    | −0.155**             | −0.139**                                           | −0.004                         | 0.107*       | 0.314**                                      | 0.294**                   |
|                                                    | Sig. (2-tailed)     |                                                  |                                  | 0.000                      | 0.000                | 0.001                                              | 0.921                          | 0.03         | 0.000                                        | 0.000                     |
|                                                    | N                   |                                                  |                                  | 525                        | 525                  | 525                                                | 525                            | 416          | 384                                          | 304                       |
| Work–family conflict scale                         | Pearson Correlation |                                                  |                                  | 1                          | −0.265**             | −0.239**                                           | −0.005                         | −0.054       | 0.370**                                      | 0.423**                   |
|                                                    | Sig. (2-tailed)     |                                                  |                                  |                            | 0.000                | 0.000                                              | 0.250                          | 0.274        | 0.000                                        | 0.000                     |
|                                                    | N                   |                                                  |                                  |                            | 525                  | 525                                                | 525                            | 416          | 384                                          | 304                       |
| Workplace engagement                               | Pearson Correlation |                                                  |                                  |                            | 1                    | 0.690**                                            | 0.643**                        | 0.086        | −0.281**                                     | −0.453**                  |
|                                                    | Sig. (2-tailed)     |                                                  |                                  |                            |                      | 0.000                                              | 0.000                          | 0.080        | 0.000                                        | 0.000                     |
|                                                    | N                   |                                                  |                                  |                            |                      | 525                                                | 525                            | 416          | 384                                          | 304                       |
| Scale of satisfaction of basic psychological needs | Pearson Correlation |                                                  |                                  |                            |                      | 1                                                  | 0.610**                        | 0.108*       | −0.258**                                     | −0.299**                  |
|                                                    | Sig. (2-tailed)     |                                                  |                                  |                            |                      |                                                    | 0.000                          | 0.028        | 0.000                                        | 0.000                     |
|                                                    | N                   |                                                  |                                  |                            |                      |                                                    | 525                            | 416          | 384                                          | 304                       |
| The work and meaning inventory                     | Pearson Correlation |                                                  |                                  |                            |                      |                                                    | 1                              | 0.058        | −0.168**                                     | −0.335**                  |
|                                                    | Sig. (2-tailed)     |                                                  |                                  |                            |                      |                                                    |                                | 0.238        | 0.001                                        | 0.000                     |
|                                                    | N                   |                                                  |                                  |                            |                      |                                                    |                                | 416          | 384                                          | 304                       |
| Patient care                                       | Pearson Correlation |                                                  |                                  |                            |                      |                                                    |                                | 1            | −0.022                                       | −0.105                    |
|                                                    | Sig. (2-tailed)     |                                                  |                                  |                            |                      |                                                    |                                |              | 0.694                                        | 0.105                     |
|                                                    | N                   |                                                  |                                  |                            |                      |                                                    |                                |              | 309                                          | 241                       |

(Continued)

TABLE 4 (Continued)

| Correlations                                 | How satisfied are you with your state of health? | The perception of the work place | Work–family conflict scale | Workplace engagement | Scale of satisfaction of basic psychological needs | The work and meaning inventory | Patient care | Stanford acute stress reaction questionnaire | Maslach burnout inventory |
|----------------------------------------------|--------------------------------------------------|----------------------------------|----------------------------|----------------------|----------------------------------------------------|--------------------------------|--------------|----------------------------------------------|---------------------------|
|                                              | Pearson Correlation<br>Sig. (2-tailed)<br>N      |                                  |                            |                      |                                                    |                                |              |                                              |                           |
| Stanford acute stress reaction questionnaire |                                                  |                                  |                            |                      |                                                    |                                |              | 1                                            | 0.559**<br>0.000<br>304   |
| Maslach burnout inventory                    | Pearson Correlation<br>Sig. (2-tailed)<br>N      |                                  |                            |                      |                                                    |                                |              |                                              | 1<br>0.000<br>304         |

wave indicate a delay in these concerns, which increased in the next wave, on the grounds that experience gained in previous waves makes us more confident in preventing disease. Lower health state-related values correspond to waves 4 and 5, suggesting an adaptation to the situation, reflected by a decrease in the concern for one's own health.

The results of the Wilcoxon signed rank test, show that statistically significant differences were recorded between the answers collected in the panel during waves 1, 2 and 4 (Table 5B). These findings are explained by the fact that people were more scared at the very beginning of the pandemic, having the feeling that their health would be seriously affected. In the fourth wave, they already adapted to the pandemic conditions, believing that their health will not be severely impacted by the SARS CoV-2 virus.

The perception of the state of health and the perceived danger at work during the pandemic was tested using the Mann–Whitney U test. The results show that there are significant differences ( $p < 0.05$ ) in the scores obtained for these variables between the following waves: wave 1 and waves 2, 3; wave 2 and wave 5; wave 3 and wave 5 (Table 6A).

The mean values show that the perception of workplace safety against the effects of the pandemic in waves 1 and 5 was lower than in waves 2, 3, 4. The transition from the COVID-19 Alpha variants specific to the first wave, to the Omicron variant characteristic to the last wave had a significant impact on health workers. Nonetheless, at the beginning of the pandemic, COVID-19 was something new and quite dangerous, causing the medical staff to doubt the safety of their workplace. The measures mandated to combat the pandemic were also very strict during the first wave (lockdown), whereas the Omicron variant of the virus, which emerged at the end of the pandemic, was perceived more as an easy flu, meaning that the perception of the danger to one's health at work decreased. In waves 2, 3, and 4, the COVID-19 isolation measures were no longer very strict in Romania, which led to higher levels of health-related self-assessment.

The Wilcoxon signed rank test recorded statistically significant differences between responses regarding the workplace perception of people in the panel between wave 1 and 4 (Table 6B), in the sense that the perception of dangerousness at work decreases in wave 4 compared to wave 1. These findings could be related to the new, less aggressive variants of SARS-CoV-2, but also to the advancement of knowledge, increased treatment capacities, and more effective measures to mitigate the pandemic (85, 86). If we compare waves 1 and 4 to waves 2, 3 and 5, we can identify a sharpening of perception regarding the state of health, but also concerns about “how risky is the workplace in the context of the pandemic” and “whenever unforeseen events can occur.” Also, between wave 1 and wave 4, it appears that the respondents in the panel sharpen their perception of job security, which may come as a result of an adaptation processes.

#### 4.3.3. Work–family conflict, work engagement and significance, psychological needs, patient care, pandemic stress and burnout dynamics

Another research aim was to measure the dynamics of conflict between professional and personal life, work engagement and commitment, work significance, satisfying basic psychological needs, patient care, pandemic stress and burnout during the 5 pandemic waves, both at the level of independent samples (based on the Mann–Whitney U test) and in the panel study (via the Wilcoxon signed rank test).



TABLE 5 Perception of one's own health state.

| A. Different pandemic waves |        |              |              |              |              | B. Different consecutive waves (panel samples) |        |              |        |              |        |
|-----------------------------|--------|--------------|--------------|--------------|--------------|------------------------------------------------|--------|--------------|--------|--------------|--------|
| A.                          | Wave 1 | Wave 2       | Wave 3       | Wave 4       | Wave 5       | B.                                             | Wave 1 | Wave 2       | Wave 3 | Wave 4       | Wave 5 |
| Wave 1                      |        | <i>0.000</i> | <i>0.000</i> | <i>0.000</i> | 0.183        | Wave 1                                         |        | <i>0.039</i> | 0.378  | <i>0.009</i> | NA     |
| Wave 2                      |        |              | 0.506        | 0.092        | <i>0.027</i> | Wave 2                                         |        |              | 1.000  | 0.402        | NA     |
| Wave 3                      |        |              |              | <i>0.024</i> | <i>0.027</i> | Wave 3                                         |        |              |        | 0.138        | NA     |
| Wave 4                      |        |              |              |              | 0.438        | Wave 4                                         |        |              |        |              | NA     |
| Wave 5                      |        |              |              |              |              | Wave 5                                         |        |              |        |              |        |

(A) Different pandemic waves; (B) different consecutive waves (panel samples used the Wilcoxon signed rank test,  $p < 0.05$ ). \*NA, no answer. The italic values are statistically significant ( $p < 0.05$ ).

TABLE 6 Perception of workplace safety.

| A. Different pandemic waves |        |              |              |        |              | B. Different consecutive waves (panel samples) |        |        |        |              |        |
|-----------------------------|--------|--------------|--------------|--------|--------------|------------------------------------------------|--------|--------|--------|--------------|--------|
| A.                          | Wave 1 | Wave 2       | Wave 3       | Wave 4 | Wave 5       | B.                                             | Wave 1 | Wave 2 | Wave 3 | Wave 4       | Wave 5 |
| Wave 1                      |        | <i>0.015</i> | <i>0.002</i> | 0.058  | 0.970        | Wave 1                                         |        | 0.084  | 0.529  | <i>0.018</i> | 0.313  |
| Wave 2                      |        |              | 0.970        | 0.925  | <i>0.024</i> | Wave 2                                         |        |        | 0.262  | 0.937        | 0.698  |
| Wave 3                      |        |              |              | 0.829  | <i>0.005</i> | Wave 3                                         |        |        |        | 0.919        | 0.250  |
| Wave 4                      |        |              |              |        | 0.060        | Wave 4                                         |        |        |        |              | 0.499  |
| Wave 5                      |        |              |              |        |              | Wave 5                                         |        |        |        |              |        |

(A) Different pandemic waves; (B) different consecutive waves (panel samples used the Wilcoxon signed rank test,  $p < 0.05$ ). The italic values are statistically significant ( $p < 0.05$ ).

TABLE 7 The work versus family conflict scale.

| A. Different pandemic waves |        |              |              |        |              | B. Different consecutive waves (panel samples) |        |        |        |        |        |
|-----------------------------|--------|--------------|--------------|--------|--------------|------------------------------------------------|--------|--------|--------|--------|--------|
| A.                          | Wave 1 | Wave 2       | Wave 3       | Wave 4 | Wave 5       | B.                                             | Wave 1 | Wave 2 | Wave 3 | Wave 4 | Wave 5 |
| Wave 1                      |        | <i>0.015</i> | <i>0.002</i> | 0.058  | <i>0.000</i> | Wave 1                                         |        | 0.569  | 0.889  | 0.352  | 0.522  |
| Wave 2                      |        |              | 0.970        | 0.925  | <i>0.024</i> | Wave 2                                         |        |        | 0.107  | 0.724  | 0.844  |
| Wave 3                      |        |              |              | 0.829  | <i>0.005</i> | Wave 3                                         |        |        |        | 0.755  | 0.625  |
| Wave 4                      |        |              |              |        | 0.060        | Wave 4                                         |        |        |        |        | 0.213  |
| Wave 5                      |        |              |              |        |              | Wave 5                                         |        |        |        |        |        |

(A) Different pandemic waves; (B) different consecutive waves (panel samples-Wilcoxon signed rank test, value of  $p < 0.05$ ). The italic values are statistically significant ( $p < 0.05$ ).

The dynamics of the conflict between work and personal life during different pandemic waves revealed statistically significant differences ( $p < 0.05$ ) between wave 1 and waves 2, 3 and 5 (Table 7A). The balance between work and family was seriously affected during the first pandemic wave, a fact that can be explained by the involvement of all available resources in the battle against an unknown impactful virus. The conflict considerably diminished in the fifth wave, and as a result of the “habit” effect. Starting with the 2nd and 3rd waves, the pandemic limitation measures relaxed (87), increasing the contamination risk of the population and causing additional pressure on the medical system. As an immediate consequence, health workers were affected, and their work conditions were subject to various risks. This explains the statistically significant differences recorded between these waves and the last one, during which the Omicron variant no longer raised major problems for the health system.

The results of the Wilcoxon signed rank test suggest that there are no statistically significant differences regarding the conflict between

family life and the time spent at work between people who responded in two consecutive pandemic waves (Table 7B).

In order to take an in-depth look on the role of profession in the life of respondents, we used the Utrecht Work Engagement Scale (UWES). One can observe that the well-being and the pleasure of going to work decreased during the last two pandemic waves, compared to first wave, and also that wave 1 is different from waves 2, 4 and 5 in this regard (Table 8A).

The Mann-Whitney U test also shows statistically significant differences in terms of work engagement. Work commitment increases with positive perception of one's health, work safety, and the satisfaction of basic psychological needs, as well as with the efficiency of medical protocols. Thus, the raising numbers of successfully treated patients fostered positive and optimistic attitudes towards dealing with the pandemic. Also, diminishing fear and anxiety associated with possible illness/infection with SARS-CoV-2, brought about consistent increases in work engagement; a trend which is observable from one pandemic wave to another.

TABLE 8 The role of profession in the life of respondents.

| A. Different pandemic waves |        |              |        |              |              | B. Different consecutive waves (panel samples) |        |        |        |        |        |
|-----------------------------|--------|--------------|--------|--------------|--------------|------------------------------------------------|--------|--------|--------|--------|--------|
| A.                          | Wave 1 | Wave 2       | Wave 3 | Wave 4       | Wave 5       | B.                                             | Wave 1 | Wave 2 | Wave 3 | Wave 4 | Wave 5 |
| Wave 1                      |        | <i>0.008</i> | 0.218  | <i>0.010</i> | <i>0.002</i> | Wave 1                                         |        | 0.343  | 0.414  | 0.407  | 0.820  |
| Wave 2                      |        |              | 0.061  | 0.394        | 0.506        | Wave 2                                         |        |        | 0.800  | 0.388  | 0.944  |
| Wave 3                      |        |              |        | <i>0.034</i> | <i>0.013</i> | Wave 3                                         |        |        |        | 0.813  | 0.875  |
| Wave 4                      |        |              |        |              | 0.849        | Wave 4                                         |        |        |        |        | 0.962  |
| Wave 5                      |        |              |        |              |              | Wave 5                                         |        |        |        |        |        |

(A) Different pandemic waves; (B) different consecutive waves (panel samples-Wilcoxon signed rank test,  $p < 0.05$ ). The italic values are statistically significant ( $p < 0.05$ ).

TABLE 9 The perception of work significance.

| A. Different pandemic waves |        |        |        |        |              | B. Different consecutive waves (panel samples) |        |        |        |        |        |
|-----------------------------|--------|--------|--------|--------|--------------|------------------------------------------------|--------|--------|--------|--------|--------|
| A.                          | Wave 1 | Wave 2 | Wave 3 | Wave 4 | Wave 5       | B.                                             | Wave 1 | Wave 2 | Wave 3 | Wave 4 | Wave 5 |
| Wave 1                      |        | 0.522  | 0.998  | 0.213  | <i>0.026</i> | Wave 1                                         |        | 0.464  | 0.432  | 0.585  | 0.850  |
| Wave 2                      |        |        | 0.553  | 0.522  | 0.169        | Wave 2                                         |        |        | 0.866  | 0.700  | 0.925  |
| Wave 3                      |        |        |        | 0.131  | <i>0.014</i> | Wave 3                                         |        |        |        | 0.058  | 0.423  |
| Wave 4                      |        |        |        |        | 0.628        | Wave 4                                         |        |        |        |        | 0.345  |
| Wave 5                      |        |        |        |        |              | Wave 5                                         |        |        |        |        |        |

(A) Different pandemic waves; (B) different consecutive waves (panel samples used the Wilcoxon signed rank test,  $p < 0.05$ ). The italic values are statistically significant ( $p < 0.05$ ).

TABLE 10 Perception of satisfying basic psychological needs.

| A. Different pandemic waves |        |              |              |        |              | B. Different consecutive waves (panel samples) |        |        |        |        |        |
|-----------------------------|--------|--------------|--------------|--------|--------------|------------------------------------------------|--------|--------|--------|--------|--------|
| A.                          | Wave 1 | Wave 2       | Wave 3       | Wave 4 | Wave 5       | B.                                             | Wave 1 | Wave 2 | Wave 3 | Wave 4 | Wave 5 |
| Wave 1                      |        | <i>0.032</i> | <i>0.010</i> | 0.107  | <i>0.000</i> | Wave 1                                         |        | 0.347  | 0.393  | 0.733  | 0.183  |
| Wave 2                      |        |              | 0.979        | 0.878  | 0.070        | Wave 2                                         |        |        | 0.272  | 0.272  | 0.147  |
| Wave 3                      |        |              |              | 0.822  | <i>0.015</i> | Wave 3                                         |        |        |        | 0.528  | 0.625  |
| Wave 4                      |        |              |              |        | 0.156        | Wave 4                                         |        |        |        |        | 0.162  |
| Wave 5                      |        |              |              |        |              | Wave 5                                         |        |        |        |        |        |

(A) Different pandemic waves; (B) different consecutive waves (panel samples used the Wilcoxon signed rank test,  $p < 0.05$ ). The italic values are statistically significant ( $p < 0.05$ ).

The Wilcoxon signed rank test indicates no statistically significant differences in terms of scores related to work commitment for the same person from one pandemic wave to another (Table 8B).

During the COVID-19 pandemic, work had a special significance in the lives of the respondents, as shown by the positive correlation between work significance and work commitment, and between the former and the satisfaction of basic psychological needs. Most health workers feel full of energy at work (52%), proud of the work they do (59.5%) and involved in their daily activities (65.5%).

The Mann-Whitney U test shows statistically significant differences between the first and last pandemic waves, and between waves 3 and 5 (Table 9A). The perception of work significance increased towards the end of the pandemic (in wave 5) compared to waves 1 and 3, possibly in the optimistic context created by increasing healing rates.

The average values of recorded scores (wave 1 = 42.91, wave 2 = 43.53, wave 3 = 42.96, wave 4 = 42.03, wave 5 = 40.86) reflect the degree to which people appreciate their work effort makes a positive contribution and brings benefits to others, or to the whole society.

When it comes to work meaningfulness, the Wilcoxon signed rank test does not show statistically significant differences between the answers given by the same people in different pandemic waves. Thus, the meaning of work remains relatively constant for the same person, at least in 2 consecutive waves (Table 9B).

