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COVID-19 epidemiological situation as a psychosocial determinant of trauma and stress

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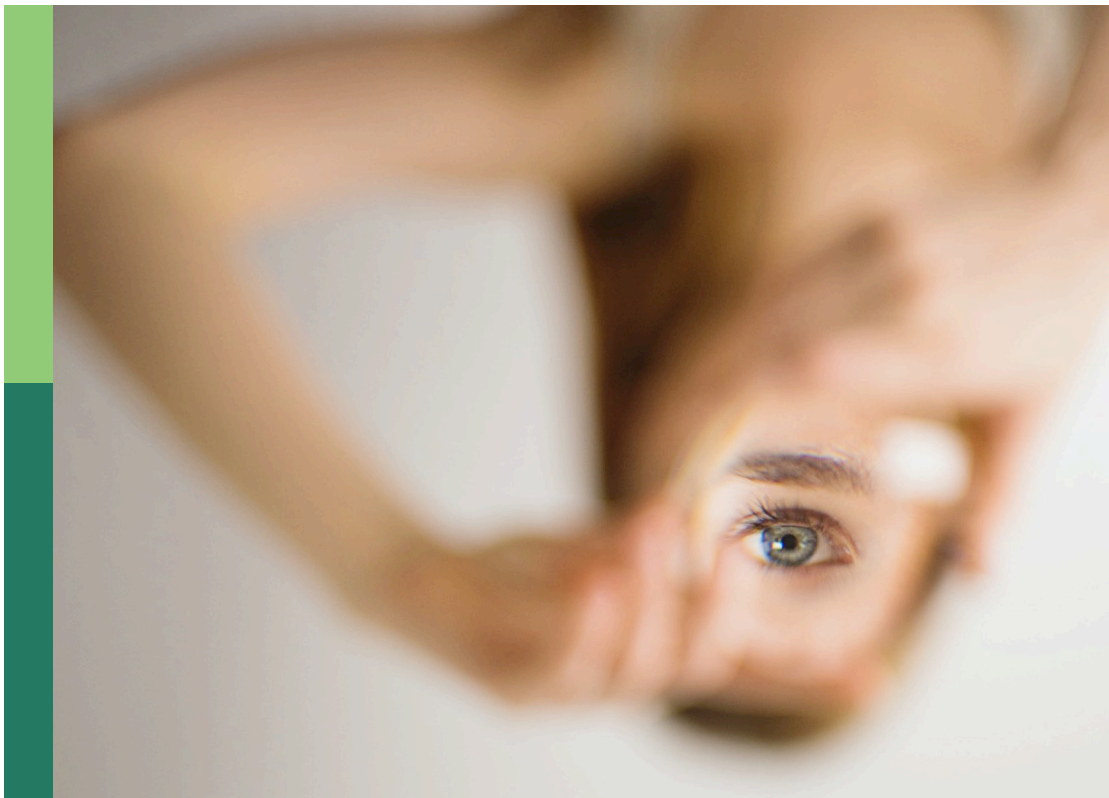

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COVID-19 epidemiological situation as a psychosocial determinant of trauma and stress

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Editorial: COVID-19 epidemiological situation as a psychosocial determinant of trauma and stress

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Editorial on the Research Topic
COVID-19 epidemiological situation as a psychosocial determinant of trauma and stress

Infectious diseases such as COVID-19 (coronavirus disease), affecting the respiratory system, have been recognized as a global pandemic due to the rapid transmission of the SARS-CoV-2 virus. While the disease manifested mildly in the majority of individuals, some patients, particularly the elderly and/or those with underlying chronic comorbidities, experienced the development of severe bilateral pneumonia, acute respiratory distress syndrome, and consequently, multiorgan dysfunction, potentially leading to mortality (Yong, 2021; Merad et al., 2022). Consequently, the fear of infection, especially the severe course of the disease and death, undoubtedly became a cause of generalized anxiety and fear for many individuals (Gunnell et al., 2020). Frequently, the overall uncertainty stemming from the evolving societal situation became a predisposing factor for mood deterioration, worsened wellbeing, and diminished quality of life. The mentioned anxiety was driven not only by concerns for one's own health but also for the health and lives of close ones. The COVID-19 pandemic unquestionably had a profound impact on the mental health of society, leaving a lasting imprint. The fear of the unknown, specifically the announcement by the World Health Organization (WHO) on March 11, 2020, of a new coronavirus pandemic, contributed to the manifestation of anxiety symptoms in the population, thereby exacerbating mental health problems, even in initially healthy individuals (Botha et al., 2020; Li et al., 2020).

Global statistics related to COVID-19 can be deemed alarming, as since the beginning of the pandemic, ~680 million people worldwide have been infected with COVID-19, and nearly seven million have died. Due to the potential severity of the disease, the WHO has issued official information and recommendations to minimize the risk of infection from the onset of the first cases of COVID-19. The daily lives of many people have changed significantly, with numerous interpersonal relationships severed, leading to experiences of loneliness and social exclusion for many. The ongoing pandemic has posed a challenge not only to the healthcare sector but also to the entire global economy, as well as education, tourism, culture, and the broader field of public health in countries worldwide.

It has resulted in negative changes across various aspects of life, the consequences of which society continues to bear. The cumulative impact of these factors has a destructive influence on the mental health of society globally (Holmes et al., 2020).

All these aspects have contributed to the initiation of a Research Topic titled "*COVID-19 epidemiological situation as a psychosocial determinant of trauma and stress*," comprising 11 original articles, one conceptual analysis, and one brief research report dedicated to this subject.

The article *Resilience mediates the effect of the COVID-19 pandemic on mental health in a sample of adults in Panama* by Oviedo et al. details the mediating role of resilience in the relationship between perceived COVID-19 impact and mental health symptoms. Individuals more personally affected by the pandemic were found to exhibit heightened depression, anxiety, and stress symptoms due to diminished resilience. Simultaneously, the article *Lived experience of Iranian pre-hospital medical staff during the COVID-19 pandemic: a descriptive phenomenological study* by Jafari-Oori et al. sheds light on the challenges faced by pre-hospital medical staff in Iran, stemming from inadequate preparedness and substantial adversity during the pandemic. Additionally, *The impacts of the COVID-19 pandemic on indirect costs of mental illness and behavioral disorders in Poland* by Sobczyk et al. marks the inception of a study investigating the economic burden of COVID-19 indirect costs in the country. Moreover, the article *Emotional control and factors differentiating it in the adult population of Poland during the COVID-19 pandemic* by Głogowska-Gruszka and Wypych-Ślusarska discloses that a higher level of knowledge about the pandemic and preventive measures correlates with increased emotional control, particularly in the anxiety subscale.

The longitudinal mixed-methods study titled *Older adults' coping strategies during the COVID-19 pandemic—a longitudinal mixed-methods study* by Kastner et al. provides valuable insights into the interplay of personal prerequisites, pandemic assessment, and coping strategies, utilizing an adapted Lazarus stress model. Simultaneously, the article *Mental health in Canadian children and adolescents during COVID-19 pandemic: the role of personality and,*

FIGURE 1
Unified system of complex support for people at risk of negative feelings related to the COVID-19 pandemic. Source: own work.

coping and stress responses by Shokrkon and Nicoladis uncovers an association between personality traits and the mental health of Canadian youth amidst the pandemic. Furthermore, the qualitative study *Challenges to dialysis treatment during the COVID-19 pandemic: a qualitative study of patients' and experts' perspectives* by Oviedo Flores et al. highlights concerns among hemodialysis patients, including being "high-risk" and preferences for home dialysis over in-center dialysis, while healthcare professionals emphasize the impact of changes in clinical routine and the emergence of telehealth. Additionally, the article *Impact of COVID-19 on employment*: *sociodemographic, medical, psychiatric and neuropsychological correlates* by Thompson et al. demonstrates significant variations between TTO vs. NTO and PS vs. PDNS in medical, psychiatric, and neurocognitive domains, and subjective measures of symptoms, providing a comprehensive understanding of the multifaceted impact of the pandemic.

The article *How COVID-19 pandemic period influences on the selected mental health parameters of Polish respondents?* By Florek et al. delves into the positive correlations between anxiety and various forms of aggression within the study population, highlighting distinctions in these associations across genders, age groups, and educational backgrounds. Simultaneously, the article *Development and psychometric properties of health care workers' concerns in infectious outbreaks scale* by Yarahmadi et al. introduces the 36-item Health Care Workers' Concerns in Infectious Outbreaks Scale (HCWCIOS) with robust psychometric properties, making it suitable for evaluating healthcare workers' concerns during a pandemic. Furthermore, the article *Using knowledge of, attitude toward, and daily preventive practices for COVID-19 to predict the level of post-traumatic stress and vaccine acceptance among adults in Hong Kong* by Cao et al. posits that individuals exhibiting good preventive practices, limited knowledge, and negative attitudes toward COVID-19 are more prone to post-traumatic stress disorder. Conversely, a positive attitude, coupled with adherence to preventive practices, significantly predicts willingness to receive vaccination and engage in voluntary testing.

The conceptual analysis article titled *Helper Syndrome and Pathological Altruism in nurses – a study in times of the COVID-19 pandemic* by Maringgele et al. unveils groundbreaking findings by illustrating Schmidbauer's concept of Helper Syndrome for the first time. Notably, the data pointed toward the presence of a subgroup aligning with Schmidbauer's Helper Syndrome description, independent of their professional roles in helping or non-helping capacities. Crucially, individuals within this subgroup appeared to be at increased risk of psychiatric disorders. Additionally, the brief research report titled *Social value of pathology: adapting primary health care to reduce stress and social anxiety in college students exposed to social distancing* by Sava discloses that educational content, delivery methods, increased homework, and extended online engagement potentially contributed to heightened stress, depression, and social anxiety disorder levels in approximately one-third of students engaging in digital learning.

The results presented in the articles and the derived conclusions constitute a significant contribution to the identification and monitoring of psychosocial issues currently faced by society in the post-COVID-19 pandemic era. In accordance with the WHO definition, mental health determines an individual's capacity for continuous development and self-realization. As indicated by the findings of the conducted research, the period from the onset of the COVID-19 pandemic until the lifting of associated sanitary restrictions represents a highly traumatizing and developmentally inhibiting phase for both individual and societal growth. The effects of misinformation, mandates/prohibitions, isolation, experienced grief, and the resultant high levels of stress and negative emotions are evident, among other aspects, in outcomes related to worsened wellbeing, heightened anxiety and fear, and the occurrence of depressive symptoms. However, further research on this matter is still necessary to diagnose the effects of the COVID-19 pandemic on society in an even more precise manner (Jin et al., 2021; Meherali et al., 2021; Riedel et al., 2021; Weich, 2022).

The experience of the COVID-19 pandemic should lead to the introduction of measures to nullify and minimize the subsequent negative effects on the mental health of the population by organizing coordinated efforts at multiple legislative and executive levels that would lead to the identification of symptoms and the reduction of negative effects on the mental health of individuals (Figure 1).

Author contributions

MG: Conceptualization, Writing – original draft. EM: Resources, Writing – review & editing. JO: Resources, Writing – review & editing. MR: Conceptualization, Visualization, Writing – review & editing.

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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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Using knowledge of, attitude toward, and daily preventive practices for COVID-19 to predict the level of post-traumatic stress and vaccine acceptance among adults in Hong Kong

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Introduction: COVID-19 has been perceived as an event triggering a new type of post-traumatic stress (PTSD) that can live during and after the pandemic itself. However, it remains unclear whether such PTSD is partly related to people's knowledge of, attitude toward and daily behavioral practices (KAP) for COVID-19.

Methods: Through a telephone survey, we collected responses from 3,011 adult Hong Kong residents. Then using the Catboost machine learning method, we examined whether KAP predicted the participant's PTSD level, vaccine acceptance and participation in voluntary testing.

Results: Results suggested that having good preventative practices for, poor knowledge of, and negative attitude toward COVID-19 were associated with greater susceptibility to PTSD. Having a positive attitude and good compliance with preventative practices significantly predicted willingness to get vaccinated and participate in voluntary testing. Good knowledge of COVID-19 predicted engagement in testing but showed little association with vaccine acceptance.

Discussion: To maintain good mental health and ongoing vaccine acceptance, it is important to foster people's sense of trust and belief in health professionals' and government's ability to control COVID-19, in addition to strengthening people's knowledge of and compliance with preventative measures.

KEYWORDS

COVID-19, KAP, knowledge – attitude – behavior, vaccine, PTSD

1. Introduction

Given the long-lasting impacts of the pandemic, mental health problems also deserve attention. COVID-19 has been perceived as a new type of traumatic stress with serious mental health impacts, including PTSD-like responses (Bridgland et al., 2021; Kira et al., 2021). Feeling distant from people, sleep issues, difficulty concentrating, and intrusive thoughts have been reported as the most common symptoms of PTSD associated with the COVID-19 pandemic (Speth et al., 2020). Direct or indirect exposure to COVID-19, or even anticipation of such exposure events, can induce PTSD-like symptoms (Bridgland et al., 2021). Cognitive model of PTSS also proposed that PTSD occurs if a person processes a traumatic event with a feeling of the presence of a serious threat (Ehlers and Clark, 2000). In Hong Kong, although the prevalence of PTSD decreased from 28.6% in 2021 (Lau et al., 2021) to 12.4% in 2022 (Cao et al., 2022), its context-dependent nature means that its prevalence could increase again, as the risk of contracting COVID-19 changes with time (Sun et al., 2021). Thus, there is an urgent need to develop strategies to prevent and address the possible deterioration of the public's mental health status.

Furthermore, COVID-19 vaccination and testing are crucial preventative measures in the context of relaxed social distancing rules (Aldila et al., 2021). In Hong Kong, despite a satisfactory level of vaccine acceptance, a decreasing trend in willingness to vaccinate has been reported in the literature (Wang et al., 2021). Participation in the "Universal Community Testing Program" implemented by the Hong Kong government in September, 2020 has not been high as well (Xin et al., 2022). Continuous attention to the uptake of these measures is essential.

Assessing people's knowledge, attitudes, and practices (KAPs) not only helps health care professionals to provide appropriate assistance to individuals but also helps different sectors of society to establish a comprehensive plan to improve public health. KAP surveys have been used to investigate knowledge gaps and behavioral patterns related to effective health interventions (Papagiannis et al., 2020). The surveys can also be used to improve public health awareness campaigns and national disease control programs (Espinoza-Gómez et al., 2002). In this study, knowledge refers to the level of accurate knowledge about COVID-19. Attitude represents people's thoughts, feelings, or beliefs about COVID-19 management. Practice refers to the preventive measures that the public has followed (Haq et al., 2012). The following sections illustrate how KAP relates to vaccine acceptance, participation in COVID-19 testing, and PTSD.

1.1. KAP and PTSD

Most studies on the relationship between KAP and mental health have focused on the impacts of the early stages of the pandemic. A high level of COVID-19-related knowledge was the greatest anti-PTSD protective factor among female college students, who were vulnerable to PTSD during the COVID-19 pandemic (Si et al., 2021). Nie et al. (2021) found that pandemic-related knowledge significantly predicted public panic, which in turn affected the incidence of PTSD.

Apart from people's understanding of COVID-19, participants' perception of the risk of infection, belief about the extent and emergency of the pandemic, and fear about the future were positively associated with the incidence of PTSD (Si et al., 2021). The perceived risk was also significant during the early stage when the lack of controllability of the pandemic was reflected in relevant information (Shi and Hu, 2004). Moreover, people with greater compliance with preventive measures recommended by the government and health care professionals, such as staying at home longer to ensure social distancing, may have negative psychological consequences, including post-traumatic stress (Ikizer et al., 2021). This association might be attributable to a lack of social support to cope with the pandemic and to stressful and traumatic perception of the pandemic (Ikizer et al., 2021).

Researchers have begun exploring the relationships among KAP, level of post-traumatic stress, and vaccine acceptance. However, most studies on COVID-19-related KAP have focused on the beginning stages of the pandemic. Research is needed to further investigate the ability of KAP to predict people's mental health based on their preventative behaviors, and identify the critical predictors in an ongoing pandemic. This study focused on examining whether KAP predicted people's level of psychological distress 1 year after the start of the pandemic in Hong Kong, and whether these factors affected their decision to get vaccinated and undergo testing.