The respondents in our study consider the work carried out during the pandemic as meaningful, with a positive impact on those around them (69.6% of all respondents), which gives them strength and inspire them to deal with difficult situations. A career in this field of work and the professional satisfaction of healing patients significantly contributes to the fulfilment of a meaningful personal life (e.g., "I found a profession whose purpose brings me satisfaction," 66% answering with a maximum score).

The Mann-Whitney U test emphasises significant differences ( $p < 0.05$ ) regarding the item of satisfying basic psychological needs between wave 1 and waves 2, 3 and 5; and waves 3 and 5 (Table 10A). This means that basic psychological needs were fulfilled towards the end of the pandemic, rather than in the initial (wave 1) or middle (wave 3) stages. On the contrary, the Wilcoxon signed rank test does

TABLE 11 Patient care.

| A. Different pandemic waves |        |        |        |        |        | B. Different consecutive waves (panel samples) |        |        |        |        |        |
|-----------------------------|--------|--------|--------|--------|--------|------------------------------------------------|--------|--------|--------|--------|--------|
| A.                          | Wave 1 | Wave 2 | Wave 3 | Wave 4 | Wave 5 | B.                                             | Wave 1 | Wave 2 | Wave 3 | Wave 4 | Wave 5 |
| Wave 1                      |        | 0.437  | 0.772  | 0.009  | 0.000  | Wave 1                                         |        | 0.723  | 0.590  | 0.179  | 0.001  |
| Wave 2                      |        |        | 0.556  | 0.017  | 0.000  | Wave 2                                         |        |        | 0.713  | 0.943  | 0.004  |
| Wave 3                      |        |        |        | 0.012  | 0.000  | Wave 3                                         |        |        |        | 0.786  | 0.250  |
| Wave 4                      |        |        |        |        | 0.000  | Wave 4                                         |        |        |        |        | 0.009  |
| Wave 5                      |        |        |        |        |        | Wave 5                                         |        |        |        |        |        |

(A) Different pandemic waves; (B) different consecutive waves (panel samples used the Wilcoxon signed rank test,  $p < 0.05$ ). The italic values are statistically significant ( $p < 0.05$ ).

TABLE 12 Stress of infection with COVID-19.

| A. Different pandemic waves |        |        |        |        |        | B. Different consecutive waves (panel samples) |        |        |        |        |        |
|-----------------------------|--------|--------|--------|--------|--------|------------------------------------------------|--------|--------|--------|--------|--------|
| A.                          | Wave 1 | Wave 2 | Wave 3 | Wave 4 | Wave 5 | B.                                             | Wave 1 | Wave 2 | Wave 3 | Wave 4 | Wave 5 |
| Wave 1                      |        | 0.089  | 0.191  | 0.077  | 0.055  | Wave 1                                         |        | 0.813  | 0.000  | 0.462  | 0.813  |
| Wave 2                      |        |        | 0.319  | 0.469  | 0.568  | Wave 2                                         |        |        | 0.641  | 0.701  | 0.570  |
| Wave 3                      |        |        |        | 0.211  | 0.097  | Wave 3                                         |        |        |        | 0.724  | 0.713  |
| Wave 4                      |        |        |        |        | 0.696  | Wave 4                                         |        |        |        |        | 0.794  |
| Wave 5                      |        |        |        |        |        | Wave 5                                         |        |        |        |        |        |

(A) Different pandemic waves, (B) different consecutive waves (panel samples used the Wilcoxon signed rank test,  $p < 0.05$ ).

not show statistically significant differences in the satisfaction of basic psychological needs between responses provided by the same people in successive pandemic waves (Table 10B).

Regarding patient care, the Mann–Whitney U test shows statistically significant differences ( $p < 0.05$ ) between waves 1 and 2 compared to waves 4 and 5. Also, the fourth wave stands out when compared to waves 1, 2, 3 and 5 (Table 11A).

Average scores (wave 1 = 23.43, wave 4 = 22.21, wave 5 = 12.05) show statistically significant differences, indicating that the basic psychological needs were satisfied by adapting to the new pandemic-related working conditions.

The Wilcoxon signed rank test also shows statistically significant differences between wave 5 and waves 1, 2 and 4 (Table 11B). Panel respondents report the same level of competence when caring for patients, across the pandemic waves. However, participants from the panel samples in wave 5 considered that the medical care provided during the last pandemic wave was of a higher level than the one specific to waves 1, 2 and 4, as shown by the following mean values: wave 1 versus wave 5: 23.92 versus 11.78; wave 2 versus wave 5: 23.63 versus 11.45; wave 4 versus wave 5: 23.88 versus 11.11.

The medical personnel appreciated that the medical care they provided during the pandemic was adequate (82% of respondents), although at the cost of one's own mental (14.2%) and physical exhaustion (17.1%). It should be highlighted that deeply rooted professional convictions, i.e., caring for patients is the central element in the code of professional conduct in the medical field (88), influence job satisfaction and make medical staff focus on the physical, mental, and emotional wellbeing of patients, even when this task becomes risky or even more demanding.

The Stanford Acute Stress Reaction Questionnaire (Stanford Acute Stress Reaction Questionnaire) was introduced into the research design starting with the second wave. Following the application of the Mann–Whitney U test, no statistically significant differences in terms

of scores were obtained when assessing the state of stress across pandemic waves (Table 12A), although average scores recorded in wave 3 (wave 3 = 47.32) are much lower than those recorded in wave 2 (wave 2 = 61.96).

The Wilcoxon signed rank test does not show statistically significant differences between participants' responses specific to different pandemic waves (Table 12B).

The Maslach Burnout Inventory scale was introduced starting with wave 3. The results of the Mann–Whitney U test point out statistically significant differences ( $p < 0.05$ ) between wave 3 and waves 4, 5 and also between waves 2 and 3 (Table 13A).

The mean scores recorded during certain pandemic waves (wave 3 = 17.10, wave 4 = 23.67, wave 5 = 22.49) show a stronger increase in burnout cases towards the end of the COVID-19 pandemic. The Wilcoxon signed rank test shows statistically significant differences between waves 3 and 4 (Table 13B), meaning that professional burnout is prevalent in wave 4, compared to wave 3 (wave 4 = 22.36, wave 3 = 15.18).

#### 4.3.4. Structural model testing

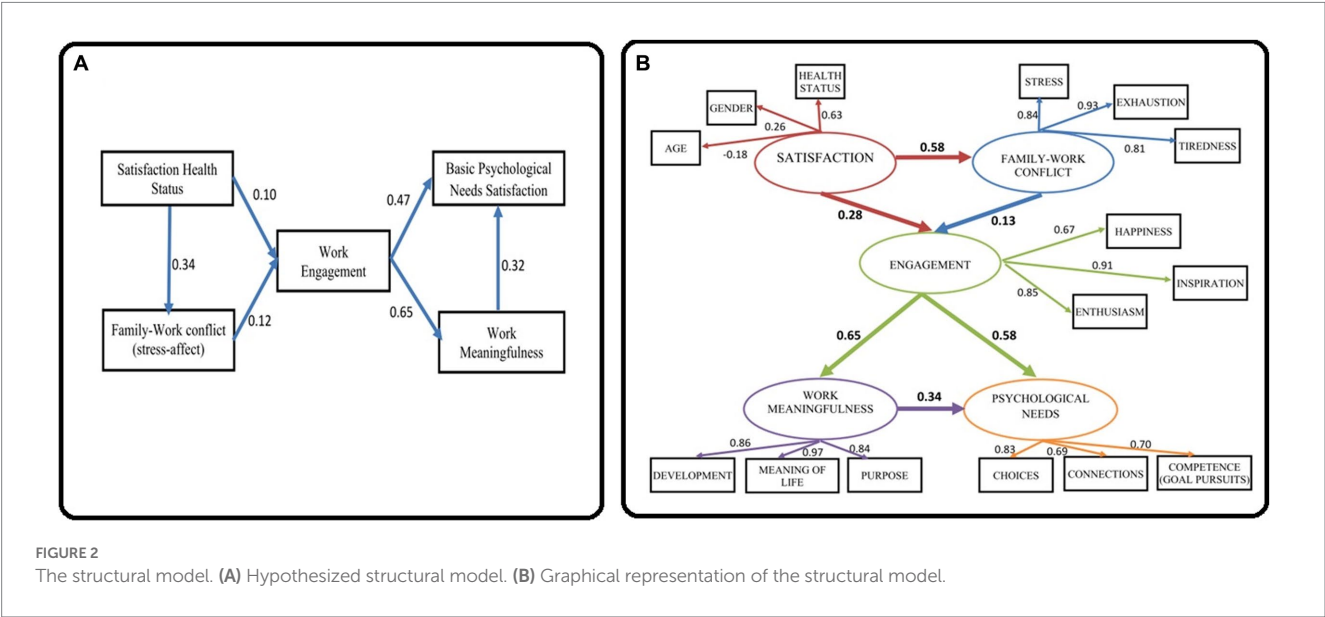
The developed model is based on inferential research results from the previous sections. It estimates accommodation mechanisms (causes and effects) to a continuous changing work environment. We hypothesized that the perceived state of health is reflected in the family relations, and in the work involvement. Work engagement gives psychological satisfaction and makes work meaningful which makes one feel fulfilled and valuable (Figure 2A).

Even if results show statistically significant but often weak relationships, the parameters for the presented model show a very good-fitting reasonably consistent with the data: SRMR = 0.027, RMSEA = 0.074, CFI = 0.985, TLI = 0.962. All the statistically significant relationships are positive in direction. The level of perceived health as a potential supporting factor in the family–work conflict has

TABLE 13 Professional burnout.

| A. Different pandemic waves |        |        |        |        |        | B. Different consecutive waves (panel samples) |        |        |        |        |        |
|-----------------------------|--------|--------|--------|--------|--------|------------------------------------------------|--------|--------|--------|--------|--------|
| A.                          | Wave 1 | Wave 2 | Wave 3 | Wave 4 | Wave 5 | B.                                             | Wave 1 | Wave 2 | Wave 3 | Wave 4 | Wave 5 |
| Wave 1                      | NA     | NA     | NA     | NA     | NA     | Wave 1                                         |        |        |        | 0.045  | 0.250  |
| Wave 2                      |        |        | 0.001  | 0.783  | 0.940  | Wave 2                                         |        |        |        |        | 0.862  |
| Wave 3                      |        |        |        | 0.009  | 0.001  | Wave 3                                         |        |        |        |        |        |
| Wave 4                      |        |        |        |        | 0.709  | Wave 4                                         |        |        |        |        |        |
| Wave 5                      |        |        |        |        |        | Wave 5                                         |        |        |        |        |        |

(A) Different pandemic waves, (B) different consecutive waves (panel samples used the Wilcoxon signed rank test,  $p < 0.05$ ). \*NA, no answer.



a loading factor of 0.34. The relation between perceived health status and work engagement has a loading factor of 0.10. Well-being at home influences work engagement (loading factor 0.12). Work engagement is an important mediator for the perceived meaningfulness of work (loading factor 0.65) and for satisfying basic psychological needs (loading factor 0.47). Work meaningfulness influences also the satisfaction of basic psychological needs (loading factor 0.32).

Using the structural equation modelling (SEM) procedure we obtained the relationships presented in Figure 2B. The final structural model provides a good fit with all significant paths (SRMR = 0.072, RMSEA = 0.085, CFI = 0.928, TLI = 0.910). In Figure 2B (Graphical representation of the structural model), the measurement model has observed variables shown in rectangles, and latent variables drawn as circles; the structural model tests the mediating effects between the latent variables (on the path satisfaction – family–work conflict – work engagement – work meaningfulness – psychological needs); straight lines with an arrow at the end represent the hypothesized effect one variable has on another.

In SEM, the exogenous variable is Satisfaction (mainly the perceived state of health), which has no predictor within the model. All other variables are endogenous or dependent variables (e.g., family–work conflict, work engagement, work meaningfulness, and psychological needs), their values being determined by other variables in the model.

All correlations are positive in direction with one exception: the relation between age and satisfaction level (−0.18). This suggests that youth is a moderate factor of confidentiality regarding perceived health status and satisfaction level, disregarding the sex of participants. The satisfaction level is a predictor of the family–work relation (0.58), both having a moderate direct effect on work engagement.

The family–work relation is saturated by the measured variables exhaustion (“Quite often I come back from work emotionally exhausted, not being able to participate in family life,” 0.93), stress (“The stress from work also affects me at home so that I can no longer do what I like, or makes me happy,” 0.84) and tiredness (“When I get home from work, I am too tired to participate in family activities,” 0.81). The largest direct contribution to work engagement comes from inspiration (“My work inspires me,” 0.91), followed by enthusiasm (“I am enthusiastic about my work,” 0.85), and a general feeling of happiness (“I feel happy when I work hard,” 0.67).

The most consistent effect in the model is that of work engagement on work meaningfulness (0.65). The general disposition that life has meaning presents the highest direct contribution to work meaningfulness (“I understand how my work contributes to the meaning of my life,” 0.97), supporting personal development (“My work contributes to my personal development,” 0.86), and becoming the purpose in life (“My work contributes to a purpose greater than myself,” 0.84). Work engagement moderately satisfies psychological

needs (0.34), saturated by the freedom of choice (“At work, I have a sense of choice and freedom in the things I do,” 0.83), competence in achieving goals (“When I am at work, I feel that I am competent to achieve my goals,” 0.70), and social connectivity (“I feel connected to the people who care about me at work and who I care about,” 0.69).

As an important outcome, in SEM there are no correlations with patient care, measuring physicians’ own perceptions of the quality of care they provide to patients, which highlights that, regardless of unfavourable long-term conditions, work involvement provides a high level of health care professionalism.

## 5. Discussion

Although the COVID-19 pandemic was emotionally exhausting, this study shows that the medical staff had a sense of personal achievement due to meaningful work and commitment to work, which is consistent with the results obtained by other research works (89, 90). Respondents in our research advocated an enhance involvement in the activities carried out during the pandemic crisis (65.5%). According to Rana (91), job satisfaction plays an important role in the work commitment and performance of medical professionals. During pandemic conditions, job satisfaction was related to the number of consecutive shifts, occupational well-being, job security, and professional stability at work. The higher the perceived job satisfaction, the higher the job performance and productivity in healthcare (91). In Mukaihata et al. (92) study on psychiatric nurses, work engagement moderated the direct and indirect effects of patient-related stressor on job satisfaction.

Silvia De Simone et al. (93) found correlations between work engagement, job satisfaction, and self-efficacy. During the COVID 19 crisis, research revealed that people with high self-efficacy are more able and comfortable to take on challenging tasks, being more confident in their ability to overcome difficult situations (94); self-efficacy being negatively correlated with anxiety (95, 96).

Our findings highlighted that work engagement and high perceived level of work meaningfulness reduce physicians’ burnout and sustain the quality of patient care. In a systematic review of over 4,700 articles focusing on physicians’ burnout Hodkinson et al. (59) found out that burnout related to low work engagement and meaningfulness, as well as low job satisfaction, and low patient satisfaction.

Similarly, Guerrero-Barona et al. (97) carried out correlations between the quality of family life and work conflict, psychosocial factors, burnout syndrome and emotional intelligence.

Literature concerning work engagement before the COVID 19 crisis indicated that work engagement was positively correlated with the quality of care (24). Other studies examined the association of burnout with the quality of patient care, based on samples from all categories of medical personnel (98, 99). Babenko (100) investigated the role of basic psychological needs (autonomy, competence, and relatedness) in physicians’ professional well-being in terms of job satisfaction, work engagement, and burnout. This study indicated that the need for relatedness had the largest contributions to physicians’ professional life satisfaction, work-related engagement, and exhaustion, respectively.

We consider that these general factors and relationships sharpened their manifestation during pandemic conditions. The uncertainty of the pandemic triggered a mobilization of resources released by physician’s commitment to work. Further, the work engagement raised the awareness of the work meaningfulness under these extreme

conditions. Likewise, patient care, becoming the central priority during COVID 19 health crisis conditions, seems to have disconnected from previous influencing factors and relationships.

## 6. Conclusion

The propose of this study was to identify potential affecting factors of healthcare work sustainability during the change-related uncertainty conditions generated by the COVID 19 crisis. Dynamics and relations of nine carefully selected variables and constructs were tracked along all five pandemic waves in Romania, which span from March 2020 to April 2022. The tested variables and constructs are perception of healthcare workers of their own state of health, their workplace safety, the work–family conflict, the satisfaction of basic psychological needs, the work meaningfulness and work engagement, patient care, pandemic stress and burnout.

Key findings can be summarized as follows:

- The analysis identified perceived personal health status as an important factor in the perception of the dangerousness of workplace, the felt pandemic stress, the work–family conflict, the satisfaction of basic psychological needs, the meaning of and commitment to work
- Patient care seems to be above the own health perception and may be associated with the satisfaction of the basic psychological needs of the medical staff, the work–family balance, and the perception of workplace safety
- The sense of belonging (ownership) and work commitment correlate with the quality of patient care and supports the encountered facts that the medical staff managed to find resources to cope with professional stress and burnout during the COVID 19 crisis
- Analysing items dynamics during the 5 pandemic waves, certain adaptive attitudes (e.g., increasing confidence, satisfaction) and behaviors towards COVID 19 pandemic threats emerged related to gained experience and the progress in terms of medical protocols and procedures
- The in-depth structural model identified that the own health status satisfaction is a mediator of the family–work conflict and, together, of the work engagement. In turn, work engagement plays a significant role in satisfying basic psychological needs and supporting work meaningfulness. Work meaningfulness influences also the satisfaction of basic psychological needs.

However, despite these strengths, our study has also some limitations that reduce the generalizability of results. The strongly female-dominated samples, with 74.5% women, although it mirrors the structure of the health personnel in Romania [70.5% female doctors in 2020, according to the National Institute of Statistics (101)] can be a risk of gender bias in the overall generalizability of our findings.