1.2. KAP and vaccine acceptance

COVID-19-related KAP shape how people understand, think, and behave in relation to vaccination. Reluctance or refusal to get vaccinated was related to inadequate knowledge of COVID-19, particularly of the mode of SARS-CoV-2 transmission (Luk et al., 2021). For attitude toward COVID-19, people with greater perceived susceptibility (i.e., the subjective assessment of the risk of contracting SARS-CoV-2 infection) and more confident toward local health authorities in managing the spread of the virus had a higher tendency to get vaccinated (Chia et al., 2021; Yu et al., 2021). However, people with lower perceived severity and perceived threat of COVID-19 were unwilling to get vaccinated (Chia et al., 2021; Luk et al., 2021). As for preventative behaviors, Xiao et al. found greater compliance with social distancing measures among unvaccinated participants than among vaccinated participants (Xiao et al., 2022). Despite the growing compliance with preventive measures, and due to concerns about vaccine safety, a decrease in the willingness to receive COVID-19 vaccines was found (Wang et al., 2021).

1.3. KAP and participation in voluntary testing

COVID-19-related KAP have slightly different impacts on the willingness to undergo COVID-19 testing. A lack of knowledge and insufficient understanding of COVID-19 have been found to be associated with a lower participation rate in voluntary testing. People had limited understanding of the testing criteria, testing access, and test-qualifying symptoms (i.e., fever, cough, and loss of smell; Bevan et al., 2021; Graham et al., 2021). When the symptoms were mild, improved, or perceived as indicative of a flu instead of COVID-19, people did not undergo COVID-19 testing (Smith et al., 2021; Sudre et al., 2021). On the other hand, people with a higher perceived risk of infection, greater perceived severity of COVID-19, and greater concerns and negative emotions were more motivated to participate in voluntary testing (Fallucchi et al., 2021; Yue et al., 2021; Xin et al., 2022). Trust in the government's control measures and the efficacy of voluntary testing may also have positively affected the participation rate in universal community testing programs (Xin et al., 2022). In addition, people who generally abide by the government's preventive measures were more willing to undergo COVID-19 testing (Fallucchi et al., 2021; Thunström et al., 2021).

1.4. Hypothesis

Based on the results of the reviewed studies, we made the following hypotheses.

- KAP would be associated with the level of PTSD, vaccine acceptance, and participation in voluntary testing.
- Good knowledge of COVID-19, a trusting attitude toward the controllability of COVID-19, and less compliance with preventative practices would contribute to the willingness to receive vaccines and participate in voluntary testing.
- Poor knowledge, a pessimistic attitude, and good compliance with preventive practices would be associated with higher PTSD scores.

2. Materials and methods

2.1. Sampling method

Data collection was carried out from December 2020 to February 2021 by a contracting company that specializes in conducting telephone surveys. Random phone numbers were first generated using the common local prefixes, which were obtained from the Office of the Communications Authority. Half of the calls were made to landlines, while the other half to mobile phones. The participants were first given information about the survey, and verbal informed consent was obtained. The participants were then screened to confirm their eligibility to participate in the survey according to the following criteria. Inclusion criteria: (i) Cantonese-speaking residents of Hong Kong and (ii) aged 18 years or above. If the call was made to a household landline where there were multiple eligible respondents, the person whose birthday was closest to the date of call was chosen as the respondent from that household. Exclusion criteria: a minor below the age of 18, unable to speak Cantonese, or is not a Hong Kong resident.

2.2. Participants

The telephone survey was completed by 3,011 participants, including 1,596 females (53%). Most of the respondents were middle-aged or older adults (16% were 18–29 years old, 53.2% were 30–59 years old, and 30.8% were 60 years old and above). Most of the participants (81.1%) had an educational attainment of high school or above. In terms of employment status, most were employed full-time (45.7%), followed by retired (20.9%), and homemakers (10.7%). Most (60.4%) of the respondents were married. We believe that the sample size of 3,011 would provide reliable and accurate findings, with a 2% margin of error (population size of 6,413,800, 95% confidence).

2.3. Survey content

The data used in this study are part of a large-scale survey study on COVID-19. The complete survey contained six sections: (1) traumatic symptoms; (2) knowledge of, attitude toward, and preventative practices for COVID-19; (3) vaccine acceptance; (4) voluntary testing; (5) media exposure, and (6) demographic questions. This study examined whether KAP predicts traumatic symptoms and attitude toward vaccine acceptance and voluntary testing. The effects of demographic variables and media exposure on traumatic symptoms, attitude toward vaccine acceptance and voluntary testing, and behavioral practices are reported elsewhere (Cao et al., 2022).

To evaluate KAP, we adapted the three-part Questionnaire of Knowledge, Attitudes, and Practice Toward COVID-19 developed by Zhong et al. (2020), specifically for use in Hong Kong. The KAP approach has been used and validated previously in a Chinese sample (Zhong et al., 2020). The Knowledge section included 13 items examining the participant's level of understanding of COVID-19. The response options were true, false, and do not know. A sample item was "People infected with COVID-19 are not contagious when they have no fever." The Attitude section included two items asking the participant's whether they thought that the pandemic will be controlled and if the spread of the virus will be stopped in Hong Kong. The response options were true, false, and do not know. The Practice section included 14 items asking participants to indicate the frequency at which they adopted the preventative measures recommended by the local

health authority. The response options were always, often, sometimes, never, and not applicable/cannot answer.

To this questionnaire, we added two questions asking about vaccine acceptance and participation in voluntary testing: (i) "*Are you willing to receive a COVID-19 vaccine that is approved by the Department of Health?*" The response options were yes, no, and unsure; and (ii) "*Have you participated in the universal and free virus test conducted by the Department of Health in 2020?*"

The Chinese version of the Impact of Event Scale – Revised (CIES-R), validated by Wu and Chan (2003), was used to measure symptoms of possible PTSD. For this study, we adapted the context of the questions that were related to COVID-19 specifically. The Cronbach's alphas for the Intrusion, Avoidance, and Hyperarousal subscales were 0.86, 0.82, and 0.79, respectively, in this study. The total score was used in the data analysis.

2.4. Data analysis

This study examined whether KAP can predict (i) the PTSD level, (ii) vaccine acceptance, and (iii) participation in voluntary testing. To this end, machine learning was adopted instead of statistical models due to its predictive accuracy. In particular, the categorial boosting algorithm Catboost was used for its distinctive ability to handle non-numeric categorical values with minimal transformation, which was instrumental for processing the data in this study. Catboost (Prokhorenkova et al., 2018) is a powerful decision tree-based ensemble machine learning method. It utilizes a greedy algorithm to combine categorical features at each split of a decision tree to produce increasingly effective features. As a supervised learning method, Catboost uses samples of input features and the corresponding known outputs to train a predictive model. In this study, the responses to the 29 items of the Questionnaire of Knowledge, Attitudes, and Practice Toward COVID-19 (Zhong et al., 2020) were adopted as inputs for the models. The models performed two-class classification, and the predicted outputs were binary. The construction of the models is detailed in the following paragraphs.

For the first scenario, the model, denoted as Model 1, was trained with Catboost to predict a high PTSD level based on whether the total score of the CIES-R (Wu and Chan, 2003) was greater than or equal to 33. The predicted PTSD level was normal if the total score was less than 33. In total, 2,632 samples fell into this scenario, with 322 positives (CIES-R score $\geq$ 33) and 2,310 negatives (CIES-R score $<$ 33) at a ratio of approximately 1:7. The imbalance was counteracted using the technique of cost-sensitive learning (Thai-Nghe et al., 2010) whereby the minority instances (positives) were weighted more heavily in the training process to avoid biasing toward the majority class (negatives).

For the second scenario, the model predicted vaccine acceptance based on the responses to the survey question "Would you get a dose of vaccine that is approved by the Department of Health?" The question had four possible choices: "Yes," "No," "Do not know/Hard to tell," and "Decline to answer." Two models were built to predict vaccine acceptance, one predicting the outcome of either "Yes" or "No" and the other predicting either "Yes" or "Not-Yes," where "Not-Yes" corresponded to the selection of one of the three non-Yes choices. These two models were denoted as Models 2 and 3, respectively. For the Yes-versus-No prediction in Model 2, there were 2,260 samples with 1,356 positives and 904 negatives (at a ratio of 1.5:1), and for the Yes-versus-Not-Yes prediction in Model 3, there were 2,978 samples with 1,356 positives and 1,622 negatives (at a ratio of 1:1.2). Cost-sensitive learning was applied in Model 2.

For the third scenario, the model, denoted as Model 4, was trained to predict the outcome of participation or non-participation in voluntary testing accordingly to the response to the survey question "Did you join the free COVID testing campaign held by the Department of Health in September 2020?" A total of 3,010 samples fell into this scenario, with 1,681 positives, and 1,329 negatives (a ratio of approximately 1.3:1).

In other words, we took a binary response ("yes" or "no") from the questionnaire as input (e.g., the binary response to the item "I am confident that Hong Kong can successfully control COVID-19."), and examined the likelihood of participants saying "yes" relative to those saying "no" with respect to the level of PTSD symptoms or vaccine acceptance (high or low), and reported these results in terms of odds ratios and p values.

In summary, the survey data provided pairs of inputs (the responses to the 29 items of the KAP questionnaire) and outputs (the CEIS-R score for Model 1, or responses to the corresponding survey items for Models 2, 3, and 4) for building models using Catboost. The samples and prediction outputs of the models are summarized in Table 1. The models were trained by 10-fold cross-validation repeated five times. The classification performance of the models was evaluated with six metrics, namely, area under the receiver operating characteristic curve (AUC), accuracy (ACC), average precision (AP), sensitivity (SEN), specificity (SPE), and F1 score (F1). Furthermore, among the 29 input features, the five that were most important for the prediction were identified during model training with Catboost, based on the feature importance values (FIVs), which represented the average change in prediction caused by changes in individual feature values. FIVs were normalized such that the sum of the FIVs of all of the input features was 100. The larger the FIV, the higher the importance. For the important input features identified, i.e., responses to survey items, the odds ratio corresponding to two groups of responses to each question, along with the value of p, were calculated.

3. Results

The performance of the four prediction models, in terms of the means and standard deviations (*SDs*) of the six metrics, is tabulated in Table 2 and shown graphically in Figure 1. The AUC, ACC, and AP of the four models were all above 0.6, with Model 2 attaining the highest AUC and ACC at 0.7266 ($SD = 0.0337$) and 0.6995 ($SD = 0.0300$), respectively, and the second highest AP at 0.7238 ($SD = 0.0364$). The SEN of Model 2 was also the highest

TABLE 1 Prediction outputs and samples used to build the four prediction models.

Model	Prediction	Binary output	Sample size	Positive samples	Negative samples	Sample ratio
Model 1	PTSD level	High or Normal	2,632	332	3,210	1:7
Model 2	Vaccine acceptance	Yes or No	2,260	1,356	904	1.5:1
Model 3	Vaccine acceptance	Yes or Not-Yes	2,978	1,356	1,622	1:1.2
Model 4	Participation in voluntary testing	Yes or No	3,010	1,681	1,329	1.3:1

TABLE 2 Mean and *SD* (inside brackets) of six performance metrics of the prediction models.

Model	AUC	ACC	AP	SEN	SPE	F1
Model 1	0.6484 (0.0487)	0.6596 (0.0324)	0.8413 (0.0211)	0.5270 (0.0886)	0.6783 (0.0356)	0.7160 (0.0255)
Model 2	0.7266 (0.0337)	0.6995 (0.0300)	0.7238 (0.0364)	0.8373 (0.0313)	0.4937 (0.0463)	0.6889 (0.0316)
Model 3	0.6813 (0.0251)	0.6375 (0.0270)	0.6699 (0.0251)	0.7150 (0.0359)	0.5730 (0.0384)	0.6370 (0.0271)
Model 4	0.6360 (0.0342)	0.6175 (0.0284)	0.6260 (0.0332)	0.7867 (0.0317)	0.4041 (0.0431)	0.6020 (0.0305)

AUC, area under receiver operating characteristic curve; ACC, accuracy; AP, average precision; SEN, sensitivity; SPE, specificity; F1, F1 score.

(mean = 0.8373, *SD* = 0.0313) among the four models. Overall, the performance of Model 2 appeared to be the best, although its SPE was below 0.5. In fact, the SPE values of all of the models were mediocre except for Model 1 whose SPE was close to 0.7. The SPE values of the rest of the models were below 0.6, with Model 4 exhibiting the lowest SPE at 0.4041 (*SD* = 0.0305). A comparison of Models 2 and 3, both of which examined vaccine acceptance, showed that Model 2 outperformed Model 3 in all but one (SPE) of the six metrics.

The important features of the four models are given in Table 3, and the five most important features (i.e., survey items) of each model are listed in Table 4. The odds ratios corresponding to the two groups of responses to each item are also given in Table 4. Among the 29 items of the KAP questionnaire, 10 items were identified as important features in the predictive modeling. Item B "*I am confident that Hong Kong can successfully control COVID-19*" was among the top five features in all of the four models, ranking first in three models (Models 2, 3, and 4) and second in one model (Model 1). Furthermore, the odds ratios for this item were greater than 2 in all models ($p < 0.0001$), The odds ratios were even greater than 6 and 4 in Models 2 and 3, respectively. This suggested that, confidence with the local control or management of the COVID-19 infections was a key protective factor against having PTSD symptoms, as well as a motivator for receiving the COVID-19 vaccination. The FIVs of Item B were close to 30 out of 100 in Models 2 and 3, 12.6 in Model 4, and only 8.8 in Model 1. The FIVs of the top five important features in Model 1 were between 5 and 10.

Item F "*Avoid unnecessary social gathering or dining*" and Item G "*Work from home or adopt staggered work hours*" were both identified as among the top five important features in Models 2, 3, and 4. Item F was ranked as the second most important feature in these three models, with the odds ratios ranging between 1.8 and 2.3 ($p < 0.0001$). In comparison, the odds ratios of Item G in these three models were all below 1.5, and had lower statistical significance ($p = 0.0818$, 0.0404, and 0.0003, respectively). Four of the top five important features were shared by Models 2 and 3 (the exceptions were Item H in Model 2 and Item J in Model 3), which indicated their resemblance. In addition, Models 2, 3, and 4 shared three of the top five important features. Items D and K, which were important features in Model 4, were not among the five most important features in Models 2 and 3.

4. Discussion

Four machine learning models were built, with responses to the items of the KAP questionnaire as inputs, to predict people's PTSD levels, vaccine acceptance, and participation in voluntary testing in the context of the COVID-19 pandemic in Hong Kong 1 year after it started. Good compliance with preventive measures and poor knowledge of and pessimistic attitude toward COVID-19 were factors associated with greater susceptibility to PTSD. Having a positive attitude and good compliance with preventative practices significantly predicted willingness to get vaccinated and participate in voluntary testing. Good knowledge of COVID-19 predicted engagement in testing but showed little association with vaccine acceptance. In particular, a positive attitude toward the controllability of the pandemic was a protective factor against PTSD and a motivator for vaccine acceptance. In contrast, good preventative practices were found to be a risk factor for higher PTSD scores, while good knowledge was protective against higher PTSD scores but had limited effect on vaccine acceptance.