Another drawback is that we have limited data from multiple respondents who are part of all 5 pandemic waves and cannot have a conclusive study in terms of comparing responses between waves. Another limitation of the present research is given by the fact that we did not include in the study a section on the possible infection of medical personnel and the return to work after passing through a COVID 19 disease. Unfortunately, these limitations cannot be improved by further research. Nevertheless, these findings can help medical health systems



better identify inner vulnerabilities and strengths, on which coping strategies can be developed to withstand future disturbances.

## 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 Ethic Committee of Center for Risk Studies Spatial and Dynamic Modeling of Land and Coastal Systems. 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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## Conflict of interest

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

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# COVID-19 challenges, responses, and resilience among rural Black women: a study protocol

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Despite the aggregated burdens and challenges experienced by rural Black women during the COVID-19 pandemic, many likely also demonstrated strength and resilience to overcome challenges. A mixed methodology and a community-based participatory approach will be used to collect multilevel data on challenges, responses, resilience, and lessons during the pandemic from Black women, community health workers, and community leaders in rural areas in South Carolina (SC). Specifically, the unique circumstances and lived experiences of rural Black women during the COVID-19 pandemic will be documented to understand their needs regarding effective management of social, physical, and mental health challenges through focus group discussions and in-depth interviews with Black women, community health workers, and local community leaders recruited from rural SC communities. Barriers, facilitators, and potential impacts of multilevel resilience development will be identified through a survey administered among rural Black women recruited from 11 rural counties (with one as site for a pilot testing of the questionnaire). A report for public health practice will be developed, including recommended strategies to optimize health systems' emergency preparedness and responses through triangulation of qualitative and quantitative data from multiple sources. Findings in the proposed study will provide valuable references in terms of addressing social determinants of health factor challenges during the pandemic, fostering resilience, and informing evidence-based decision-making for policymakers. The study will contribute to the development of public health emergency preparedness plans, which can promote the resilience of women, their families, and local communities as well as optimize effective preparedness and response of health systems for rural Black women and their families during infectious disease outbreaks and other public health emergencies.

## KEYWORDS

COVID-19, Black or African American, women, rural health, psychological resilience, community-based participatory research



## Introduction

Existing literature suggests that women are more likely to bear the brunt of socioeconomic and health consequences of the pandemic due to the compounded effect of pre-existing gender inequity, their social role as caregivers, work-life conflicts, increased domestic violence, and limited access to healthcare services in the context of COVID-19 (1–4). Unpaid caregiving during the pandemic has imposed a disproportionate burden on women who are often the primary caregivers for children and older adults (5). Lack of paid leave, family caregiving responsibilities, and traditional gender roles have placed additional strains on work-life conflicts (6, 7). When social isolation and distancing practices are being enforced in a pandemic, the risk of violence against women increases (8, 9). The pandemic also has impacted the availability and utilization of women's healthcare services such as sexual and reproductive health services and preventive care such as mammography screening (10, 11). Mental health issues for women related to financial and other stressors are also evident during the pandemic (12). Furthermore, national polls indicate that women are more likely than men to report negative mental health effects from worrying about COVID-19 (13, 14).

Black women from rural households in southern states are especially vulnerable, given the existing disparities in social determinants of health (SDOH), health infrastructure, and access to healthcare resources (15–18). The disproportionate effects of COVID-19 among racial/ethnic minority groups were present from the beginning of the pandemic (19). Counties with large Black populations experienced greater case, mortality, and progression rates of the disease than counties with small Black populations (20). Analysis of data from the COVID Tracking Project highlighted that the national COVID-19-related mortality rate for Black people was 2.4 times higher than that of White people (21). The COVID-19 pandemic further elevated social disparities. Black people were more likely than White people to experience job or wage loss because of the pandemic (44 and 38%, respectively) (22) and experienced higher levels of food insufficiency and rent or mortgage defaults relative to other racial and ethnic groups as well (23). In addition, the southern United States is a region in which structural racism and oppression have resulted in poor health infrastructure, limited access to care (e.g., lack of health insurance and geographic maldistribution of healthcare services) (24), and biased and suboptimal care (25, 26).

Despite the aggregated burdens and challenges experienced by rural Black women during the pandemic, it is likely that many have also demonstrated strength and resilience to overcome challenges and manage critical resources for themselves and their families (27, 28). Resilience refers to the capacity to which individuals are able to respond to stress-induced challenges and burdens (29). Within the literature over the past few decades, there has been a shift to consider resilience not only as an individual trait but, from the ecologic perspective, an bidirectional interaction between individuals and their environment (30). Thus, resilience can now be understood as a multidimensional, responsive, and dynamic process across the life span (31). Resilience can be cultivated through a series of protective factors

such as social support, self-efficacy, positive self-perception, and an optimistic perspective of the future (32–34). The extant literature demonstrates the essential role of protective factors in aiding in the bolstering and maintenance of resilience within the individual, community, and the institutional levels of the socioecological model in times of crisis including public emergencies (35–39). Several recent studies particularly examined the resilience model for older people in the context of COVID-19 pandemic (40, 41).

Resilience can play a significant role in the coping and responses to the pandemic (42, 43). However, empirical data are especially limited regarding the needs and challenges among Black women in rural areas, how they successfully cope with SDOH challenges during the pandemic, and the facilitators of resilience from multiple levels (e.g., family, community, policy) (14, 44–46). Furthermore, there are limited data on first-hand evidence from front-line health workers and key stakeholders in rural areas such as community health workers and community leaders who are rooted in local communities, serve women in rural areas through connecting local neighborhood and external resources, and can provide insights and recommendations to public health policy and practice (47).

To address these gaps, a mixed-methods exploratory study will be conducted to collect multilevel data on challenges, responses, and resilience among rural Black women during the pandemic. A community-based participatory approach will be used to engage Black women, community health workers, and community leaders in South Carolina (SC), a state with 27% of its population being Black and 33.7% of its population living in rural areas (48). The advanced understanding of the resilience process and facilitators and barriers of resilience for women will contribute to optimizing emergency preparedness and response for special needs and challenges identified for Black women from rural areas and their families (42).

## Methods and analysis

### Research setting and community engagement

#### Research setting

SC is a largely rural state (48), currently ranked the 42nd overall healthiest state, 49th for cost of care, and 32nd for access to care in the nation (49). A majority of counties in SC (45 of 46) are designated as Health Professional Shortage Areas (50, 51). SC also ranked at the bottom for various health outcome indicators in 2019: 49th in infectious diseases, 41st in maternal mortality, and 39th in infant mortality (52). According to the most recent American Community Survey, White people account for 63.7% of the whole population, followed by Black people (27.03%), and Hispanics or Latinos (6%). In SC, racial disparities exist in many healthcare outcomes such as breast cancer (53, 54), stroke (55), maternal health (56, 57), and cervical cancer (58, 59). Considering SC's poor health ranking, striking disparities in many health outcomes, racially diverse population, and historical Southern context, SC has an appropriate environment to explore



and understand lived experiences of Black women living in rural areas facing SDOH challenges during the pandemic. The study will be conducted in 11 rural counties (out of totally 46 counties in SC) in which Black people account for over 30% of the total population. These counties have been heavily hit by COVID-19. The participants of the study are adults with a large range of age in order to explore the lived experiences across life course.

## Community engagement and Community Advisory Board

The research team will closely work with community-based organization and community health workers on the study design and implementation. Our main local partner is the South Carolina Community Health Worker Association (SCCHWA), a community-based organization made up of community health workers and their supporters in SC. It provides a forum for networking and sharing of strategies and resources as well as a foundation for education and training of community health workers. The SCCHWA has implemented numerous health promotion education projects with local partners across SC, including the multilevel COVID-19 vaccination promotion project among Black communities with collaboration from our team. With the assistance of the SCCHWA, a CAB will be assembled to include Black women, community leaders, government officers, healthcare providers and community health workers. The CAB members will either live in or serve people in the local communities or have strong connections with rural communities. The CAB will meet every 2 months to provide advice regarding community engagement, study protocol development, and research implementation and dissemination.

## Study design

The proposed mixed methodology study consists of three main specific research phases in term of study design. Phase 1 is qualitative research via focus group discussions (FGDs) and in-depth interviews with Black women, community health workers and community leaders in rural areas. Phase 2 is quantitative research including the adaption of assessment tools and implementation of a survey among Black women from the research sites. Phase 3 includes data triangulation and report writing. A community charrette approach (60) will be applied in report revision and finalization to empower local partners.

## Qualitative research

### Focus group discussions

FGDs will be conducted with Black women, community health workers, and local community leaders recruited from various rural SC communities to document the unique circumstances and lived experiences of rural Black women during the COVID-19 pandemic and to understand their needs regarding effective management of social, physical, and mental health challenges.

FGD is selected to collect qualitative data for Aim 1 since it is a time-efficient and interactive approach to conduct need assessments among diverse subgroups (61). With the assistance of SCCHWA and the CAB, participants will be purposely recruited from the study sites including Black women ( $n=15$ ), community health workers serving rural communities ( $n=10$ ), and local community leaders ( $n=10$ ) to conduct 3 FGDs. The Black women will include young adults (18–34 years of age), middle-aged adults (35–59 years of age), and older adults ( $\geq 60$  years of age) given that COVID-19 may impose different challenges for women at different age. COVID-19 infection history of women and their families will also be considered to maximize the focus group representativity. Community health workers will include the ones staying short in the local communities ( $< 3$  years) and staying long ( $\geq 3$  years). Community leaders may include people from churches, non-government organizations, grassroot organizations, or other trusted messengers in local communities with covering both health-related organizations and non-health-related organizations. Potential eligible participants will be identified through local community health workers in study sites (for Black women), SCCHWA staff (for community health workers), or recommendation by the CAB (for community leaders). Research staff at SCCHWA will conduct outreach and recruit the participants, highlighting that the FGDs are confidential.

To ensure that FGD participants have sufficient time and opportunities to express their opinions and share their experiences, the research team will hold relatively small FGDs with 5–6 participants per group. The group discussion guidelines will be drafted by the research team and then be reviewed and discussed by our local partners and the CAB to ensure that the questions are meaningful in local contexts and asked in appropriate way/language. The FGDs will be facilitated by experienced SCCHWA project staff, but research staff will attend all of the FGDs as backups and for assistance. The main topics of the FGDs may include: (1) lived experiences in response to the COVID-19 pandemic, including COVID-19 prevention, testing, and treatment and health seeking; (2) challenges with various health and social aspects during the pandemic; (3) impacts of COVID-19 on physical health, mental health, family relationships, social networks, and socioeconomic conditions; (4) needs and available resources to address multiple challenges, especially SDOH challenges; and (5) unmet needs and additional resources they need to deal with the evolving pandemic and life recoveries. To avoid research burden of the participants, the research team will select relevant topics and tailor the questions to different groups. For example, for Black women participants, the questions will focus on their own experiences; for community leaders, the topics will also include their observations of the whole communities; and for community health workers, the discussion will focus on lessons in bridging communities and healthcare systems, reflections on organizational responses, and suggestions toward capacity building as public health front-line workers. The FGDs will last about 1 h and be held in a private conference room at the SCCHWA site offices. Considering the transportation cost and burden for participants, online FGDs via an Internet conference (e.g., Team, Zoom meetings) will also be prepared for, depending on local logistics as well as suggestions and preferences of the participants.

## In-depth interviews

In-depth interviews will be conducted with Black women, community health workers, and community leaders recruited across the communities to explore effective strategies that women use in coping with various challenges in the pandemic and identify barriers to and facilitators of multiple resilience. Given that people will apply various coping strategies and demonstrated different types of resilience, in-depth interviews will be an appropriate approach to collecting qualitative data regarding our specific research aims, which will offer opportunities for one-on-one, in-depth conversations with minimum influence of others on the interviewee.

Following a similar study protocol as used in the FGDs, the research team will purposely recruit about 20 Black women living in rural areas, 10 community health workers, and 10 local community leaders for in-depth interviews. A “saturation” approach will be applied in the interviews, whereby respondents will be interviewed until a point that no significant new data are anticipated from additional interviews. Data saturation will be assessed after ~60% of the interviews have been conducted with each group of participants.

Separate interview guides will be developed for Black women, community health workers, and community leaders. Semi-structured qualitative interview guides will be created with significant input and guidance from the local CAB. The interview guides will be grounded in phenomenological and constructivist frameworks, which provide a general structure for discussion but require participants to provide their own conceptualizations of terms and phrases based on their life experiences. The interview with Black women will document their lived experiences and various coping strategies in response to SDOH challenges during the pandemic; identify components of multilevel resilience, interactions of different resilience, and barriers and facilitators for resilience; and needs, expectations, and suggestions for health systems’ emergency responses tailored to their needs. Interviews with community health workers and community leaders will focus on community resilience and institutional/organizational resilience observed and experienced during the pandemic, local resources, community connections, and their reflections and insights on optimizing emergency response strategies in healthcare systems and local communities. Additional topics will be added as appropriate and as indicated by the CAB and findings from the FGDs. With appropriate consent, the interviews will be audio-recorded. Interviewers will take field notes during the interviews to serve as a complementary data source. The field notes will include interviewees’ non-verbal responses and interviewers’ observations or impressions regarding the conditions of the interviews. Each interview will take 1 h led by a trained interviewer in a private room. Online interview will be conducted if preferred by the participants.

## Qualitative data analysis

The analysis of both FGD and in-depth interview data will be guided by grounded theory (62) in order to obtain key themes based on data itself rather than preexisting opinions. This inductive approach helps prevent preconceived notions from interfering

with the data collection and analysis (62). In keeping with the grounded theory principles, data analysis will run concurrently alongside data generation. Transcription and coding will take place after the first three interviews for each group. The line-by-line open coding will sensitize us to the range of potential meanings in the data and identify themes. Axial coding will be used to elucidate relationships between themes and subthemes along with their properties and dimensions. Memo writing and diagramming will be used to develop themes and relationships between themes. Research staff will independently code all of the transcripts. Any coding disagreements will be resolved through discussions. Representative quotes will be selected verbatim to illustrate key findings. Data analysis will be conducted through the software NVivo 12. The project coordinator and research staff at SCCHWA and CAB members will also contribute to result interpretation and findings dissemination.

The findings from qualitative research in Phase 1 will be used to inform the cultural adaptation of assessment tools in Phase 2 and data triangulation and report development in Phase 3. Specifically, the measurement instruments and existing scales will be adapted regarding resilience, coping, and other psychosocial wellbeing outcomes in the local context. The results of the qualitative studies will advance our understanding of the social and cultural environment that surrounds Black women, their families, and community health workers, and thus assist us in measurement selection and adaptation. Reports will be developed on needs assessment and strategy recommendations based on the rich qualitative evidence. For example, the materials of lived experiences and challenges of Black women, community health workers, and other key stakeholders in rural communities as they have faced this public health crisis will inform potential interventions and policymaking in fostering resilience and readiness for public health emergencies among rural communities and healthcare systems. Specific scenarios and examples needed in the intervention will also be developed by extracting the qualitative data and/or citing representative quotes. From the perspective of the community-based research, our local partner will be engaged in each step of the study design and data collection and analysis, which will empower community health workers and increase their ownership of this project, and thus further strengthen the academic-community trust and collaboration.

## Quantitative research

### Participants and recruitment

After discussion with our local partner SCCHWA, a cluster sampling approach will be used to recruit ~200 Black women living in rural areas in SC. Specifically, the research team will select 11 counties (with one county as the site for pilot testing) in SC as our study sites. About 20 Black women in each site will be recruited. With the coordination of research staff at SCCHWA, community health workers serving the rural communities in the study sites will recruit potential participants for the survey through disseminating project flyers at community activity centers, community clinics, grocery stores, and public

libraries. Inclusion criteria include: (1) Black females; (2) at least 18 years of age; (3) living in the study site since the COVID-19 outbreak; and (4) not concurrently participating in any health promotion intervention. A half-day project training workshop will be conducted for the local research team (mainly composed of community health workers) in terms of study protocol, data collection, and research ethics. The trained research staff (survey interviewers) will confirm the eligibility of the participants; explain the study design, including the purpose, procedure, risk and benefit, and confidentiality issues; and invite them to participate. All who agree to participate will provide written informed consent.

## Data collection

Survey interviewers (local community health workers who receive project training) will administer the survey to participants via Tablets. The Tablet will display and read (with a real human voice, utilizing a headset) the survey questionnaire in a private room (e.g., community health worker's office) in local counties where the participants are recruited. By using this method, the research team will not only ensure the privacy and quality of the data collection, but also ensure that varying degrees of literacy do not affect the individual's ability to understand the items. Clarifications or assistance (with the Tablet) will be provided on site by the interviewers as needed. It is estimated that the survey will take about 30 min. Participants will be instructed to take a short break (~5 min) after every 15 min as needed.

In the survey, basic screening will be conducted to avoid logic errors in completing the questionnaire. The project PI and local partner will take the responsibility of data quality control and monitoring during the data collection by randomly selecting and reviewing first five finished questionnaires and data record from each site. The questions and feedback will be provided to the research staff in a timely way through daily supervision by SCCHWA and regular meeting and monitoring by the USC research team.

## Key measurements

The key measurements in this study are composed of primary outcomes, secondary outcomes, and individual background measures (to be collected through the survey questionnaire); and contextual measures (to be extracted from publicly available datasets). Most of the demographic and psychosocial and health behavior measurements used for Black women participants in this study are field-tested and validated in previous studies and have been shown to be reliable and valid. The measures will be further modified based on the specific aims of this study, qualitative study findings, and literature on resilience, coping strategies, mental health in the context of COVID-19. The final draft of all measures will be reviewed by the CAB and will be pilot-tested among 15 Black women recruited from pilot-testing site to obtain participants' perspectives on the clarity, cultural sensitivity, and appropriateness of relevant measures.