4.1. Vaccination

The classification performance of the models suggests that responses to the KAP questionnaire could to a certain extent

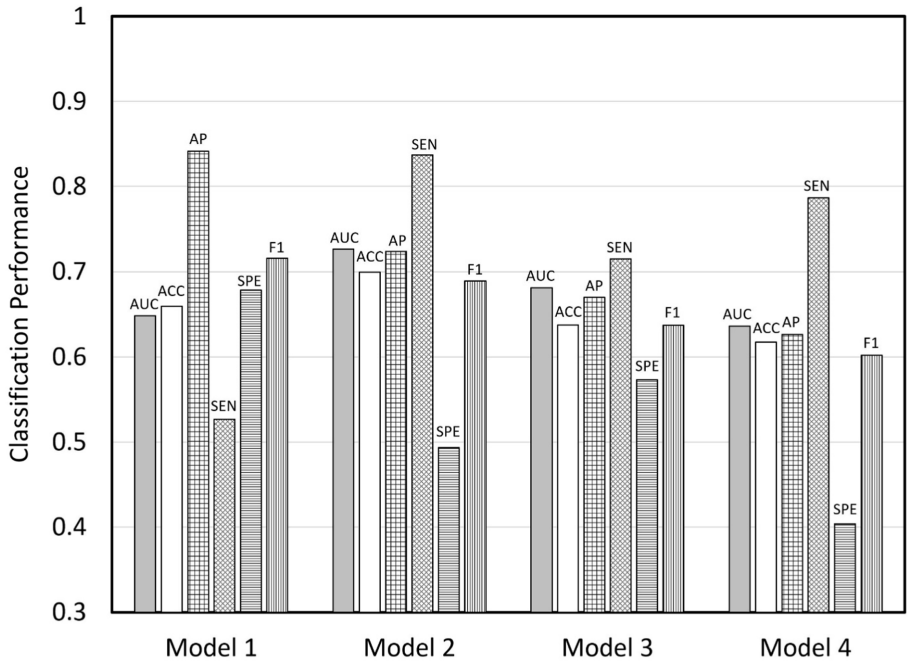

FIGURE 1
Bar charts showing the performance of the four prediction models. AUC, area under receiver operating characteristic curve; ACC, accuracy; AP, average precision; SEN, sensitivity, SPE, specificity; F1, F1 score.

predict vaccine acceptance. Furthermore, using KAP to predict the decision to getting vaccinated was particularly promising, given the good performance of Model 2. This model also had a high SEN (0.8373). Although it was a variant of Model 2, the classification performance of Model 3 was comparatively lower, because the ambiguity of the "Not-Yes" responses in Model 3 obscured the prediction of vaccination-related decision with KAP. This suggests that it was more difficult to predict vaccine hesitancy than to predict refusal to get vaccinated, based on KAP responses alone.

The finding suggests that a positive attitude toward COVID-19 management and good compliance with preventative measures were more important in predicting vaccine acceptance than knowledge of COVID-19. In Models 2 and 3, only attitude toward COVID-19 (Item B) and preventive practices (Items F, I, and J) affected vaccine acceptance; the fifth most important feature, knowledge of COVID-19, did not have a significant effect. The lack of association between knowledge and vaccine acceptance may be because the vast, disparate, and even contradictory information spread through various media platforms, word-of-mouth, and health professionals undermined social trust in information (Wong et al., 2021). People could also have had information overload, and thus had difficulty in understanding all of the information (Holton and Chyi, 2012). Therefore, the local authorities and health professionals should focus on fostering people's trust and belief in their abilities and health advice to better manage this health crisis (Lindholt et al., 2021; Yu et al., 2021; Xiao et al., 2022).

We then examined the important features that predicted vaccine acceptance, participation in voluntary testing, and PTSD level. Item B "*I am confident that Hong Kong can successfully control COVID-19*" was identified as a critical predictor for the three dependent variables, particularly for vaccine acceptance in Models 2 and 3 (FIVs close to 30 and odds ratios greater than 4). This is in line with our hypothesis and suggests that the general public's decision to get vaccinated was largely dependent on their confidence in the controllability of the spread of the disease locally, that is in local health professionals' or government's ability to manage the pandemic. Another important feature was Item F "*Avoid unnecessary social gathering or dining*," which was found to predict vaccine acceptance and participation in voluntary testing (Models 2, 3, and 4). This association indicates that promotion of compliance with such social distancing policies may lead to greater willingness to get vaccinated or undergo testing. This finding is not in line with the literature, which has suggested that there is a greater tendency to refuse vaccines among people more compliant to preventative measures, as they may believe that the daily preventative measures adequately protect their health (Wang et al., 2021; Xiao et al., 2022). This discrepancy may be due to the timing of the studies: we collected data approximately 1 year after the pandemic started, whereas most studies have focused on the beginning stage of the pandemic. It is possible that, over time, people are recognizing the limitations of the daily preventative measures or are perceiving vaccines to be part of the regular preventative measures.

TABLE 3 Important features of the four models.

Item	Important features in predictive modeling	Models
A	Eating or touching wild animals can cause COVID-19.	1, 4
B	I am confident that Hong Kong can successfully control COVID-19.	1, 2, 3, 4
C	Clean hands before touching the mouth, nose, or eyes.	1
D	Reduce leaving home and social activities.	1, 4
E	Not all infected people are seriously ill.	1
F	Avoid unnecessary social gatherings or dining.	2, 3, 4
G	Work from home or adopt staggered work hours.	2, 3, 4
H	Pay attention to toilet hygiene.	2
I	Maintain proper functioning of drainage pipes.	2, 3
J	Maintain environmental hygiene, e.g., sufficient indoor ventilation.	3

4.2. Voluntary testing

The identification of the top five important features in Model 4 revealed the significance of KAP in predicting participation in voluntary testing. In this model, the most important feature was "*I am confident that Hong Kong can successfully control COVID-19*" (Item B), suggesting that a positive attitude toward COVID-19 control was related to a higher likelihood of participating in voluntary testing. Among features related to knowledge, a better understanding of Item A "*Eating or touching wild animals can cause COVID-19*" was related to greater willingness to undergo testing. However, mixed results were found for features related to preventative practice. Both the higher compliance items, Item D "*Reduce leaving home and social activities*" and Item F "*Avoid unnecessary social gathering or dining*," and the lower compliance item, Item G "*Work from home or adopt staggered work hours*" were related to higher participation in voluntary testing. It is possible that the response to Item G was related to the nature of the participant's work, such that they could not work from home (e.g., catering business) or that their employer did not allow flexible working hours. The findings related to knowledge of COVID-19 were in line with previous studies showing that the accuracy of people's understanding of COVID-19 was positively related to their willingness to undergo testing (Graham et al., 2021; Smith et al., 2021; Sudre et al., 2021).

4.3. Post-traumatic stress

In Model 1, knowledge (Items A and E), attitude (Item B), and practice (Item C and D) were all represented in the five most important features. The FIVs of the top three important features (Items A, B, and C) were close, between 8.5 and 9.2, implying that these three features were equally important in determining a person's emotional distress related to COVID-19. In fact, there was no dominant feature, as the FIVs of all of the five important features were relatively close and below 10. Specifically, the people with a poor understanding of how the virus is spread (Item A "*Eating or touching wild animals can cause COVID-19*") or the potential severity of the disease (Item E "*Not all infected people are seriously ill*") were more vulnerable to PTSD. Furthermore, a negative response to Item B "*I am confident that Hong Kong can successfully control COVID-19*" was associated with higher levels of PTSD. A higher compliance with certain preventative measures such as "*Clean hands before touching the mouth, nose, or eyes* (Item C)" and "*Reduce leaving home and social activities* (Item D)" was also related to higher levels of PTSD. These findings are in line with our hypothesis that poor knowledge of, pessimistic attitude toward, and good compliance with preventive practices for COVID-19 would be related to higher PTSD scores. This combination of predictors suggests that, even if people are following health advice on disease prevention, if they are not sufficiently knowledgeable of the disease or have negative attitudes or doubts about the controllability of the disease locally, they can experience psychological distress relating to the disease. This is consistent with prior research. For example, Si et al. reported that knowledge of COVID-19 served as a protective factor against PTSD, and that negative attitudes toward COVID-19 may be related to concerns about the risk of infection, worldwide impacts, and severity of the disease, all of which were positively associated with PTSD (Si et al., 2021).

4.4. Strengths and limitations

This study fulfills the research gap of lack of literature examining the strongest predictors on COVID-19 preventions and mental health during the pandemic. The results do shed light on people's behavioral choices and mental health situation at approximately 1 year after the start of the pandemic. The multidimensional data was efficiently handled and analyzed using machine learning model. Together with a large and diverse sample, the predictive accuracy of the models enabled us to provide stronger conclusions. For the limitations, as the pandemic situation changes across different waves, more data could be collected at different time points to increase the accuracy of the prediction models. Furthermore, more algorithms could be compared in

TABLE 4 Top five features of each model.