**Primary outcomes** will be mental health symptoms measured by standardized self-reported scales with good psychometric

characteristics (e.g., validity and reliability) in previous studies: (1) depression, measured Patient Health Questionnaire-9 (PHQ-9) (63). One recent literature review suggests solid evidence supporting the validity of the PHQ-9 as a unidimensional measure of depression. Used in major depressive disorder (MDD) screening with a cut-point of 11, its sensitivity was 95% and specificity was 88.3% (PPV 51.4%, NPV 48.6%) (64); (2) anxiety measured by Generalized Anxiety disorder-7 (GAD-7) (65). Confirmatory factor analyses suggest the 1-dimensional structure of the GAD-7 and its factorial invariance for gender and age. GAD-7 shows high reliability across gender and age groups ( $\alpha = 0.89$ ). Intercorrelations with the depression and the Rosenberg Self-Esteem Scale were  $r = 0.64$  ( $P < 0.001$ ) and  $r = -0.43$  ( $P < 0.001$ ), respectively (66). (3) Post-traumatic stress disorders, PTSD, measured by (PC-PTSD-5) (67). The PC-PTSD-5 is modified based on Primary Care PTSD screen (PC-PTSD) to reflect the new Diagnostic and Statistical Manual of Mental Disorders (DSM-5) criteria for PTSD. The PC-PTSD-5 demonstrated excellent diagnostic accuracy (AUC = 0.941; 95% C.I.: 0.912–0.969) (68); and (4) domestic violence measured by a four-item scale that asks respondents how often their partner physically Hurt, Insulted, Threatened with harm, and Screamed at them. These four items make the acronym HITS (69). This is a short domestic violence screening tool widely used in a family practice setting. The sensitivity ranged from 30 to 100% and specificity ranged from 86 to 99%. The reliability is generally good ( $\alpha$  ranged from 0.61 to 0.8) (70).

**Secondary outcomes** will include multiple resilience and their resources: (1) individual resilience of Black women, for example, personal resilience strengths (71), coping strategies (72), self-concept (73); (2) family factors, for example, quality of relationship (74), and healthcare system factors, such as perceived acceptance and trust from healthcare facilities; (3) community resilience, for example, perceived social support (75); and (4) institutional resilience, for example, organizational resilience (an organization's ability to anticipate issues ahead of time and develop a plan for handling identified problems) (76).

**Individual background measures** are basic sociodemographic variables, including: (1) age; (2) educational level; (3) marriage status; (4) household income; (5) health insurance; (6) employment; and (7) COVID-19 infection history, long COVID symptoms, or caregiving experience for family members or neighbors infected by COVID-19, if any.

**Contextual characteristics variables** include aggregated county-level measures at the structural level, community level, and institutional level (Table 1): (1) Structural level: SDOH obtained from the American Community Survey (ACS) (77); (2) Community level: social capital data from an existing dataset from the county-level Social Capital Index Project in the US (78), behavioral and environmental risk exposure data obtained from Behavioral Risk Factor Surveillance System (BRFSS) and County Health Rankings & Roadmaps Program (CHRRP); and (3) Institutional level: health infrastructure data can be retrieved from Area Health Resources File (AHRF), including health professions capacity [primary care physicians (PCP) per 100,000 population, population to PCP ratio] and distance to health facilities. All the aggregated data are county-level measures so we control the cluster effect of various counties in the analysis.

TABLE 1 Contextual characteristics variables and their data sources.

| Variables at multiple socioecological levels                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Data sources                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| <b>Structural level</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                         |
| SDOH measures: population characteristics (race/ethnicity composition, urban/rural status), percent of population with a high school education, percent of population lacking health insurance, income inequality, median household income, percent of population unemployed, percent of population living in poverty, percent of population living with food insecurity, percent of population living in unstable housing                                                                           | American Community Survey (ACS)                                                                         |
| <b>Community level</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                         |
| Social capital index score: family unity (e.g., share of births in past year to women who were unmarried, share of own children living in a single-parent family), community health (numbers of non-religious, non-profit organization, religious congregation per 1,000 population and informal civic engagement), institutional health (Presidential election voting rate, mail-back census response rate, confidence in institution), collective efficacy (Violent crimes per 100,000 population) | Social Capital Index Project                                                                            |
| Behavioral and environmental risk exposure: depression rate and poor mental health days, substance use indicators                                                                                                                                                                                                                                                                                                                                                                                    | Behavioral Risk Factor Surveillance System (BRFSS)<br>County Health Rankings & Roadmaps Program (CHRRP) |
| <b>Institutional level</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                         |
| Health infrastructure: health professions capacity [e.g., primary care physicians (PCP) per 100,000 population, population to PCP ratio], health facilities capacity, distance to health facilities                                                                                                                                                                                                                                                                                                  | Area Health Resources File (AHRF)                                                                       |

## Data analysis

Given the preliminary nature of this work and the small sample size dictated by time and budget limitations of the 1-year research mechanism, quantitative analyses will focus on obtaining estimates of mental health outcomes and multilevel resilience among Black women living in rural areas and characteristics associated with these outcomes, for use in design of a larger study. Therefore, the specific analysis plan includes (1) Participant characteristics will be presented using counts and percentages for categorical variables and means and standard deviations or medians and inter-quartile ranges (IQR) for continuous variables; (2) Descriptive statistics will be used to evaluate distributions of the measures; (3) Psychometric characteristics of scales will be evaluated using Cronbach's alpha and factor analysis, then compared to published scale psychometrics in Black women if possible. The temporal stability of scales will also be investigated to ensure reliability. These approaches will help assess the utility of the instruments used for future analyses and research in this subpopulation; (4) Exploration and estimation of the associations between primary outcomes (mental health and domestic violence) and secondary outcomes (multilevel resilience), for which correlation analysis and ANOVA for continuous variables will be conducted; and (5) Potential cofounders (e.g., sociodemographic factors) will

be evaluated for associations with outcomes using Wilcoxon rank sum or independent-sample *t*-tests, Spearman or Pearson correlations, and chi-square tests as appropriate. Multivariable analyses will be used to adjust for sociodemographic and other potential covariates (including aggregated county-level contextual characteristics). Cluster effect will be adjusted too in the regression analysis.

## Power analysis

Since the proposed study is not a clinical trial or longitudinal study, it is not designed or powered to determine the overall intervention effect nor the causal relation between key variables. It is hard to calculate the power and appropriate sample size due to lack of information of key indicators. However, according to rule of thumb of the minimum sample sizes in absolute *N*s, any  $N > 200$  sample offers adequate statistical power for data analysis (79, 80). Therefore, the sample size of 200 in our quantitative study is still acceptable and the preliminary data analysis will help to provide some insights into the promise of a potential resilience-based intervention to inform a future RCT.

## Data triangulation and report development

### Data triangulation

Different types of data will be synthesized and triangulated in different forms and from multiple sources, including inputs from our governmental and community partners and the CAB, findings from the qualitative research and quantitative research, published peer-reviewed and gray literature, conference presentations, government reports, and unpublished data. The data triangulation activities will engage various community and health organization stakeholders (e.g., through local data sharing and interpretation forums). The main results/themes will be cataloged using data-plotting worksheets to identify areas of convergence ("syntheses") or divergence of the study findings from different sources of data (81). For issues with significant divergence from multiple data sources, the CAB and other key stakeholders will be consulted with for further clarification and interpretation. For results that remain inconclusive, the research team will generate research questions or hypotheses for future research.

### Drafting the final report

With assistance from SCCHWA and CAB, the University of South Carolina (USC) research team will draft the final report on policy recommendations based on the outputs of data triangulation. Generally, five key issues will be covered in the policy recommendation report: (1) **Risk and vulnerability** including the key challenges, especially SDOH challenges among Black women in rural communities during the COVID-19 pandemic and their unique needs in healthcare access and mental health intervention; (2) **Resilience** including the manifestations of multilevel resilience (individual-, community-, institutional-level) extracted from participants' lived experiences and their coping strategies. (3) **Resources** including available resources for Black women and community health workers in local



communities in response to public health emergencies as well as the types of resources they need but that are not yet available to optimize emergency responses; (4) **Community connectedness**. Rural communities could be connected with each other and shared resources through statewide health organizations such as SCCHWA. The practice will be discussed regarding resource sharing and collaborations across communities but within a common healthcare system; and (5) **Planning and procedures**. Recommendations will be provided about how to improve preparedness and readiness in response to public health emergencies through highlighting the take-home messages for policymakers in healthcare systems. The report will be tailored for community health workers as part of toolkit of their resilience development to optimize emergency preparedness and responses in research translation phase.

### Finalizing report via community charrette

The report draft will be adapted and finalized through a community charrette among the CAB members. As a community engagement strategy recommended by the National Minority AIDS Council, a charrette is a collaborative planning process that purposefully brings together the expertise of community and academic research partners in order to strengthen partnerships, engage stakeholders, and make decisions regarding translational research (82). Since the launch of the charrette model in 2009 [i.e., originating from a clinical translational science award (CTSA) initiative], this process has been used successfully to launch community-engaged research initiatives across the clinical-translation spectrum (82, 83). This approach can help address specific community problems and provide a context for integrating design and scientific inquiries with local community knowledge (84).

The community charrette will be held in a USC or SCCHWA conference room to assure privacy or conducted in a Zoom platform using the “breakout discussion room” function, depending on the logistics and the COVID-19 situation at the time. CAB members will receive the report draft 2 weeks prior to the charrette and be required to review and provide feedback on its content and structure. The charrette will begin with a review of the charrette goals and an explanation of the procedures for the day. Participants (about 10–15) will be divided into groups of 3–4, and members of the research team will co-lead each of the small group discussions. Each group will discuss the same set of questions that are based on the charrette objective (e.g., feedback on each chapter, strengths and weakness, additional content, etc.), and a co-leader will record the primary points on poster paper. After completing small group discussions, the full group will re-convene, and a representative from each group will present their findings; other members will ask questions and points of clarification, and additional information will be added to the poster paper if needed. The poster paper notes become the primary data source. Field notes will be taken during the course of the charrette by two research staff, with observational and interpretive elements. At the end of the charrette, the CAB will engage in a process of critical reflection regarding the group and develop combined reflection notes based on these conversations.

The report will be further revised and finalized based on the data/notes collected from the community charrette among the CAB members. The USC research team will lead the revision and hold multiple meetings of research staff (from both USC and SCCHWA) when necessary. An iterative process will be used with interactive strategies similar to the community charrettes, whereby poster paper notes become new primary data sources, along with field notes taken during the course of each meeting.

## Discussion

The COVID-19 challenges, responses, and resilience among Black women and their families in rural communities in southern states are critical issues for addressing health disparities and improving population wellness. Aiming to explore lived experience and resilience resources among Black women in rural areas, our study has several strengths in terms of theories, data integration, and research approach. First, the integration of multilevel resilience emphasized in the proposed study will address potential limitations or even hazards of an “individual resilience only” approach (e.g., lack of cultural reflection regarding individualism, victim blaming) and inform effective strategies to equip Black women in rural areas with supportive systems from their communities for boosting resilience. Second, the multiple sources of data collected from key stakeholders (e.g., Black women, community leaders, and community health workers) will delineate a full picture regarding individual, institutional, and social/cultural factors influencing the manifestations and effects of different resilience in the context of the southern states. Our final recommendation report based on data triangulation will inform a comprehensive, concrete, and evidence-based strategies and/or interventions tailored for Black women living in rural areas. Finally, the application of community-based participatory approach will contribute to research/operational capacity-building to paraprofessionals and local health organizations, which will, in turn, enhance resilience, increase access to care, improve public health emergency response, and address the healthcare needs of underserved subpopulations and communities affected by COVID-19 (including long COVID).

This study also has some limitations. First, the participants recruited in the study may not be representative for all the Black women in SC given not all of them can access to the recruitment flyers or have the time to receive the interview or finish the survey questionnaire. With the assistance of the community health workers rooted in the local communities, the research team will advertise our project recruitment via multiple channels and optimize their social network in reaching out the “hidden” group. Second, it is difficult to avoid bias in data collection. For example, the recall bias and socially desirable bias may occur in our in-depth interviews and self-report-based survey. Therefore, the insights and advice from the CAB through each step of the research development, implementation, and interpretation of the findings is critical and helpful. Third, the study sites are not randomly selected from all the Black rural counties in SC with a relatively small sample size. Therefore, the findings may not be generalized to the SC and beyond. Further studies with a larger sample size using random sampling are needed to improve the external validity of



the resilience study among Black women in rural areas. Last, the study will not recruit Black men in rural counties therefore there is no “control group” in data analysis. This study design is based on the research aims with a focus on Black women’s lived experiences. Future studies can investigate and compare the challenges and resilience by gender.

Despite these limitations, this study will have strong and sustainable public health implications in terms of improving emergency responses and informing capacity-building strategies. Through reviewing our reports, the health officers will get a comprehensive picture of the lived experience, vulnerability and resilience of rural Black women, their families, and local communities; obtain solid, multi-level, and multi-type evidence of the common challenges and typical situations Black women and their families have to face in public health crisis; and develop effective strategies and plans for resource allocations to increase the preparedness of the whole health system for future local or national emergencies.

Identifying potential resilience resources in local communities that may mitigate negative impacts of COVID-19 pandemic will inform capacity building within rural healthcare system. The findings of this proposed study will assist the state agencies and health systems in their efforts in assessing, integrating, and fostering multilevel resilience resources, particularly at the institutional and community levels. In the future, the research team will work with SCCHWA and key stakeholders through a series of meetings and workshops to finalize the assessment tools and develop training materials beyond the toolkit to assist with institutional resilience development and improvement within community health workers. Through long-term ownership by SCCHWA of the assessment instruments and training package, the resilience development will be sustained and incorporated into the capacity building efforts in response to public health emergency now and in the future.

The data collection, analysis, and interpretation will strengthen our collaboration with SCCHWA and other key stakeholders in rural communities. The dissemination of findings will further enhance the academic-government partnership in response to COVID-19 and future public health emergencies and address unique health needs among rural Black women and their families. The key stakeholders will be encouraged to share their lessons and experiences from front-line practice and give insights into their expectations and recommendations so that the research team can collectively develop plans and strategies for building a resilient health system.

In conclusion, findings in the proposed study will provide valuable references in terms of addressing SDOH challenges during the pandemic, fostering resilience, and informing evidence-based decision-making for policymakers. The study will contribute to the development of public health emergency preparedness plans, which can promote the resilience of women, their families, and local communities as well as optimize effective preparedness and response of health systems for rural Black women and their

families during infectious disease outbreaks and other public health emergencies.

## Ethics statement

The studies involving human participants were reviewed and approved by the Institutional Review Boards at the University of South Carolina (Pro00123957). Informed consent will be provided by participants in the focus group discussions, in-depth interviews, and survey. All methods will be conducted in accordance with relevant guidelines and regulations. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

SQ and XL conceptualized and designed the study. SQ wrote the first draft. SW and XL participated in reviewing and editing the original proposal. BO reached out and engaged local partners and community organization. SQ and SW secured the funding. All authors critically reviewed and edited the manuscript. All authors contributed to the article and approved the submitted version.

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## Conflict of interest

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

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# Comparison of depressive symptoms among healthcare workers in high-risk versus low-risk areas during the first month of the COVID-19 pandemic in China

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**Introduction:** The psychological health of healthcare workers (HCWs) has become a significant concern, particularly during the initial stage of a pandemic. This study compared the depressive symptoms among HCWs in high-risk areas (HRAs) and low-risk areas (LRAs) with matching demographics.

**Methods:** A cross-sectional study was employed to compare the depressive symptoms (Patient Health Questionnaire score  $\geq 10$ ), workplace environment characteristics, the Health Belief Model (HBM) and socio-demographics of the HCWs working in HRAs and LRAs in several accessible regions (mainly Hubei Province and Guangdong–Hong Kong–Macao Greater–Bay–Area) in China. Eight hundred eighty-five HCWs were recruited for unmatched analysis between March 6 and April 2, 2020. After matching with occupation and years of service using a 1:2 ratio, 146 HCWs in HRAs and 290 HCWs in LRAs were selected for matched analysis. Subgroup analyzes were performed using two individual logistic regressions to delineate the associated factors in LRAs and HRAs, respectively.

**Results:** HCWs in LRAs (Prevalence=23.7%) had 1.96 times higher odds of depressive symptoms than those in HRAs (Prevalence=15.1%) after adjusting for occupation and years of service ( $p < 0.001$ ). Significant differences in workplace environment characteristics ( $p < 0.001$ ) and the 5-dimension of the HBM of HCWs ( $p < 0.001$  to  $p = 0.025$ ) were found between HRAs and LRAs.

Logistic regression showed that workers with years of service between 10 and 20 years (OR:6.27), ever had contact with COVID-19 patients (OR:14.33) and had higher scores of “perceived barrier” of HBM (OR:4.48) predicted depressive symptoms in HRAs while working in pneumology departments and infectious disease units (OR:0.06), and high “self-efficacy” in the HBM (OR:0.13) was a protective factor against depressive symptoms.

Contrarily, in LRAs, those HCWs who worked in ICUs (OR:2.59), had higher scores of “perceived susceptibility toward the COVID-19 outbreak” (OR:1.41), “perceived severity of the pandemic” (OR:1.25), and “perceived barriers of wearing masks”



(OR:1.43) in the HBM predicted depressive symptoms. High “cues to action” (OR:0.79), and better “knowledge” (OR:0.79) in the HBM were protective factors against depressive symptoms.

**Conclusion:** The risk of depressive symptoms of HCWS was double in LRAs than in HRAs in the first month of the COVID-19 pandemic. Furthermore, salient predictors for depressive symptoms among HCWs in HRAs and LRAs were very different.

#### KEYWORDS

COVID-19, health personnel, depression, personal protective equipment, health belief model

## Introduction

The coronavirus disease (COVID-19) has become a global pandemic since December, 2019, resulting in massive loss of lives and posing an unprecedented challenge to global health (1, 2). Healthcare workers (HCWs) are at the core of this global fight against the COVID-19 pandemic. The enormous number of cases and fatalities brought on by this pandemic means that HCWs worldwide have been under work overload and mental stress (3), a situation which can lead to an increased prevalence of depressive symptoms among health professionals (4).