Model	Five most important features (Survey items)	Feature importance value	Groups of responses	Odds ratio	Value of *p*
1	A: Eating or touching wild animals can cause COVID-19.	9.2	Yes vs. No	1.5476	0.0022
	B: I am confident that Hong Kong can successfully control COVID-19.	8.8	No vs. Yes	2.0528	<0.0001
	C: Clean hands before touching the mouth, nose, or eyes.	8.5	Usually or more vs. Seldom or less	2.2748	<0.0001
	D: Reduce leaving home and social activities.	6.3	Usually or more vs. Seldom or less	1.6911	0.0008
	E: Not all infected people are seriously ill.	5.8	No vs. Yes	2.3265	<0.0001
2	B: I am confident that Hong Kong can successfully control COVID-19.	30.7	Yes vs. No	6.2338	<0.0001
	F: Avoid unnecessary social gathering or dining.	8.0	Always vs. Not always	2.2667	<0.0001
	G: Work from home or adopt staggered work hours.	6.8	Never vs. Not never	1.1932	0.0813
	H: Pay attention to toilet hygiene.	4.2	Not never vs. Never	1.2543	0.2224
	I: Maintain proper functioning of drainage pipes.	4.2	Usually or more vs. Seldom or less	1.9248	<0.0001
3	B: I am confident that Hong Kong can successfully control COVID-19.	29.5	Yes vs. No	4.7255	<0.0001
	F: Avoid unnecessary social gathering or dining.	6.9	Always vs. Not always	1.8053	<0.0001
	I: Maintain proper functioning of drainage pipes.	4.9	Usually or more vs. Seldom or less	1.5922	<0.0001
	G: Work from home or adopt staggered work hours	4.4	Never vs. Not never	1.2167	0.0404
	J: Maintain environmental hygiene, e.g., sufficient indoor ventilation.	3.9	Usually or more vs. Seldom or less	2.097	<0.0001
4	B: I am confident that Hong Kong can successfully control COVID-19.	12.8	Yes vs. No	2.3230	<0.0001
	F: Avoid unnecessary social gathering or dining.	9.6	Always vs. Not always	1.8526	<0.0001
	K: Eating or touching wild animals can cause COVID-19.	6.6	No vs. Yes	1.2681	0.0053
	D: Reduce leaving home and social activities.	5.6	Always vs. Not always	1.6589	<0.0001
	G: Work from home or adopt staggered work hours.	5.1	Never vs. Not never	1.4611	0.0003

future studies to achieve the best prediction performance. We also acknowledge our sample might not be representative of the whole population in Hong Kong, as we could not obtain responses of people without a landline/mobile, or refused to participate in the study. Opinions of young people below the age of 18 were not included in this study. Regarding the content of the questionnaire, the measurements for KAP and the PTSD symptoms were based on previous studies using different Chinese samples. However, we were the first to apply them to the COVID-19 context in the Hong Kong Chinese population. Further research may be needed to confirm the suitability of the scales in this context. While outsourcing the telephone survey to a company was cost effective, it might introduce error in the data collection process. Measures had been made to reduce bias by withholding the hypothesis of the

project form the data collection company, i.e., the data collectors were blind to the hypothesis. Therefore, systematic bias or error that could interfere with the overall pattern of results was minimized.

4.5. Conclusion

In conclusion, the results suggested that vaccine acceptance, PTSD symptoms and engagement in COVID-19 testing were all partly explained by levels of knowledge level, attitude, and daily preventative practices in relation to the COVID-19 pandemic. Among the three factors, having an optimistic attitude about the local management of the pandemic was found to be the key protective factor for the prevention of PTSD symptoms, and it was also the key motivator for vaccine acceptance. Therefore, to maintain good mental health and acceptance of ongoing vaccine boosters, it is important to foster people's sense of trust in the ability of the health professionals and the government in controlling COVID-19, in addition to strengthening their knowledge of and compliance with preventative measures. Given the limitations of the project, care should be taken in interpreting the results. Future longitudinal studies would be useful, to establish a causal relationship between KAP and mental health, both during and post- the COVID-19 pandemic.

Data availability statement

The datasets presented in this article are not readily available due to participants' confidentiality. Requests to access the datasets should be directed to DS, david.shum@polyu.edu.hk.

Ethics statement

The studies involving human participants were reviewed and approved by the Human Subjects Ethics Sub-Committee of The Hong Kong Polytechnic University. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

Author contributions

DS, YC, and JS were responsible for the conceptualization, funding acquisition, methodology, and investigation. YC, KCW, K-SC, and NH drafted the original manuscript. K-SC and NH conducted the data analysis. All authors provided important contributions for the interpretation of findings and contributed to the final version of the manuscript, read, and approved the final manuscript.

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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.

Publisher's note

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Development and psychometric properties of health care workers' concerns in infectious outbreaks scale

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Introduction: Healthcare workers are a crucial workforce; from a moral perspective, understanding their concerns and how to support them is crucial and makes it possible for health services to keep functioning. This study aimed to develop and validate Health Care Workers' Concerns in Infectious Outbreaks Scale (HCWCIOS).

Methods: This exploratory sequential mix-method study was employed to design and validate the HCWCIOS. The initial tool was designed after searching similar studies and performing a qualitative phase under the semi-structured approach. Both qualitative and quantitative methods were used to evaluate the face and content validity. The content validity ratio, content validity index, and item-level content validity index were also calculated. Exploratory factor analysis was employed to evaluate the construct validity. Using a convenient sampling method, 354 Iranian healthcare workers participated in the study. Computing Cronbach's alpha coefficient estimated the internal consistency for HCWCIOS and its subscales. Furthermore assessed was test–retest reliability.

Results: The preliminary scale was designed with 57 items. By eliminating nine items in the content validity phase and 12 items during factor analysis, the final 36-item scale was developed on six factors: inadequate preparedness, lack of knowledge, risk perception, affected social relations, work pressure, and absenteeism. These six factors accounted for 46.507% of the total variance. The whole scale's Cronbach's alpha coefficient was 0.912, and the intra-class correlation coefficient was 0.88.

Conclusion: A 36-item HCWCIOS has good psychometric properties and is suitable for measuring healthcare workers' concerns during a pandemic.

KEYWORDS

concern, exploratory factor analysis, infectious disease outbreaks, psychometry, reliability, validity

1. Introduction

Increased outbreaks of infectious diseases in recent years, including Severe Acute Respiratory Syndrome (SARS) in 2003, Novel Influenza A/H1N1 in 2009, and Middle East Respiratory Syndrome (MERS) in 2012, have raised concerns about the potential of a global pandemic. The emergence of Corona Virus Disease-2019 (COVID-19) brought this potential to realization (Fernandez et al., 2020) and caused a tremendous public health crisis (Que et al., 2020; Sperling, 2021).

Healthcare workers (HCWs) are on the front lines of the fight against the crisis of such infectious outbreaks (Abolfotouh et al., 2017). They often risk contracting pathogens (Temsah et al., 2020). Therefore, during the past and current infectious outbreaks, frontline HCWs became infected, and many have lost their lives (Chakravorty et al., 2020; Jalili et al., 2021). COVID-19 infections and deaths among HCWs follow that of the general population worldwide, and over 150,000 infections and 1,400 deaths were reported until 2020 (Bandyopadhyay et al., 2020). According to a recent Iranian study, COVID-19 has killed about 10,000 HCWs (Jalili et al., 2021).

Participating in frontline work and receiving such negative information appears to be significant risk factors for psychological distress and problems (Goulia et al., 2010). High levels of concern have been reported in many studies (Alsubaie et al., 2019) in both frontline and non-frontline HCWs (Sahashi et al., 2021). It has significantly impacted them professionally and personally (Moseley et al., 2020). Understanding HCWs' concerns and how to support them is crucial, not only from a moral perspective but also to ensure that health services remain on track (Borek et al., 2022). The HCWs' concerns mean facing challenges, fears, and anxieties (Heidarijamebozorgi et al., 2021).

Many frontline HCWs' are concerned about well-reported deaths, according to media reports in the United Kingdom (Chakravorty et al., 2020). They are frequently concerned about their health and the health of their families, concerned about how they function, and fear being stigmatized (Goulia et al., 2010). A survey of over 10,000 HCWs during the SARS outbreak (2003) reported that many respondents experienced social stigmatization. Nearly half (49%) and 31%, respectively, believed that "people avoid me because of my employment" and "people avoid my family members because of my job." For instance, some parents of school-aged children prohibited their kids from playing with or being close to HCWs' kids. A significant portion of HCWs (69%) also thought that "those close to me are concerned they might contract the virus from me" (Koh et al., 2005).

These are only part of the concerns of HCWs during pandemics. Various studies reported that during the outbreak of pandemics, widespread concerns are created among health workers, which becomes a big challenge for health systems in crisis periods (Abolfotouh et al., 2017; Khademipour et al., 2017; Berkhout et al., 2021).

The novelty of the diseases, the lack of prior experience, and the potential that HCWs were not fully informed about the management difficulties by the pertinent authorities during their teaching campaign all could be attributed to a high level of concern (Alsubaie et al., 2019).

Higher job stress, social isolation, and health fears have all been related to HCWs' concerns and psychological distress around the outbreaks (Goulia et al., 2010; Sheikhbardsiri et al., 2022). Unrecognizing emotions and concerns may prevent patient-centered care, neglect patients' psychological issues, avoid bonding with patients, and inhibit the quality of care. It also could affect the HCWs' sense of well-being and may lead to distress, disengagement, job conflict, and burnout (Barello et al., 2020). In an extended crisis such as the pandemic, the sustainability of the healthcare response entirely depends on its capability to protect the health of responders and the HCWs (Muller et al., 2020). However, even when supplied for free or at a low cost, the support uptake by HCWs has remained limited (Berkhout et al., 2021). For an appropriate epidemic response, it is vital to understand the concerns, behaviors, and knowledge of HCWs. The concerns may affect HCWs' overall effectiveness and must be addressed by including organization policies in outbreak planning (Alsubaie et al., 2019).

Limited studies focus on HCW'S perception of concerns and worries in the past (Wong et al., 2008; Goulia et al., 2010; Abolfotouh et al., 2017) and current pandemics (Koh et al., 2005; Chaudhary et al., 2020; Kinariwala et al., 2020; Sperling, 2021) among different groups of HCWs. In these studies, questionnaires have been used as a data collection tool. However, there is some ambiguity regarding their creditability.

In Singapore, a study evaluated how HCWs perceived the risk and its effects on their work and personal life. A three-part questionnaire has applied, including individual characteristics, 88 questions about the perceived risk of infection, the perceived impact of the SARS pandemic on personal and professional life, and the impact of events scale (Koh et al., 2005). After 3 years of an avian influenza pandemic, Wong et al. (2008) from the same country used a modified version of that questionnaire to study concerns, perceived impact, and preparedness in HCWs (Wong et al., 2008). In MERS outbreaks in Saudi Arabia, the level of concern among HCWs was assessed with Wong's et al. (2008) instrument (Abolfotouh et al., 2017). Based on retrieved studies, research in Greek is the only article on past outbreaks that report Cronbach's α score. In this study, Goulia et al. (2010) designed the questionnaire based on the information in the literature about the perspectives and opinions of experts on infectious disease outbreaks (Goulia et al., 2010).

With the emergence of COVID-19, HCWs' concerns and worries have become the focus of some researchers again. A modified version of Goulia et al.'s (2010) instrument without validity assessment has been used to survey worries and concerns among HCWs in COVID-19 in Japan (Sahashi et al., 2021). Researchers have applied a modified version of Wong's et al. (2008) scale to study concerns, perceived impact, and preparedness of oral HCWs. In this study, Cronbach's α score has been reported (Chaudhary et al., 2020). An instrument with no psychometric

report was applied to study the concerns and fears of Indian dentists regarding professional practice (Kinariwala et al., 2020).

This brief review of applied questionnaires to study concerns of HCW shows no clear, sufficient, and substantial evidence on the rigorous process of designing and psychometric evaluating of used questionnaires. There is no valid and reliable tool to evaluate HCWs' concerns in an infectious disease outbreak. More objectively, among those already built instruments, no one validated for the Iranian context can evaluate the healthcare workers' concerns. Thus, we seek to contribute by filling this gap and offering an instrument to healthcare workers' concerns in infectious outbreaks, given the relevance and urgency of the matter. Hence, this study aimed to develop and psychometrically evaluate a scale to measure HCWs' concerns in infectious outbreaks.

2. Materials and methods

2.1. Study design

This exploratory sequential mix-method study (qualitative-quantitative) was employed to develop and validate the HCWCIOS in Iran during the COVID-19 pandemic in 2020. This study was carried out in two stages: (1) item generation based on literature review and qualitative study findings and (2) psychometric analysis of the developed scale. The data in the first stage were collected by reviewing related literature and performing semi-structured interviews with HCWs.

2.2. Item generation

The item generation phase consisted of three steps: (1) a Literature review to find out the concept dimensions; (2) Carrying out a qualitative study to discover other dimensions of HCWs' concerns in infectious outbreaks that were not fully obtained in the previous step in order to generate the item pool; and (3) Designing the initial tool.

2.2.1. Literature review

In this step, a literature review was applied to identify prior researches that discussed the HCWs' concerns about infectious outbreaks. The search was conducted in Web of Science, Scopus, and PubMed databases, as well as Iranian ones and Google Scholar search engine, without any time limitation. There were no restrictions regarding the study design. Studies were included if they addressed the concerns of healthcare workers during epidemics and contagious diseases. The statements were extracted to be used as the initial items.

2.2.2. Qualitative phase

Nine HCWs (six female and three male) with strong communication skills and willingness to participate in a study were recruited for the qualitative phase. In this phase, individual interviews under the semi-structured approach were conducted regarding the participants' preferences. Due to the importance of having different points of view, it was tried to choose participants with maximum diversity in terms of parameters such as gender, job categories, and work experience. Purposive sampling was used to select HCWs. First, the participants received a written consent form, which they must read and sign. The researcher had a pre-prepared interview guide with key questions to better manage the interview time. The interviews were started by asking general questions such as "Tell us about your experiences working during the pandemic?" Through which the participant was allowed to talk openly about the topic. Following the main questions generated from our literature review, exploratory questions were asked. At this point, content analysis was utilized. After transcription, researchers read the written interviews several times to get immersed in the data. They examined the data to identify their preconceptions to build self-reflexivity. To make sense, the researchers frequently asked Wh-questions while performing the analysis. The data analysis and coding were performed. The codes, subcategories, and categories were derived from the transcript data. The researchers also conferred with team members regarding the themes and codes they had retrieved, followed by a thorough explanation of the data analysis procedure and precise citations. The inclusion criteria were: hospital staff who had direct or indirect contact with COVID-19 patients had at least 1 month of work experience during the pandemic and were willing to participate in the study. The interviews continued until the data were saturated because the sample size for qualitative studies could not be determined (Polit and Yang, 2016).

2.2.3. Synthesis stage and designing the initial scale

With the information obtained from the previous two steps and by putting them together (literature review and qualitative interviews), an item pool was created, which was used to build the primary scale in this step.

2.3. Psychometric evaluation

In this study stage, face validity and content validity were assessed. Then, the tool's psychometric properties were then examined in a descriptive cross-sectional study.

2.3.1. Face validity

Face validity is the extent to which a test appears to assess what it is intended to measure (Johnson, 2021). At this stage, the newly designed scale was completed by 10 HCWs. The item impact score was evaluated to determine the quantitative face validity. The item will be retained and considered suitable for further analysis if the impact score exceeds 1.5 (Polit and Yang, 2016). A 5-point Likert scale was used for calculating the item impact score by 10 HCWs that were requested through

convenience sampling to study the items. The categories of unimportant (1), slightly important (2), relatively important (3), important (4), and very important (5) were taken into consideration (Cresswell and Plano Clark, 2011). In the qualitative phase of face validity, regarding the items that scored 1.5 or less, the same 10 participants of the quantitative stage were interviewed face-to-face about the items' difficulty, relevancy, and ambiguity (Ebadi et al., 2017).