According to two latest systematic reviews conducted in Asia, the COVID-19 pandemic has posed a challenging problem among HCWs because of mental tiredness, burnout, dread, sadness, insomnia, and psychological stress, which may adversely affect both HCWs and patient safety (5, 6). The demanding work conditions coupled with the shortage of personal protective equipment and the fear of contracting the virus may enhance the risk of developing depressive symptoms among HCWs (7–9). Current local studies in China and international research on the depressive symptoms also indicated that HCWs were under higher psychological pressure (10–14), a finding which may be attributed to the high demand of work, a lack of readiness for such a pandemic, and the inadequate supply of occupational protective measures. Many studies compared depressive symptoms among HCWs who worked in different working environments [for example, high-risk area (HRAs) and low-risk areas (LRAs)] in Mainland China using convenience sampling as the data collection method (15). However, when this sampling method is used without matching the samples’ demographics, the analysis may be prone to error due to the presence of some essential confounders related to the workplace environment (15). This can lead to over- or under-estimation of the results.

Depressive symptoms among HCWs have been indicated to be closely related to years of work experience and type of occupation (16, 17). However, there are few comparative studies on the depressive symptoms among HCWs in relation to their risk of workplaces, such as in HRAs and LRAs. Owing to this comparative gap, determining the factors that affect HCWs’ depressive symptoms is difficult. Hence,

this study aimed to compare the depressive symptoms among HCWs in HRAs and LRAs in China based on matched characteristics, and hence identify the associated factors that predict HCWs’ depressive symptoms specific to different workplaces.

## Methods

This comparative and cross-sectional study adopted a matching of socio-demographics approach to increase the rigor of comparison between HCWs in HRAs and LRAs. A null hypothesis was used that there is no difference of depressive symptoms between HCWs working in HRAs and LRAs.

## Participants

We conducted an online survey among HCWs working in HRAs and LRAs in China through various platforms (WenJuanXing, WeChat, and other Internet platforms) between March 6 and April 2, 2020, using the convenience sampling method. The World Health Organization officially declared “a Public Health Emergency of International Concern on January 30, 2020, and to characterize the outbreak as a pandemic on March 11, 2020” (18). Therefore, this study investigated the first month of the COVID-19 pandemic (18) on depressive symptoms and related situations among HCWs, where a pandemic is defined as an infectious disease spreading across several countries and affecting a higher-than-expected (usually very large) number of people.

## Settings

Since this was an online data collection method, the names of study places would be various (refer to the [Supplementary Table A](#)), namely Hubei Province and Guangdong–Hong Kong–Macao Greater Bay Area. An HRAs refers to the clinical environment where HCWs would routinely perform treatment or care for patients with confirmed or suspected COVID-19 cases, such as the infectious disease ward, intensive care unit, and accident and emergency department in a region with a known COVID-19 outbreak (19–21). An LRAs refers to the clinical environment wherein the HCWs were unlikely to or only occasionally have contacted some identified COVID-19 cases, such as

Abbreviations: HCWs, Healthcare Workers; HRAs, High-risk areas; LRAs, Low-risk areas; COVID-19, Coronavirus disease; PHQ-9, Patient Health Questionnaire-9; HBM, Health Belief Model.



the infirmary unit and rehabilitation ward (19–22). HCWs for regions that did not experience the COVID-19 outbreak were regarded as working for LRAs at the time of data collection (refer to the [Supplementary Table B](#) for details).

## Data collection

The survey link for the questionnaire was sent by our research team with invitation sentences to one or two doctors or nurses from the target hospital who, then distributed the questionnaire to their colleagues in other departments. The questionnaire comprised 35 items and can only be submitted after HCWs have completed all the questions. Each IP address was only allowed to submit the questionnaire once. Informed consent was obtained from the participants before starting the study. The inclusion criteria were as follows (1): HCWs who could understand the study purpose and agree to participate in this study on a voluntary basis, and (2) HCWs who routinely worked during the outbreak of COVID-19. A total of 885 questionnaires were collected from the study. Consequently, data of 146 and 739 HCWs were coded for HRAs and LRAs, respectively.

## Study tools

HCWs from HRAs and LRAs were surveyed using a Chinese self-reported questionnaire with five sections, i.e., socio-demographics, workplace environment characteristics, Patient Health Questionnaire (PHQ-9) (16, 23, 24), and the Health Belief Model (HBM) (25).

Socio-demographic variables such as gender, occupation, working department, education level, marital status, years of service ( $\pm 1$  year), contact with confirmed or suspected cases of COVID-19, and contact with patients infected with respiratory infectious diseases were also recorded for analysis.

Workplace environment characteristics were investigated with five items (1): the types of masks routinely used (2), the type of masks provided by the department (3), the types of masks that HCWs most wanted to wear (4), whether the protective equipment provided by the hospital is adequate, and (5) the satisfaction level of infection prevention training provided by the hospital. These items have been adopted and reported in a previous study conducted by Lam and his team (21).

The PHQ-9 was employed to assess the depressive symptoms of HCWs in HRAs and LRAs. The nine items comprising the PHQ-9 were measured with a four-point ordinal scale ranging from “0 = not at all” to “3 = nearly every day” (23, 24). The total score could range from 0 to 27, and the severity of depression increases with the score (10–14 for moderate depression, 15–19 for moderately severe depression, and 20–27 for severe depression) (23). Results from a large population study in Hong Kong showed that PHQ-9 was effective in screening depressive symptoms (sensitivity 80%, specificity 92%) (23). In this study, the cutoff value of PHQ-9  $\geq 10$  was defined as having a depressive symptom tendency, and  $< 10$  was described as having no depressive symptom tendency (24). The reliability (Cronbach's  $\alpha = 0.89$  for internal consistency) and validity (exploratory and confirmatory factor analysis used for construct validation) of PHQ-9 for the Chinese people were satisfactory (24).

The HBM (25) is a widely used social-psychological model which provides a valuable framework for investigating health behaviors and identifying essential health beliefs. This study adopted the questionnaire published by Bressington et al. (26) and Cheung et al. (27), their work being the first two studies that investigated the association between mental health and health beliefs globally and locally. The questionnaire consisted of 7 dimensions with 13 questions, including (i) perceived susceptibility toward the COVID-19 outbreak (3 items); (ii) perceived severity of the pandemic (2 items); (iii) perceived benefits of wearing masks (1 item); (iv) perceived barriers of wearing masks (2 items); (v) cues to action for self-protection (2 items); (vi) knowledge of the COVID-19 outbreaks (2 items); and (vii) self-efficacy of properly wearing a mask (1 item). Face, content validity, and construct validity (i.e., known-group method and exploratory factor analysis) was reported in previous studies with satisfactory results (26, 28).

## Statistical analysis

The data were inputted into an Excel spreadsheet, and SPSS statistical package version 28.0 software was used for data analysis. Study participants' demographics and characteristics (categorical data) were analyzed using frequency and percentage. Continuous data were expressed as mean and standard deviation (SD). The differences in participants' workplace environment characteristics, HBM scores, and PHQ-9 scores were analyzed using independent samples t-test and Chi-square test. For identifying the risk and exploring the associated factors of depressive symptoms among HCWs from HRAs and LRAs, multinomial logistic regression and binary logistic regression were applied. We defined the statistical significance as  $p < 0.05$ ; all tests were two-sided.

## Results

### Socio-demographic characteristics

A total of 885 questionnaires were collected from this study. There were 146 HCWs in HRAs and 739 HCWs in LRAs. [Table 1](#) presents the socio-demographic characteristics of both HRAs and LRAs groups before and after matching. According to the matching ratio of 1:2 for this cross-sectional study, 146 HCWs (37% male and 63% female) were grouped as the HRAs group. After matching with occupation and years of service, 290 HCWs (23.4% male and 76.6% female) were grouped as the LRAs group, for a total of 436 samples. The majority of HCWs were female (63.0–77.7%), licensed nurses (60.2–62.1%), married (64.3–76.9%), with bachelor's degrees (60.9–65.8%), and with less than 20 years of service (82.5–93.8%; refer to [Supplementary Table C](#) for graphical illustration).

Significant differences (i.e., gender, working department, ever had contacted with COVID-19 patients, and ever had contacted with respiratory infectious diseases) were consistently demonstrated in unmatched and matched samples for HCWs in HRAs and LRAs ( $p < 0.05$ ; analysis not shown in [Table 1](#)). After matching, a cluster of variables, including occupation, education level, marital status, and years of service, revealed no significant difference between HRAs and LRAs groups.

TABLE 1 Characteristics of the HCWs before and after matching.

| Characteristics                                            | Unmatched       |                | Matched <sup>a</sup> |                |
|------------------------------------------------------------|-----------------|----------------|----------------------|----------------|
|                                                            | High-risk areas | Low-risk areas | High-risk areas      | Low-risk areas |
|                                                            | (N = 146)       | (N = 739)      | N = 146              | N = 290        |
| <b>Gender</b>                                              |                 |                |                      |                |
| Male                                                       | 54 (37.0%)      | 165 (22.3%)    | 54 (37.0%)           | 68 (23.4%)     |
| Female                                                     | 92 (63.0%)      | 574 (77.7%)    | 92 (63.0%)           | 222 (76.6%)    |
| <b>Occupation</b>                                          |                 |                |                      |                |
| Doctor                                                     | 52 (35.6%)      | 213 (28.8%)    | 52 (35.6%)           | 100 (34.5%)    |
| Nurse                                                      | 89 (61%)        | 445 (60.2%)    | 89 (61%)             | 180 (62.1%)    |
| Other                                                      | 5 (3.4%)        | 81 (11.0%)     | 5 (3.4%)             | 10 (3.4%)      |
| <b>Working department</b>                                  |                 |                |                      |                |
| Internal medicine & surgery department                     | 19 (13.0%)      | 196 (27.0%)    | 19 (13.0%)           | 65 (22.4%)     |
| Other                                                      | 29 (19.9%)      | 435 (60.0%)    | 29 (19.9%)           | 186 (64.1%)    |
| ICU                                                        | 67 (45.9%)      | 48 (6.6%)      | 67 (45.9%)           | 17 (5.9%)      |
| Pneumology department and infectious disease               | 31 (21.2%)      | 46 (6.4%)      | 31 (21.2%)           | 22 (7.6%)      |
| <b>Education level</b>                                     |                 |                |                      |                |
| Associate degree or below                                  | 32 (21.9%)      | 193 (26.2%)    | 32 (21.9%)           | 60 (20.7%)     |
| Bachelor's degree                                          | 96 (65.8%)      | 449 (60.9%)    | 96 (65.8%)           | 183 (63.1%)    |
| Master's degree or above                                   | 18 (12.3%)      | 95 (12.9%)     | 18 (12.3%)           | 47 (16.2%)     |
| <b>Marital status</b>                                      |                 |                |                      |                |
| Unmarried/Other                                            | 46 (31.5%)      | 264 (35.7%)    | 46 (31.5%)           | 67 (23.1%)     |
| Married                                                    | 100 (68.5%)     | 475 (64.3%)    | 100 (68.5%)          | 223 (76.9%)    |
| <b>Year of service</b>                                     |                 |                |                      |                |
| <10                                                        | 67 (45.9%)      | 348 (47.1%)    | 67 (45.9%)           | 134 (46.2%)    |
| 10–20                                                      | 69 (47.3%)      | 262 (35.4%)    | 69 (47.3%)           | 138 (47.6%)    |
| >20                                                        | 10 (6.8%)       | 129 (17.5%)    | 10 (6.8%)            | 18 (6.2%)      |
| <b>Ever contacted with COVID-19 patients</b>               |                 |                |                      |                |
| No                                                         | 34 (23.3%)      | 512 (69.3%)    | 34 (23.3%)           | 196 (67.6%)    |
| Yes                                                        | 112 (76.7%)     | 227 (30.7%)    | 112 (76.7%)          | 94 (32.4%)     |
| <b>Ever contacted with respiratory infectious diseases</b> |                 |                |                      |                |
| No                                                         | 11 (7.5%)       | 147 (19.9%)    | 11 (7.5%)            | 53 (18.3%)     |
| Not sure                                                   | 5 (3.4%)        | 60 (8.1%)      | 5 (3.4%)             | 11 (3.8%)      |
| Yes                                                        | 130 (89.1%)     | 532 (72.0%)    | 130 (89.1%)          | 226 (77.9%)    |
| <b>Depressive symptoms</b>                                 |                 |                |                      |                |
| No                                                         | 124 (84.9%)     | 564 (76.3%)    | 124 (84.9%)          | 224 (77.2%)    |
| Yes                                                        | 22 (15.1%)      | 175 (23.7%)    | 22 (15.1%)           | 66 (22.8%)     |
| <b>Severity of depressive symptoms</b>                     |                 |                |                      |                |
| Non-depressive symptoms                                    | 124 (84.9%)     | 564 (76.3%)    | 124 (84.9%)          | 224 (77.2%)    |
| Moderate depressive symptoms                               | 15 (10.3%)      | 94 (12.7%)     | 15 (10.3%)           | 38 (13.1%)     |
| Moderately severe depressive symptoms                      | 6 (4.1%)        | 54 (7.3%)      | 6 (4.1%)             | 22 (7.6%)      |
| Severe depressive symptoms                                 | 1 (0.7%)        | 27 (3.7%)      | 1 (0.7%)             | 6 (2.1%)       |

<sup>a</sup>In our study, occupation and year of service were matched.

## Comparison of depressive symptoms

The prevalence of depressive symptoms in matched HRAs and LRAs groups were 15.1 and 22.8%, respectively. In

addition, a significant difference in depressive symptoms among HCWs in HRAs and LRAs was found only in unmatched samples ( $p=0.022$ ) but not in matched samples ( $p=0.054$ ) in univariate analyzes.

As shown in Table 2, the risk of depressive symptoms in the unmatched sample was 1.93 times higher among the HCWs of LRAs relative to their HRAs counterparts [adjusted odds ratio (AOR): 1.93, 95%CI=1.12–3.33]. A comparable and consistent result was also obtained in the matched sample (AOR: 1.96, 95%CI=1.07–3.62). However, multinomial logistic regression indicated HCWs in two different workplaces did not predict the degree (i.e., moderate, moderately severe, and severe) of depressive symptoms in either unmatched or matched samples, adjusted or non-adjusted calculations.

## Comparison of the items of depressive symptoms

Table 3 shows the results of the PHQ-9 scores of HCWs in matched samples. The total scores of PHQ-9 for HCWs working in HRAs and LRAs were 5.43 (SD 4.64), and 6.21 (SD 5.39), respectively. The PHQ-9 score of >10 was used as the cutoff value in this study to indicate a depressive symptoms tendency.

HCWs in LRAs had significantly higher scores than those in HRAs for Item 1, “little interest or pleasure in doing things” (0.89, SD 0.83 vs. 0.71, SD 0.73;  $p=0.026$ ), Item 2 “feeling down, depressed, or hopeless,” (0.82, SD 0.78 vs. 0.60, SD 0.64,  $p=0.004$ ), Item 6 “feeling bad about yourself or that you are a failure or have let yourself or your family down” (0.56, SD 0.72 vs. 0.33, SD 0.60,  $p<0.001$ ), and Item 9, “thoughts that you would be better off dead or of hurting yourself” (0.19, SD 0.51 vs. 0.10, SD 0.39,  $p=0.029$ ).

## Comparison of workplace environment characteristics

Table 4 shows the comparison of workplace environment characteristics of the HCWs in the matched sample. The N95 respirator was the most commonly used respiratory protection device in HRAs in both routine use (54%) and under specific conditions (55%;  $p<0.001$ ). Regarding personal protective equipment adequacy, a significant difference was found between HRAs and LRAs (76.0% vs. 52.1%,  $\chi^2=24.19$ ,  $p<0.001$ ). Among HCWs, greater satisfaction with the provided infection control training was observed in those from HRAs (97.3%) rather than from LRAs (80.0%) areas ( $\chi^2=29.70$ ,  $p<0.001$ ).

## Comparison of scores on the health belief model

Table 5 presents the results of the HCWs’ scores in the HBM questionnaire. The following five dimensions of the HBM questionnaire showed significant differences between HCWs in HRAs and LRAs: perceived susceptibility ( $t=2.253$ ,  $p=0.025$ ), perceived severity ( $t=-4.895$ ,  $p<0.001$ ), perceived barrier ( $t=2.495$ ,  $p=0.013$ ), cues to action for self-protection ( $t=4.054$ ,  $p<0.001$ ), and knowledge ( $t=5.772$ ,  $p<0.001$ ). Hence, the total scores also showed statistically significant differences ( $t=3.493$ ,  $p=0.001$ ). Apart from the dimension of perceived severity that the score from LRAs (4.93, SD=1.63) was higher than that from HRAs (4.25, SD=1.24), all the above mentioned dimensions obtained higher scores in HRAs than that in LRAs.

## Subgroup analysis of associated factors to depressive symptoms

As the workplace environment characteristics of the HRAs and LRAs were heterogeneous, grouping all the samples for regression analysis is not recommended. Instead, subgroup analysis was used to delineate the corresponding associated factors in unmatched samples. Table 6 presents two individual results of binary logistic regression analyzes regarding factors related to depressive symptoms in HRAs and LRAs, respectively.

For HCWs in HRAs, logistic regression showed that participants with years of service between 10 and 20 years (OR: 6.27, 95%CI=1.07–36.70), ever had contacted with COVID-19 patients (OR: 14.33, 95%CI=1.20–171.62), and had higher score of “perceived barrier” of HBM (OR: 4.48, 95%CI=1.82–11.05) were at higher risk of depressive symptoms. Working in pneumology departments and infectious disease units (OR: 0.06, 95%CI=0.00–0.95) and higher “self-efficacy” in the HBM (OR: 0.13 95%CI=0.02–0.86) were protective factors against depressive symptoms.

For HCWs in LRAs, those who worked in ICUs (OR: 2.59, 95%CI=1.18–5.72), had higher scores of “perceived susceptibility toward the COVID-19 outbreak” (OR: 1.41, 95%CI=1.10–1.79),

TABLE 2 Results for logistic regression model using high-risk areas as a reference before and after matching.

|                            | Depressive symptoms <sup>a</sup> |               | Moderate depressive symptoms <sup>b</sup> |               | Moderately severe depressive symptoms <sup>b</sup> |               | Severe depressive symptoms <sup>b</sup> |               |
|----------------------------|----------------------------------|---------------|-------------------------------------------|---------------|----------------------------------------------------|---------------|-----------------------------------------|---------------|
|                            | OR(95%CI)                        | AOR(95%CI)    | OR(95%CI)                                 | AOR(95%CI)    | OR(95%CI)                                          | AOR(95%CI)    | OR(95%CI)                               | AOR(95%CI)    |
| <b>Unmatched</b>           |                                  |               |                                           |               |                                                    |               |                                         |               |
| Low-risk areas             | 1.75                             | 1.93          | 1.38                                      | 1.54          | 1.98                                               | 2.31          | 5.94                                    | 4.69          |
|                            | (1.08–2.84)                      | (1.12–3.33)   | (0.77–2.46)                               | (0.80–2.95)   | (0.83–4.70)                                        | (0.89–5.96)   | (0.80–44.10)                            | (0.58–38.07)  |
| High-risk areas            | 1 [reference]                    | 1 [reference] | 1 [reference]                             | 1 [reference] | 1 [reference]                                      | 1 [reference] | 1 [reference]                           | 1 [reference] |
| <b>Matched<sup>c</sup></b> |                                  |               |                                           |               |                                                    |               |                                         |               |
| Low-risk areas             | 1.66                             | 1.96          | 1.40                                      | 2.04          | 2.03                                               | 1.72          | 3.32                                    | 2.30          |
|                            | (0.98–2.82)                      | (1.07–3.62)   | (0.74–2.65)                               | (0.98–4.23)   | (0.80–5.14)                                        | (0.60–4.95)   | (0.40–27.90)                            | (0.24–21.86)  |
| High-risk areas            | 1 [reference]                    | 1 [reference] | 1 [reference]                             | 1 [reference] | 1 [reference]                                      | 1 [reference] | 1 [reference]                           | 1 [reference] |

OR, odds ratio; CI, confidence interval.

AOR, adjusted for gender, occupation, working department, years of service, ever contacted with COVID-19 patients and ever contacted with respiratory infectious diseases.

<sup>a</sup>Binary logistic regression model.

<sup>b</sup>Multinomial logistic regression model.

<sup>c</sup>In our study, occupation and year of service were matched.

TABLE 3 Comparison of PHQ-9 scores of HCWs after matching<sup>a</sup> ( $\bar{x} \pm \text{SD}$ ).

| Items                                                                                                                                                                       | High-risk areas    | Low-risk areas     | $t/\chi^2$ | $p$ value |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|------------|-----------|
|                                                                                                                                                                             | ( $n=146$ )        | ( $n=290$ )        |            |           |
| 1. Little interest or pleasure in doing things                                                                                                                              | 0.71 $\pm$ 0.73    | 0.89 $\pm$ 0.83    | −2.235     | 0.026     |
| 2. Feeling down, depressed, or hopeless                                                                                                                                     | 0.60 $\pm$ 0.64    | 0.82 $\pm$ 0.78    | −2.865     | 0.004     |
| 3. Trouble falling or staying asleep, or sleeping too much                                                                                                                  | 1.10 $\pm$ 0.89    | 0.94 $\pm$ 0.91    | 1.684      | 0.093     |
| 4. Feeling tired or having little energy                                                                                                                                    | 0.87 $\pm$ 0.77    | 1.01 $\pm$ 0.92    | −1.552     | 0.121     |
| 5. Poor appetite or overeating                                                                                                                                              | 0.73 $\pm$ 0.74    | 0.71 $\pm$ 0.81    | 0.283      | 0.777     |
| 6. Feeling bad about yourself -- or that you are a failure or have let yourself or your family down                                                                         | 0.33 $\pm$ 0.60    | 0.56 $\pm$ 0.72    | −3.526     | <0.001    |
| 7. Trouble concentrating on things, such as reading the newspaper or watching television                                                                                    | 0.60 $\pm$ 0.83    | 0.63 $\pm$ 0.82    | −0.340     | 0.734     |
| 8. Moving or speaking so slowly that other people could have noticed? Or the opposite --being so fidgety or restless that you have been moving around a lot more than usual | 0.39 $\pm$ 0.59    | 0.46 $\pm$ 0.72    | −1.001     | 0.318     |
| 9. Thoughts that you would be better off dead, or of hurting yourself in some way                                                                                           | 0.10 $\pm$ 0.39    | 0.19 $\pm$ 0.51    | −2.192     | 0.029     |
| Total score                                                                                                                                                                 | 5.43 $\pm$ 4.64    | 6.21 $\pm$ 5.39    | −1.557     | 0.120     |
| Depressive symptoms                                                                                                                                                         | Number of HCWs (%) | Number of HCWs (%) |            |           |
| • Yes                                                                                                                                                                       | 22 (15.1%)         | 66 (22.8%)         | 3.703      | 0.054     |
| •No                                                                                                                                                                         | 124 (84.9%)        | 224 (77.2%)        |            |           |

The items adapted from the PHQ-9 questionnaire (23, 24).

<sup>a</sup>In our study, occupation and year of service were matched.

“perceived severity of the pandemic” (OR: 1.25, 95%CI=1.07–1.46), and “perceived barriers of wearing masks” (OR: 1.43, 95%CI=1.21–1.69) in the HBM were at higher risk of depressive symptoms. By contrast, HCWs who had higher scores of “cues to action for self-protection” (OR: 0.79, 95%CI=0.67–0.95) and “knowledge of COVID-19” (OR: 0.79, 95%CI=0.64–0.98) in the HBM were at lower risk of depressive symptoms.

## Discussion

This comparative study (HRAs vs. LRAs) adopted a cross-sectional design with matching essential socio-demographics in a 1:2 ratio, an approach which increases rigor in the method to reduce the risk of errors. According to the current result, a null hypothesis is hence rejected. Although a significant difference in depressive symptoms was found between HCWs working in HRAs and LRAs only in the unmatched sample, logistic regression analyzes indicated that the risk level of workplace significantly predicted depressive symptoms in both unmatched and matched samples. Surprisingly, HCWs in LRAs consistently expressed higher depressive symptoms than those in HRAs.

The impact of COVID-19 on HCWs’ psychological health (anxiety and depressive symptoms) has been reported in local (29, 30) and international studies (31–33). Studies have also reported high depressive symptoms (and high suicidal thoughts, measured by one item in the PHQ-9) among HCWs, particularly during the COVID-19

pandemic (31–33). To our knowledge, this research is one of the first to quantitatively compare the depressive symptoms among HCWs in HRAs and LRAs using a matched method. Utilizing these matched samples in a comparative study that minimized the selection bias of conveniently sampled HCWs would result in better credibility than a simple cross-sectional study, as the confounding factors have been adjusted (34, 35). After matching with occupation and years of service, the depressive symptoms among HCWs in LRAs were 1.96 times that of counterparts in HRAs.

## Overlooked group of healthcare workers

Depressive symptoms were common among HCWs during the initial stage of the pandemic (i.e., the first few months), irrespective of workplace environment characteristics. Studies conducted in other locations in Saudi Arabia, China, Europe, and Canada also found that HCWs had a high prevalence of depressive symptoms at 54, 43, 28, and 23%, respectively (36–39). Furthermore, in the United States, machine-learning analysis on the mental health of HCWs reported a decline in mental health associated mainly with the healthcare role of HCWs (i.e., Nurse, emergency room staff, etc.) (40). Various local research in China also established that HCWs were more likely to have depressive symptoms during the COVID-19 pandemic, a circumstance which was more common among women and nurses (29, 30, 41). The prevalence of depressive symptoms in this study was higher in LRAs than in HRAs (23.7% vs. 15.1%), an

TABLE 4 Comparison of the HCWs' workplace environment characteristics after matching<sup>a</sup>.

| Variables                                                    | High-risk areas | Low-risk areas | $\chi^2$ | p value |
|--------------------------------------------------------------|-----------------|----------------|----------|---------|
|                                                              | (n=146)         | (n=290)        |          |         |
| Type of mask for routine use:                                |                 |                | 107.591  | <0.001  |
| • General medical surgical mask                              | 66 (45.2)       | 264 (91)       |          |         |
| • N95 respirator                                             | 80 (54.8)       | 26 (9)         |          |         |
| Type of mask used in conditions (under specific conditions): |                 |                | 44.518   | <0.001  |
| • General medical surgical mask                              | 65 (44.5)       | 223 (76.9)     |          |         |
| • N95 respirator                                             | 81 (55.5)       | 67 (23.1)      |          |         |
| Wished type of mask:                                         |                 |                | 49.609   | <0.001  |
| • General medical surgical mask                              | 14 (9.6)        | 117 (40.3)     |          |         |
| • N95 respirator                                             | 132 (90.4)      | 173 (59.7)     |          |         |
| Adequacy of personal protective equipment:                   |                 |                | 24.189   | <0.001  |
| • Enough                                                     | 111 (76)        | 151 (52.1)     |          |         |
| • Not enough                                                 | 35 (24)         | 139 (47.9)     |          |         |
| Satisfactory level of infection control training:            |                 |                | 29.695   | <0.001  |
| • Satisfactory                                               | 142 (97.3)      | 232 (80)       |          |         |
| • Not satisfactory                                           | 4 (2.7)         | 58 (20)        |          |         |

Variables adapted from a study by Bressington et al. (26).

<sup>a</sup>In our study, occupation and year of service were matched.

outcome which differs from the general perspectives and is new to the literature. HCWs in HRAs are believed to have a higher risk of depressive symptoms as they were facing more COVID-19 patients and witnessing much more death than their counterparts in LRAs, especially during the first month COVID-19 pandemic. However, our results revealed that HCWs working in LRAs during the initial stage of the COVID-19 pandemic had even higher depressive symptoms. Such a result might be related to insufficient attention or support.

## Justifications for the results

HCWs are at higher risk of depressive symptoms, particularly in the LRAs in our study. Several explanations may account for the current results.

First, we intentionally compared the workplace environment characteristics between HRAs and LRAs. We anticipated better quality, standard, and quantity of personal protective equipment and training in HRAs. Regarding the department/unit in which HCWs worked, most of the HCWs in LRAs worked in the internal medicine, surgery, and other departments. Additionally, HCWs exposed to COVID-19 patients were much fewer in LRAs than in HRAs (Table 1, 32.4% vs. 76.7%). Thus, we can infer that the samples of HCWs in HRAs in this study were indeed from HRAs. With reference to the

principle of being “reasonably practicable” as resources for infection control and prevention (42), the current result is sound. Nevertheless, insufficient personal protective equipment is associated with depressive symptoms among HCWs regardless of the unit or workplace involved (20, 21, 42, 43). Therefore, clear instructions with justifications and the necessity of standard infection precaution and control are critical to strengthen the principle of being “reasonably practicable” and hence reduce unnecessary worry and anxiety.

Second, we also compared the scores of the HBM in our matched samples. The significant group difference for perceived severity indicated that HCWs in LRAs might overestimate the severity of COVID-19, thereby causing additional depressive symptoms. Coupled with their higher perceived barriers, fewer cues to action for self-protection, and less knowledge on COVID-19, HCWs in LRAs demonstrated more depressive symptoms. All of these associated factors were salient predictors in the logistic regression model.

Lastly, the univariate analysis indicated that the difference in depressive symptoms was marginally not significant between matched HCWs in HRAs and LRAs ( $p = 0.054$ ). However, after adjusting for several essential confounders (i.e., gender, occupation, working department, years of service, ever contacted with COVID-19 patients and ever contacted with respiratory infectious diseases), both unmatched and matched samples demonstrated a consistent and significant result that HCWs in LRAs had a higher risk of depressive symptoms than those in HRAs. This inconsistency demonstrated the



TABLE 5 Comparison of HCWs HBM scores after matching\* ( $\bar{x} \pm SD$ ).

| Dimensions               | High-risk areas  | Low-risk areas   | <i>t</i> | <i>p</i> value |
|--------------------------|------------------|------------------|----------|----------------|
|                          | ( <i>n</i> =146) | ( <i>n</i> =290) |          |                |
| Perceived susceptibility | 4.94 ± 0.94      | 4.72 ± 1.02      | 2.253    | 0.025          |
| Perceived severity       | 4.25 ± 1.24      | 4.93 ± 1.63      | −4.895   | <0.001         |
| Perceived benefits       | 3.57 ± 0.67      | 3.49 ± 0.65      | 1.186    | 0.236          |
| Perceived barriers       | 5.76 ± 1.21      | 5.44 ± 1.36      | 2.495    | 0.013          |
| Cues to action           | 7.29 ± 1.15      | 6.80 ± 1.33      | 4.054    | <0.001         |
| Knowledge                | 7.16 ± 1.00      | 6.49 ± 1.38      | 5.772    | <0.001         |
| Self-efficacy            | 3.77 ± 0.50      | 3.69 ± 0.51      | 1.45     | 0.148          |
| Total score              | 36.73 ± 3.48     | 35.56 ± 3.21     | 3.493    | 0.001          |

Dimensions adapted from the health belief model (25).

\*In our study, occupation and year of service were matched.

limitation of the univariate analysis and the strength of the multivariate analysis.

In HRAs, this result is consistent with those reported by Luo and his teammates (29). HCWs in HRAs were under immense pressure to work with many COVID-19 patients and diagnose and treat highly infectious COVID-19 cases. Therefore, depressive symptoms were intuitively understandable, as reported by numerous studies (30, 39–41, 44). In contrast to their high-risk counterparts, HCWs in LRAs were less likely to be exposed to COVID-19 patients. However, diversity and workload intensity have been added as variables because of shift scheduling from those HCWs assigned to HRAs. According to the literature, depressive symptoms among HCWs might be attributed to longer working hours, responsibility for and contact with more patients, insufficient personal protective equipment, inadequate infectious control training, and frequently witnessing the death of patients (7–9, 17, 45, 46). Some associated factors, like working on the frontline and worried about infection, were consistently indicated by a multidimensional machine learning-based prediction model (28).

## Recommendations

HCWs in HRAs received widespread public attention and emotional support, such as national awards and commendations, gratitude, salary improvement, and welfare (47, 48). By contrast, HCWs in LRAs did not receive adequate public attention and emotional support, which might explain why they were being overlooked in relation to their contribution as well as their needs.

Thus, governments, health administrations, and society should also pay appropriate attention to HCWs in LRAs as they do for HCWs in HRAs. Hospital leaders should enhance support in the workplace, including improving infection control of COVID-19 and psychological training for HCWs. Furthermore, strategies should be implemented to reduce the working hours for one shift, increase subsidy, and provide HCWs preferential treatment in professional title appraisals. Hospital leaders should also support HCWs with a sense of professionalism, mission, and honor to keep improving their psychological health.

## Limitations

This study had several limitations. First, the HCWs in the LRAs only came from the Guangdong–Hong Kong–Macao Greater Bay Area. This geographical limitation affects the representativeness of the HCWs. Second, the HCWs in LRAs were mostly from other and internal medicine departments compared to HCWs in HRAs who were mostly from intensive care units and infectious disease units, a discrepancy which might lead to the underestimation of the prevalence of depressive symptoms in the LRAs group compared to their high-risk counterparts. However, our study revealed a higher tendency of depressive symptoms among HCWs in LRAs relative to those from HRAs, an outcome which may somewhat attenuate the working department difference of HCWs from the two areas. Moreover, this underestimation of the prevalence of depressive symptoms in LRAs would generate greater attention toward the psychological health prevention strategy of HCWs in LRAs during the COVID-19 pandemic. Finally, given the self-report questionnaires and online-based approach applied for data collection in this study, recall and selection biases are possible. Although we applied a matched sampling method and adjusted for confounding factors during analysis, those measures cannot completely rectify these biases.

## Conclusion

The prevalence of depressive symptoms among HCWs in LRAs was significantly higher than that in HRAs. Associated factors of depressive symptoms among HCWs in LRAs and HRAs were different. Hence, subgroup analyzes were recommended to delineate their salient predictors. In general, results suggested a need for a holistic approach, such as providing adequate personal protective equipment and suitable infection control training and support, to reduce the risk of depressive symptoms among HCWs whether they are employed in HRAs or LRAs.

## Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding authors.

## Ethics statement

The studies involving human participants were reviewed and approved by Human Subjects Ethics Sub-committee of the Special Geriatric Committee of Zhongshan Medical Association. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

EH, SL, and LS were responsible for the conceptualization and study design. EH, SC, VP, and JH collected the data. EH, LL, and X-WZ handled the preparation of the first draft of the

TABLE 6 Binary logistic regression examining factors related to depressive symptoms among high-risk areas ( $n=146$ ) and low-risk areas ( $n=739$ ).

| Variables                                                  | High-risk areas |             |                | Low-risk areas |           |                |
|------------------------------------------------------------|-----------------|-------------|----------------|----------------|-----------|----------------|
|                                                            | AOR             | 95%CI       | <i>p</i> value | AOR            | 95%CI     | <i>p</i> value |
| <b>Basic characteristics</b>                               |                 |             |                |                |           |                |
| <b>Gender</b>                                              |                 |             |                |                |           |                |
| Male                                                       | Reference       |             |                | Reference      |           |                |
| Female                                                     | 0.27            | 0.06–1.32   | 0.106          | 0.79           | 0.45–1.39 | 0.415          |
| <b>Occupation</b>                                          |                 |             |                |                |           |                |
| Doctor                                                     | Reference       |             |                | Reference      |           |                |
| Nurse                                                      | 1.33            | 0.24–7.36   | 0.748          | 0.83           | 0.44–1.57 | 0.563          |
| Other                                                      | 0.39            | 0.01–30.86  | 0.670          | 0.52           | 0.22–1.24 | 0.142          |
| <b>Working department</b>                                  |                 |             |                |                |           |                |
| Internal medicine & surgery department                     | Reference       |             |                | Reference      |           |                |
| Other                                                      | 0.24            | 0.02–3.42   | 0.292          | 0.80           | 0.49–1.30 | 0.364          |
| ICU                                                        | 0.11            | 0.01–1.27   | 0.078          | 2.59           | 1.18–5.71 | 0.018          |
| Pneumology department and Infectious Disease               | 0.06            | 0.00–0.95   | 0.046          | 0.47           | 0.17–1.32 | 0.151          |
| <b>Education level</b>                                     |                 |             |                |                |           |                |
| Associate degree or below                                  | Reference       |             |                | Reference      |           |                |
| Bachelor degree                                            | 0.57            | 0.05–6.37   | 0.644          | 0.80           | 0.49–1.32 | 0.387          |
| Master degree or above                                     | 0.06            | 0.00–3.47   | 0.170          | 0.77           | 0.38–1.56 | 0.472          |
| <b>Marital status</b>                                      |                 |             |                |                |           |                |
| Unmarried/Other                                            | Reference       |             |                | Reference      |           |                |
| Married                                                    | 3.65            | 0.54–24.49  | 0.183          | 0.92           | 0.54–1.59 | 0.777          |
| <b>Year of service</b>                                     |                 |             |                |                |           |                |
| <10                                                        | Reference       |             |                | Reference      |           |                |
| 10–20                                                      | 6.27            | 1.07–36.70  | 0.042          | 1.10           | 0.64–1.89 | 0.740          |
| >20                                                        | 0.00            | 0.00–       | 0.998          | 1.11           | 0.57–2.19 | 0.757          |
| <b>Ever contacted with patients with COVID-19</b>          |                 |             |                |                |           |                |
| No                                                         | Reference       |             |                | Reference      |           |                |
| Yes                                                        | 14.33           | 1.20–171.62 | 0.036          | 1.35           | 0.83–2.18 | 0.223          |
| <b>Ever contacted with respiratory infectious diseases</b> |                 |             |                |                |           |                |
| No                                                         | Reference       |             |                | Reference      |           |                |
| Not sure                                                   | 0.00            | 0.00–       | 0.999          | 1.06           | 0.43–2.63 | 0.897          |
| Yes                                                        | 0.11            | 0.00–2.62   | 0.171          | 1.14           | 0.62–2.09 | 0.678          |
| <b>Health Belief Model</b>                                 |                 |             |                |                |           |                |
| Perceived susceptibility                                   | 1.63            | 0.73–3.64   | 0.236          | 1.41           | 1.10–1.79 | 0.006          |
| Perceived severity                                         | 0.93            | 0.46–1.87   | 0.829          | 1.25           | 1.07–1.46 | 0.006          |
| Perceived benefits                                         | 0.40            | 0.12–1.30   | 0.126          | 1.04           | 0.73–1.48 | 0.846          |
| Perceived barriers                                         | 4.48            | 1.82–11.05  | 0.001          | 1.43           | 1.21–1.69 | <0.001         |
| Cues to action                                             | 1.15            | 0.58–2.30   | 0.686          | 0.79           | 0.67–0.95 | 0.010          |
| Knowledge                                                  | 0.69            | 0.23–2.04   | 0.498          | 0.79           | 0.64–0.98 | 0.028          |
| Self-efficacy                                              | 0.13            | 0.02–0.86   | 0.034          | 1.26           | 0.81–1.95 | 0.314          |

AOR, adjusted odds ratio.

manuscript. X-WZ analyzed the data. SL and LS provided a critical review to finalize the draft. All authors provided intellectual content, reviewed the manuscript, and agreed on the submitted version.

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## Conflict of interest

The authors declare that this research was conducted without any commercial or financial relationships that could be construed as potential conflicts of interest.

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## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsy.2023.1154930/full#supplementary-material>

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# Identification and comparison of pandemic-to-symptom networks of South Korea and the United States

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**Background:** The Coronavirus (COVID-19) pandemic resulted in a dramatic increase in the prevalence of anxiety and depression globally. Although the impact on the mental health of young adults was especially strong, its underlying mechanisms remain elusive.

**Materials and methods:** Using a network approach, the present study investigated the putative pathways between pandemic-related factors and anxiety and depressive symptoms among young adults in South Korea and the U.S. Network analyses were conducted on cross-country data collected during the COVID-19 lockdown period ( $n=1,036$ ). Our model included depression symptoms (PHQ-9), generalized anxiety symptoms (GAD-7), and COVID-19-related factors (e.g., COVID-19-related traumatic stress, pandemic concerns, access to medical/mental health services).

**Results:** The overall structure of pandemic-to-symptom networks of South Korea and the U.S. were found to be similar. In both countries, COVID-related stress and negative future anticipation (an anxiety symptom) were identified as bridging nodes between pandemic-related factors and psychological distress. In addition, worry-related symptoms (e.g., excessive worry, uncontrollable worry) were identified as key contributors in maintaining the overall pandemic-to-symptom network in both countries.

**Conclusion:** The similar network structures and patterns observed in both countries imply that there may exist a stable relationship between the pandemic and internalizing symptoms above and beyond the sociocultural differences. The current findings provide new insights into the common potential pathway between the pandemic and internalizing symptoms in South Korea and in the U.S. and inform policymakers and mental health professionals of potential intervention targets to alleviate internalizing symptoms.

## KEYWORDS

COVID-19 pandemic, anxiety, depression, network analysis, cross-country study



## 1. Introduction

The Coronavirus (COVID-19) pandemic broke out in December 2019 and has spread to more than 200 countries, resulting in approximately 6.4 million casualties worldwide (1, 2). During the pandemic, there has been a sharp increase in the prevalence of anxiety and depression globally (3–5). A recent study reported that cases of moderate-to-severe depression increased by 25.4% and cases of anxiety disorder rose by 19.5% in 59 countries during the pandemic (6). According to a report by the Organization of Economic Co-operation and Development (7), the COVID-19 pandemic had a greater impact on the mental health of young adults compared to other age groups, with the prevalence of anxiety and depression symptoms almost doubling since before the pandemic for this age group. Young adulthood is the prime time for the emergence and recurrence of anxiety and depressive disorders (8, 9). Young adults, who generally have less secure jobs and are more sensitive to social restrictions, may be more vulnerable to psychological distress caused by vast changes in daily life during the pandemic (10–13). In order to mitigate mental health burden of the pandemic and prepare for future social upheavals, it is critical to understand the mechanisms underlying its impact in this population.

The impact of the pandemic on peoples' mental health is not independent of their sociocultural contexts. While the COVID-19 pandemic has increased the risk of anxiety and depression worldwide, the way it affects mental health of people across different countries may not be the same. A case in point is South Korea and the United States. There are some contextual differences, including pandemic-related government policies, culture, and access to mental health services, which may have affected the way mental health problems have been manifested in the two countries during the pandemic. For instance, the South Korean government has taken a containment strategy focusing on disease prevention (14–17), whereas in the U.S., a mitigation strategy was implemented at the level of government, that focused on reducing severe cases, while the stringency of the strategy differed widely depending on individual states (14, 18). In addition, people of a collectivistic orientation like that of South Korea tend to show stronger risk perception and a higher sense of social responsibility toward their in-groups compared to a more individualistic culture (e.g., U.S.) (19–21), which may have impacted the psychological vulnerability during the early, adjustment stages of the pandemic. Lastly, differences in mental health care systems and accessibility to available mental healthcare in the two countries might also have contributed to different progress of anxiety/depression during the pandemic.

To our knowledge, there exists only one cross-country study that compared the impact of the pandemic on mental health between South Korea and the U.S. Dean et al. (22) investigated how various factors including demographics, public health strategies and psychological factors during the early stages of the pandemic influenced psychological distress in four countries (South Korea, Hong Kong, France, and the U.S.). Despite the differences in culture and public health strategies, they found overall similarities in the relationship between the pandemic-related factors and psychological distress across these countries. Specifically, younger age, greater concern for COVID-19 and loneliness were identified as the common factors that contributed to deteriorated psychological health during the pandemic (22). However, the dependent variable in their study

was a single psychological distress score. The present research examined individual symptoms of anxiety and depression in an attempt to delineate specific pathways from pandemic-related factors to psychological distress.

Network analysis is a promising approach to examine the relationship between pandemic-related factors and anxiety/depression symptoms. The network perspective assumes that mental disorders are emergent phenomena that arise from mutual interactions among multiple symptoms, which is an alternative approach to latent variable models that conceptualize mental disorders as underlying variables that cause a range of psychiatric symptoms (23, 24). Firstly, because the network perspective regards mental disorders as a result of interactions between symptoms, it presumes the role of bridging symptoms that connect the two disorders, or symptoms clusters, to explain their comorbidity (24, 25). Moreover, the network approach can also give insights into the specific pathways between external factors and symptom clusters, by including environmental variables within the network (26). For example, studies have used network analysis to identify specific pandemic-related factors (e.g., fear of infection, isolation and loneliness due to the pandemic) that have direct relationship with anxiety and depressive symptoms within a particular culture or society (27–31). Finally, this approach is useful for detecting core symptoms in the overall network as it reveals the relative degree of connectivity between symptoms (23). As such, unveiling the structure of core and bridging internalizing symptoms and their link with COVID-19 factors using the network approach can provide critical insight into how the pandemic impacts the emotional distress of individuals, and could potentially reveal effective intervention targets.

The aim of the present study was to identify and compare the putative pathways between pandemic-related factors and anxiety and depressive symptoms among young adults in South Korea and the U.S. using a network approach.

## 2. Materials and methods

### 2.1. Study design and participants

A cross-sectional online survey was conducted in South Korea and the U.S. The study was implemented in August 2021 in Korea and September 2020 to May 2021 in the U.S. According to WHO reports, the pandemic in the US was at its peak whereas it had not yet reached its peak in South Korea at the time of data collection.<sup>1</sup> Participants responded to the survey through an online survey platform, Qualtrics in Korea, and REDCap in the U.S. Given our focus on young adulthood, only the data from undergraduate students attending 4-year university (19–29 years old) were considered. The U.S. study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board of Columbia University and the New York State Psychiatric Institute. Informed consent was obtained from all participants involved in the study.

<sup>1</sup> During the data collection period, the pandemic in the US was at its peak with a maximum of 1,667,151 infected cases and 23,212 death cases per week. On the other hand, the trend in the number of confirmed cases and death in South Korea was still increasing (with a maximum of 13,034 infected cases and 64 death cases per week) at the time of data collection.

In South Korea, of the 676 participants who responded to the survey, 5 participants (average percentage of missing: 12.6%) were excluded due to their incomplete responses, yielding a final sample of 671 Korean subjects. Data inspection revealed that a large portion of the U.S. data was not usable for the purpose of the current study. In the U.S., of the 1,159 participants who participated in the survey, a total of 803 subjects (average percentage of missing: 69.1%) were excluded from analysis due to incomplete responses ( $n=738$ ) and unknown gender ( $n=65$ ). Thus, only a subset (33.3%) of the U.S. sample was used for the current study, yielding a final sample of 365 American subjects (66% White, 11% Asian, 2% Black/African American, 3% Native Hawaiian or Pacific Islander, 18% Native American/Other). The present study was approved by the Institutional Review Board of Yonsei University (South Korea) and Columbia University (U.S.) in their respective countries.

The mean age of South Korean participants was 22.3 years ( $SD=2.1$  years), and the proportion of female participants was 70.7% ( $n=474$ ). On the other hand, the mean age of the American participants was 21.2 years ( $SD=2.2$  years), and 80.8% ( $n=295$ ) were female. Statistical analysis showed significant differences in both age ( $t=7.347, p<0.01$ ) and gender ( $\chi^2(1)=12.283, p<0.01$ ) between the two countries. Follow-up analyses confirmed that the main results remained the same with or without adding these as covariates, suggesting that they did not have a significant impact on the overall network models of the two countries.

## 2.2. Measures

Anxiety symptoms were assessed with the Generalized Anxiety Disorder scale [GAD-7; (32)], a 7-item scale using a 4-point frequency scale ranging from 0 (not at all) to 3 (nearly every day). Depressive symptoms were measured with the Patient Health Questionnaire [PHQ-9; (33)], a 9-item scale ranging from 0 (not at all) to 3 (nearly every day). COVID-19-related variables formulated for the study included the following: COVID-19-related traumatic stress (e.g., hypervigilance, intrusions, avoidance, or nightmares due to issues of COVID-19, etc.), COVID-19 concern about safety and security, COVID-19-related xenophobia, access to mental health services, and access to medical services. Demographic variables included age and gender (male or female). More detailed information on our measures can be found in [Supplementary Table S1](#).

## 2.3. Missing data and imputation

Multiple imputation was adopted which is commonly used in network analysis to address the issue of missing data in the present study. A conservative approach was employed, only including data with missing values of 10% or less. The imputation of missing data was conducted using the *mice* package in R (34).

## 2.4. Analytic strategy

Network analysis was used to examine and compare the pandemic to-anxiety/depression symptoms network in South Korea and the U.S. The overall network structure was estimated separately for each

country to identify links within the networks independently. Then, centrality and predictability indices, which reflect the relative importance of each symptom in the network, were calculated to quantify the characteristics of each network. Finally, the network models of the two countries were statistically compared. The accuracy of edge estimation and stability of both centrality indices and network comparison test were additionally assessed to check the robustness of the results.

### 2.4.1. Network estimation

The R program (version 4.1.3) was used for all statistical analyses. All models were visualized as network graphs using the R-package *qgraph* (35), where 'nodes' represent variables, and 'edges' represent the pairwise conditional association between nodes (35, 36). The network structure was estimated with the Mixed Graphical Model (MGM) via regularized generalized regression using the R-package *mgm* (37). MGM was used due to its broad applicability in estimating networks because it allows for the inclusion of diverse variable types and relaxes strict assumptions, such as normality, that are required in traditional models like the Gaussian Graphical Model (36–38). To control spurious associations, the least absolute shrinkage and selection operator (LASSO) was used, which shrinks all edge weights and reduces small weights toward zero (39). Also, as suggested in Epskamp and Fried's study (2018) (40), Extended Bayesian Information Criterion (EBIC) model with its tuning parameter ( $\gamma=0.5$ ) was applied to select the best fitting network (41).

### 2.4.2. Centrality and predictability indices

Centrality and predictability indices were computed to investigate the structural features of the network (36). Specifically, bridge centrality index indicates a node's overall connectivity with nodes of the other clusters. It is used to identify nodes that connect different clusters within the network (42) such as bridging symptoms explaining the comorbidity pattern between symptom clusters. The bridge strength index was assessed by using the R-package *networktools* (42, 43). Since visual inspection can lead to misinterpretation of the connections between the different clusters when the network is complex (42, 44), this index was used to objectively quantify and detect nodes that are highly connected to other clusters. As per prior work (42), the top 20% score of bridge strength values were selected as predicted bridging nodes. The strength centrality index, one of the most commonly used indices in network analysis, represents the level of connectivity of a given node with the rest of the nodes in the network, indicating the relative importance of a given node within the network. It was calculated as the sum of all edge weight values connected to the specific node. The predictability was additionally computed by using the R-package *mgm* (37). It represents the extent to which nodes are predicted by other nodes in the network, similar to R<sup>2</sup> in regression (45). A high predictability value indicates that the given node can be controlled by its neighboring nodes while a low value stands for the need of direct intervention to the target symptom (46).

### 2.4.3. Accuracy and stability analyses

In order to check the robustness of the results, accuracy and stability analyses were conducted using R-package *bootnet* (47).

To assess the accuracy of network estimation, 1,000 non-parametric bootstraps for each node were performed by computing confidence intervals (CIs), and new datasets were created by resampling observations in the data based on 95% CIs. Narrower CIs corresponds with more accurate estimation of the edges (47). Then, to conduct stability analyses, a case-dropping bootstrap was performed to measure the correlation stability (CS)-coefficient, which indicates the maximum drop percentage of cases to retain a correlation with original centrality indices above 0.7 in at least 95% of the sample (47). Epskamp et al. (47) suggests that a CS-coefficient higher than 0.25 is acceptable but that values greater than 0.5 are preferred. Bootstrapped difference tests were additionally performed to evaluate the differences among edge weights (47).

## 2.4.4. Network comparison test

The Network Comparison Test (NCT) was conducted using the R-package *NetworkComparisonTest* (48). NCT assesses whether there is a statistically significant difference between networks in aspects of network structure (i.e., overall relations between variables), edge strength, and global strength (i.e., overall connectivity) (48). Since several edges were tested simultaneously, alpha values for multiple comparisons were adjusted using the Holm-Bonferroni correction.

## 3. Results

The descriptive statistics for the anxiety/depressive symptom measures as well as the pandemic-related variables are presented in [Supplementary Table S2](#).

## 3.1. Network of South Korea

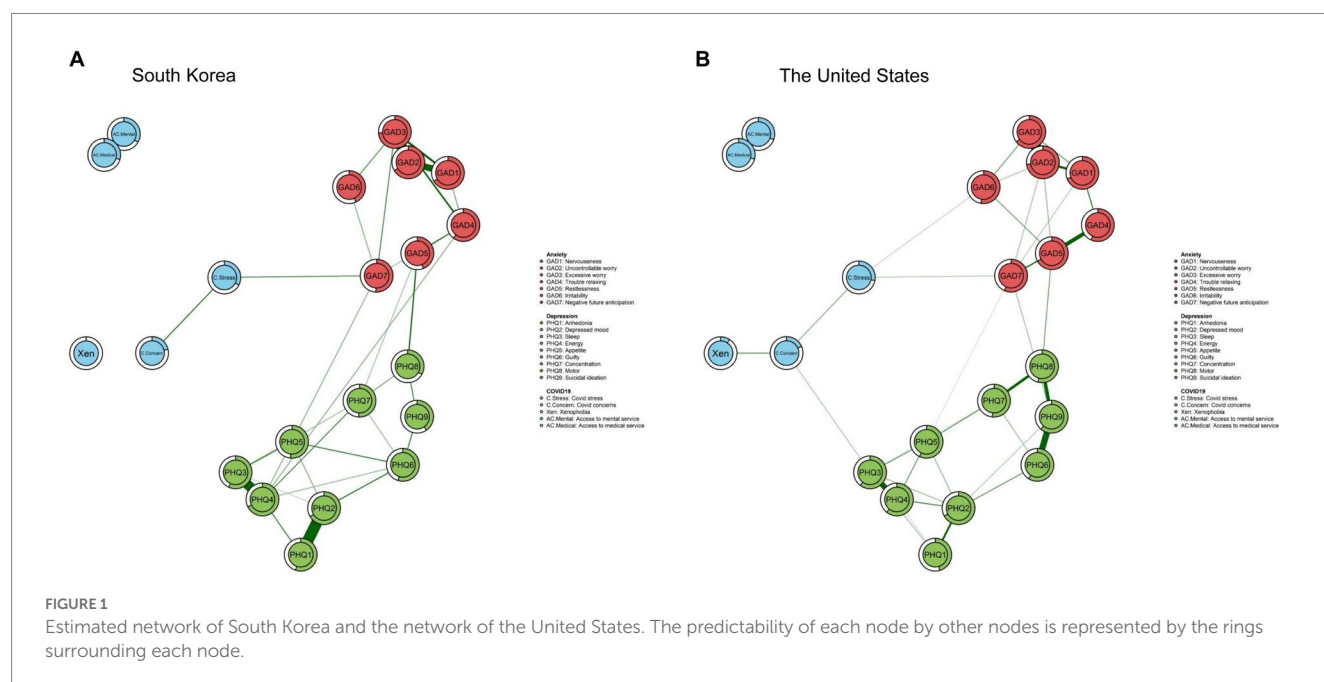
### 3.1.1. Network estimation

The MGM network for the Korean data is presented in [Figure 1A](#). In this network, anxiety symptoms, depressive symptoms, and pandemic-related factors formed separate clusters with densely interconnected nodes. Within the pandemic-related cluster, the strongest associations were found between 'Access to mental health service' and 'Access to medical service' ( $r=0.47$ ). Within anxiety/depressive symptom clusters, two anxiety symptoms, 'Uncontrollable worry (GAD-2)' and 'Excessive worry (GAD-3)' ( $r=0.42$ ) showed the strongest association. Across clusters, there were direct edges between 'COVID-19 stress' and 'Irritability (GAD-6)' ( $r=0.06$ ) and 'Negative future anticipation (GAD-7)' ( $r=0.08$ ) as well as between 'COVID-19 concerns' and 'Sleep (PHQ-3)' ( $r=0.08$ ). Other pandemic factor such as healthcare accessibility did not show any direct relationship with anxiety and depressive symptoms.

### 3.1.2. Centrality and predictability

The result of bridge centrality index is shown in [Figure 2A](#). The top bridging nodes which had high bridge centrality values in South Korea were 'COVID-19 stress,' 'Negative future anticipation (GAD-7),' 'Restlessness (GAD-5),' and 'Motor (PHQ-8)'. As for strength centrality nodes, 'Restlessness (GAD-5)' and 'Uncontrollable worry (GAD-2)' in the anxiety clusters were identified as the most central nodes in the network of South Korea, followed by 'Depressed mood (PHQ-2)' ([Figure 3](#)). This indicates that these symptoms are the most influential in maintaining the whole network.

Predictabilities are represented in the rings in the pie chart in [Figure 1A](#). Predictability values ranged from 0.10 to 0.74 (Mean predictability =  $0.51 \pm 0.18$ ), and the highest predictability



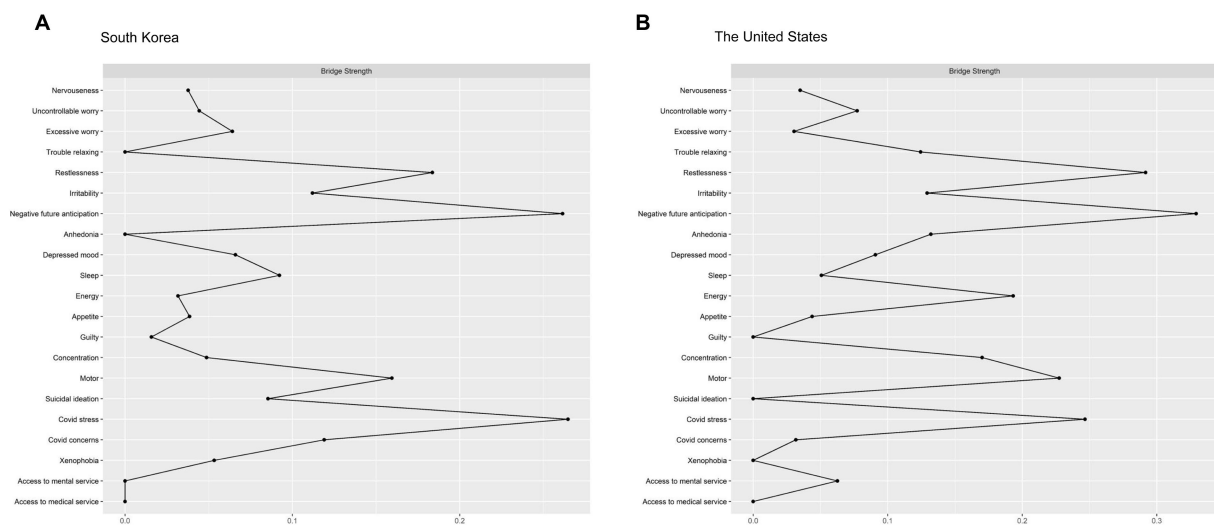


FIGURE 2  
Bridge strength centrality estimates of both networks.

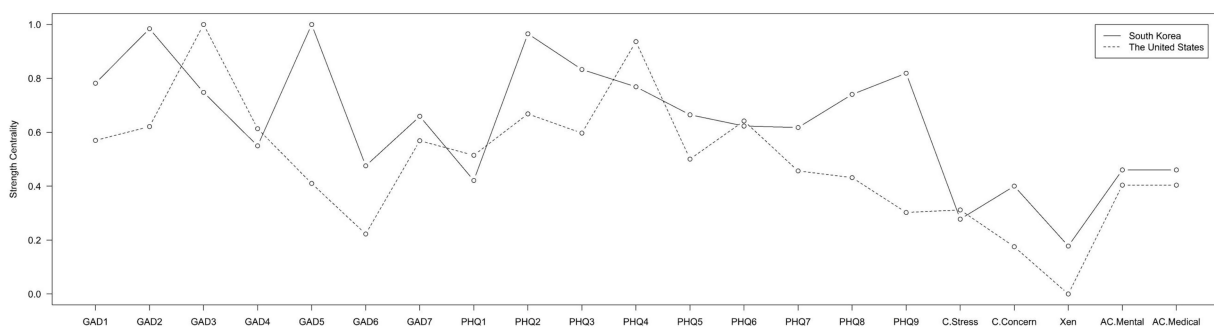


FIGURE 3  
Strength centrality estimates of both networks.

value in the overall node was ‘Uncontrollable worry (GAD-2)’ (0.73), which is one of the anxiety symptoms. The lowest predictability index was ‘Xenophobia’ (0.09), which is a pandemic-related factor.

### 3.1.3. Network accuracy and stability

The results of the accuracy and stability analyses attest to the robustness of the network of South Korea (Supplementary Figures S1, S3, S5). Edge weights showed substantial overlap with the 95% CIs of edge weights, indicating that the edges were stable (Supplementary Figure S1). The bootstrapped difference tests also revealed that most of the comparisons among edge weights were statistically meaningful (Supplementary Figure S3). In addition, case-dropping bootstrap procedure showed that the strength and bridge strength coefficients were 0.75 and 0.36, respectively, which implies that results remained stable after dropping the different proportions of the sample (Supplementary Figure S5).

## 3.2. Network of the United States

### 3.2.1. Network estimation

The network structure for the U.S. data is presented in Figure 1B. Similar to South Korean data, there was a direct link between the ‘COVID-19 stress’ and ‘Negative future anticipation (GAD-7)’ ( $r=0.15$ ) but no direct association was found between the pandemic-related factors and depressive symptoms. The strongest association was exhibited in the edge between the two COVID-19-related factors, ‘Access to mental health service’ and ‘Access to medical service’ ( $r=0.45$ ), followed by the two anxiety symptoms ‘Uncontrollable worry (GAD-2)’ and ‘Excessive worry (GAD-3)’ ( $r=0.39$ ) and the two depressive symptoms ‘Anhedonia (PHQ-1)’ and ‘Depressed mood (PHQ-2)’ ( $r=0.38$ ).

### 3.2.2. Centrality and predictability

The bridge centrality result is shown in Figure 2B. Similar to South Korean data, symptoms showing the highest bridge centrality values included ‘Negative future anticipation (GAD-7)’ ‘Restlessness



(GAD-5), 'COVID-19 stress,' and 'Motor (PHQ-8),' and indicated the high bridge strength value.

As shown in Figure 3, the highest strength centrality node was 'Excessive worry (GAD-3)' in the anxiety symptom cluster, followed by 'Energy (PHQ-4)' and 'Depressed mood (PHQ-2)' in the depressive symptom cluster. As for the predictability value, the node with the highest predictability score was 'Excessive worry (GAD-3)' (0.74), and the node with the lowest predictability was 'Xenophobia' (0) (Figure 1B).

### 3.2.3. Network accuracy and stability

In the network of the U.S., bootstrapped 95% CIs for edges validated the accuracy of the edge-weight estimates (Supplementary Figure S2). The bootstrapped difference test showed that a large proportion of the comparisons among edge weights were significant (Supplementary Figure S4). The CS-coefficient strength centrality and bridge strength was 0.67 and 0.36, respectively, demonstrating the stability of the network model (Supplementary Figure S6).

## 3.3. Estimating the effects of age and gender in network models

In the present study, significant differences were found between the South Korean and American samples in terms of age and gender. Prior to comparing the networks of the two countries, the impact of covariates on the pandemic-to-symptom networks were examined in both countries. Following previous studies (49–51), the pandemic-to-symptom networks of South Korea and the U.S. was re-estimated while controlling for age and gender. Significant correlations were found between the re-estimated network and the original one in both South Korea ( $r = 0.99, p < 0.001$ ) (Supplementary Figure S7) and the U.S. ( $r = 0.98, p < 0.001$ ) (Supplementary Figure S8). Both statistics and visual inspection of the models confirm that covariates did not have a significant impact on the overall network models in either country.

## 3.4. Network comparison

Finally, the NCT was applied to compare the networks identified in South Korea and the U.S. and revealed no significant differences in network structure ( $p = 0.15$ ) or global strength ( $p = 0.36$ ). This result shows that there is no meaningful difference in overall structure and connectivity between the networks of the two countries.

## 4. Discussion

Using a network approach, the present study investigated the putative pathways between pandemic-related factors and anxiety and depressive symptoms among young adults in South Korea and the U.S. In short, the overall structure of pandemic-to-symptom networks of South Korea and the U.S. were found to be similar. In both countries, anxiety symptoms, depressive symptoms, and pandemic-related factors formed separate clusters. Also, networks from both countries revealed similar common bridging nodes that linked different clusters, and central symptoms were found to be similar in

both countries. The implications of the main findings are discussed below.

In both countries, 'COVID-19 stress' and 'Negative future anticipation' (an anxiety symptom) were identified as bridging nodes and had a direct edge between them, suggesting that this link is likely to function as a key mechanism through which the pandemic affects internalizing symptoms. The COVID-19 stress item measured traumatic stress reactions such as hypervigilance, intrusions, avoidance, or nightmares from issues related to the pandemic over the past month regardless of the presence of direct contact or exposure to the virus. Its strong connection with 'Negative future anticipation' suggests that stress induced by the fear of COVID-19 may extend its influence on mental health of young adults primarily by strengthening negative anticipation of the future. Studies have found that, compared to other age groups, young adults tend to experience high levels of pandemic-related stress due to the deprivation of educational/employment opportunities (52, 53). Similarly, with a sample of 18 to 35 years old, Dean et al. (22) found that younger age was a common contributing factor to psychological distress during the early stages of the pandemic across countries with different sociocultural backgrounds. Extending prior work, the present finding suggests that negative future anticipation function as a main trigger for psychological distress experienced by young adults during the pandemic.

It is also noteworthy that 'Restlessness (GAD-5)' and 'Motor (PHQ-8)' symptoms were identified as bridging symptoms between anxiety and depressive symptom clusters, suggesting that symptoms of physical agitation are strong contributors of the comorbidity between anxiety and depression. The current finding is consistent with prior work demonstrating that physical symptoms show strong bridge centrality indices among anxiety and depressive symptoms (54–56) and that 'restlessness' loads on the general distress factor shared in both anxiety and depression (57, 58). Recent studies suggest that physical symptoms observed in comorbid anxiety and depression are reflective of reduced parasympathetic activity for flexible adaptation to stress (59). Though more research is needed, it is possible that the physical symptoms reflect an underlying neurobiological mechanism associated with poor neurovisceral control and emotion regulation generally observed in anxiety and depression. This implicates that physical symptoms may be an important intervention target for comorbid cases of anxiety and depression (56).

Worry-related symptoms were identified as key contributors in maintaining the overall pandemic-to-symptom network in both countries. Specifically, the node 'Uncontrollable worry (GAD-2)' showed the highest strength centrality and predictability value in the network of South Korea while the node 'Excessive worry (GAD-3)' displayed the highest score in both indices in the network of the U.S. This replicates prior findings that worry-related symptoms were the core symptoms in anxiety-depression network of young adults during the pandemic (60, 61). Since COVID-19 has brought about unprecedented apprehension over future uncertainty, especially for young adults, it is possible that unregulated worrying cascades into a series of internalizing symptoms. Even if worry-related symptoms served as core symptoms in both countries, it is worth noting that the specific elements of worry-related symptoms that served as core symptoms differed between two countries – i.e., 'excessive worry' in the U.S. and 'uncontrollable worry' in South Korea. According to the initiation-termination (IT) model of worry,



which suggests worry as a dynamic process that unfolds over time rather than a static entity (62), “excessive worry” may be more relevant to “proneness of worry initiation when threat is perceived” whereas “uncontrollable worry” is more related to “difficulty in terminating worry.” This suggests that each worry symptom may differ in underlying mechanisms. More research is warranted to investigate this possibility further.

To the best of our knowledge, this is the first comparative network analysis study of the relationship between symptoms of anxiety, depression and factors related to COVID-19 in South Korea and the U.S. The current findings suggest that potential political and societal differences in the two countries (e.g., access to mental/medical health services) was not critically involved in the relationship between the pandemic and internalizing symptoms. Instead, the similar network structures and patterns observed in both countries imply that there may exist a stable relationship between the pandemic and internalizing symptoms above and beyond the sociocultural differences. The current findings suggest that interventions mainly targeting key bridge symptoms (i.e., COVID-19 related stress, negative future anticipation) and worry-related symptoms would most effectively alleviate the impact of the broader internalizing symptom networks during the pandemic in both countries. For instance, treatment elements of cognitive behavioral therapy (CBT) such as exposure-based interventions targeting fear or traumatic symptoms, or cognitive restructuring targeting pathological worry would be helpful to reduce overall comorbidity (63).

The present findings need to be interpreted with the following caveats in mind. Firstly, although Van Borkulo et al. (48) validated NCT results with cases where the sample size of one group was twice as large than the other, the null NCT result should be interpreted cautiously due to the disparity in the number of participants between the two countries. Replication studies are warranted with similar sample sizes in both countries. Secondly, though the null NCT result revealed that there is no statistically meaningful difference in the pandemic-to-symptom networks of the two countries, the difference identified from visual inspection of the networks is worth noting. Under visual inspection, the relationship between COVID-19 concerns and depressive symptoms (i.e., ‘Sleep’) was observed only in South Korea’s network but not in the U.S. data. The disparity between the two results (visual inspection vs. statistical testing) might stem from the methodological difference in network estimation between the Network Comparison Test and Mixed Graphical Model (64). Further studies are needed to address this point since these edges may imply a potential difference between the two networks, even though they were not detected through the statistical comparison test in the current study. Thirdly, in our study, COVID-19 stress was represented as a single score averaging each item for individual pandemic-related trauma symptoms (i.e., proportion of positive symptoms) due to a high number of missing values in the individual items. However, as each item represents slightly different symptoms related to the trauma experience, it will be important for future studies to further investigate the impact of each item separately. Fourthly, the current study did not directly measure contextual factors (e.g., political/cultural factors) that may have influenced the pandemic-to-symptom networks in the two countries. Future studies are warranted to include various contextual factors to gauge their direct impact on the overall networks of the two countries.

Lastly, although this study revealed the connection between pandemic-related factors and anxiety and depressive symptoms, it does not confirm any causal relationship since the study was based on a cross-sectional design. Although the results provide evidence of a potentially causal structure, longitudinal studies are called for to investigate whether a clear directionality of influence exists among the anxiety, depressive symptoms, and COVID-19-related factors.

Taken together, the current findings provide new insights into the common potential pathway between the pandemic and internalizing symptoms in South Korea and in the U.S. These observations provide a framework for understanding the impact of economic and/or social upheavals, including but not limited to COVID-19, on mental well-being of young adults and inform policymakers and mental health professionals of potential intervention targets to alleviate internalizing symptoms of this population.

## Data availability statement

The datasets presented in this study can be found at <https://osf.io/cs6zm/>. Requests to access these datasets should be directed to the corresponding author.

## Ethics statement

The studies involving human participants were reviewed and approved by Institutional Review Board of Yonsei University (South Korea) and Columbia University (U.S.). The patients/participants provided their written informed consent to participate in this study.

## Author contributions

MP and JH designed the study and analytic strategy. JK, HY, GL, LM, LA, and SP collected data. JK cleaned and preprocessed the data. MP performed analyses and created figures and tables. MP and DS drafted the manuscript. JH provided supervision. JH, YK, SH, HY, SP, LM, and LA obtained funding that supported the work. All authors edited the manuscript and approved the final version.

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## Conflict of interest

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

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## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpsy.2023.1161200/full#supplementary-material>

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