2.3.2. Content validity

Both qualitative and quantitative methods were used to evaluate content validity. In the qualitative phase, 20 faculty members with experience in instrument development, patient care, and psychology were requested to evaluate and provide feedback on the items' wording, item allocation, and scaling. Then, the Content Validity Ratio (CVR) and Content Validity Index (CVI) were computed. Twenty experts were asked to score each item on a three-point scale for reporting CVR as "necessary," "useful but not necessary," and "unnecessary." The items with a CVR of 0.62 and higher were conserved according to Lawshe's table (Lawshe, 1975). The CVI for each item (I-CVI) and modified kappa coefficient were calculated based on the scoring of the same expert panel. A CVI value of 0.79 or higher was considered optimal without any need to be re-reviewed in the final version. Items with a kappa index less than 0.74 also were deleted. Furthermore, the scale-level CVI (S-CVI) was estimated. If S-CVI/Ave is 0.9 and higher, the scale's content validity is reported as favorable (Polit et al., 2007).

2.3.3. Construct validity

The final scale was distributed to HCWs to construct validity. Sampling was done by convenience method. The inclusion criteria were: hospital staff directly or indirectly in contact with COVID-19 patients had at least 1 month of work experience during the pandemic and were willing to participate in the study. An incomplete questionnaire was considered as an exclusion criterion. Maximum Likelihood Exploratory Factor Analysis (MLEFA) with varimax rotation was used to assess the scale's construct validity. The univariate and multivariate normal distributions of data were examined by Skewness (±3) and Kurtosis (±7). Sample adequacy was determined through the Kaiser–Meyer–Olkin (KMO) and Bartlett's tests. KMO values above 0.7 were considered acceptable (Pahlevan Sharif and Sharif Nia, 2020). The minimum sample size needed for factor analysis is 300, according to Tabachnick et al. (2007). Due to the spread of COVID-19 and the lack of in-person access to the respondents, the questionnaires were provided electronically. From May to November 2020, 304 questionnaires were gathered. The number of factors was calculated using the "Eigenvalue" and "Scree Plot" techniques. Each factor that was extracted from the factor analysis required to be loaded at least 40% to remain constant. More than one eigenvalue was considered (Saggino and Kline, 1996).

2.3.4. Reliability

Cronbach's alpha (≥0.7) was determined to assess the scale's internal consistency and that of its subscales (Grove et al., 2012). Fifty HCWs participated in this stage. The test–retest method was used to assess the scale's stability, and the Intra-Class Correlation (ICC) coefficient >0.8 was an acceptable, two-way mixed model with an absolute agreement in the second round (Polit and Yang, 2016). In this way, the test–retest method was used. A validated scale was given to 30 HCWs, and they were asked to answer the items on a 6-point Likert scale (1 = completely disagree, 6 = completely agree). After 7 days, the same questionnaire was again provided to the HCWs, and they were asked to answer, then the ICC coefficient was calculated. IBM SPSS Amos 25 was used to perform all statistical analyses.

3. Results

3.1. Item generation

After reviewing related studies, 49 items were obtained by combining and changing the items of similar instruments (Koh et al., 2005; Wong et al., 2008; Abolfotouh et al., 2017). Interviews with nine participants led to the formation of 520 codes, 32 sub-themes, and six themes. Based on the obtained codes, eight items were extracted. The HCWCIOS preliminary item pool was created using the extracted themes, primary categories, and existing literature. The initial scale, 57 items, was then ready for the psychometric procedure.

3.2. Psychometric evaluation

Eight items had an impact factor of 1.5 or below, according to the evaluation of face validity. These items were revised in the qualitative stage, and after the reforms, they were returned to the item pool. All the modifications suggested by experts were used in the qualitative review of content validity. The items with a numerical value of less than 0.62 were eliminated following the CVR results. Based on the overall content validity results, nine items were removed, and 48 items reached the item analysis stage. Noteworthily, the S-CVI/Ave scale was obtained as 0.93. At the stage of item analysis, estimates put Cronbach's alpha at 0.947, and no items were deleted.

Based on the inclusion criteria, 304 HCWs completed the electronic questionnaires. The participants' average age was 32.25 (SD = 7.34) years. The majority of participants were women (67.10%) with a bachelor's degree (70.40%) and married (60.20%). The participants had a mean work experience of 10.18 (SD = 6.42) years. We observed that 88.10% of the participants contracted with patients directly, and 55.30% were nurses.

Exploratory Factor Analysis (EFA) was done to assess the factor structure of the HCWCIOS items. According to the results

presented in Table 1, the Kaiser–Meyer–Olkin (KMO) test value was 0.872, and Bartlett's test value was 7468.038 ($p < 0.001$). Six factors were extracted and categorized as "Inadequate Preparedness" (eight items); "Lack of Knowledge" (seven items); "Risk Perception" (six items); "Affected Social Relations" (six items); "Work Pressure" (six items); and "Absenteeism" (three items). These six factors had eigenvalues of 9.800, 4.262, 3.051, 2.209, 1.985, and 1.797, respectively, and 46.507% of the total variance of variables of the HCWs' concerns in the scale of the infectious outbreaks explained (Table 2). The Varimax rotation was done based on the scree plot (Figure 1) and the total variance table. Due to commonalities below 0.4, seven items were excluded from the EFA.

The internal consistency based on Cronbach's alpha coefficient for the inadequate preparedness factor was $\alpha = 0.854$; for the lack of knowledge factor was $\alpha = 0.858$; for the risk perception factor was $\alpha = 0.864$; for affected social relations factor was $\alpha = 0.817$; for work pressure factor was $\alpha = 0.754$; for absenteeism was $\alpha = 0.735$, and for the whole scale was $\alpha = 0.912$. On the other hand, ICC was found as 0.880 (95% confidence interval: 0.854–0.901) by the test–retest method (Table 3).

4. Discussion

This study aimed to design and psychometrically evaluate a scale to measure HCWs' concerns in infectious outbreaks. The initial scale was developed based on data obtained from extensive reviews of existing literature on HCWs' concerns in infectious outbreaks and a qualitative study. The findings of this study confirmed that the validity and reliability of the final HCWCIOS were as expected. HCWCIOS featured 36 items and six factors: inadequate preparedness, lack of knowledge, risk perception, affected social relations, work pressure, and absenteeism.

The first factor of HCWCIOS was inadequate preparedness. Emergency preparedness involves a broad range of skills, abilities, and knowledge to prepare for and respond to catastrophes, threats, and pandemics. Understanding the readiness and preparation of HCWs to handle emergencies like the COVID-19 pandemic and deliver safe and effective treatment during these times is lacking (Chua et al., 2021). In a qualitative study, Borek et al. (2022) with the issue of HCWs' concerns in the COVID-19 pandemic, stated that HCWs experienced substantial stress and anxiety due to the pandemic's inadequate preparation, which was followed by requests for reflection and learning from the experience.

TABLE 1 Kaiser–Meyer–Olkin (KMO) and Bartlett's tests for sample adequacy of HCWCIOS.

Kaiser-Meyer-Olkin measure of sampling adequacy		0.872
Bartlett's test of sphericity	Approx. Chi-Square	7468.038
	df	1,081
	Sig.	0.000

The second factor of this scale was the lack of knowledge. HCWs might need more knowledge regarding pandemics. As a result, individuals could not fully comprehend the risk or danger involved, which could affect their ability to stop the virus's spread. Related studies conclude that less experienced HCWs are less knowledgeable, have lower levels of self-control and resilience, and experience greater levels of stress than more experienced HCWs who also have greater expertise (Chigwedere et al., 2021; Jamebozorgi et al., 2021). According to Malekshahi Beiranvand and Hatami Varzaneh (2018) the HCWs faced difficulties during COVID-19, including a lack of specialized expertise, inadequate readiness, and access to practical skills for managing and controlling the disease. One of the stressors identified among HCWs during the COVID-19 pandemic was a lack of knowledge and experience (Yusefi et al., 2022).

Risk perception was the third factor on the scale, with six items. Risk perception is essential in making the proper decisions during a pandemic crisis and can be viewed as the driving force behind preventive behaviors (Cori et al., 2020). According to the findings of the research done in the United States, because it was recognized that COVID-19 could result in severe effects other than death, such as serious infections and self-quarantine, the association between risk perception of COVID-19 and death due to COVID-19 has a stronger relationship with protective activities (Bruine De Bruin and Bennett, 2020). However, a cross-sectional study in Asian and European regions found no connection between awareness of the influenza pandemic risk and taking protective behaviors during the outbreak (Sadique et al., 2007). Studies showed that considering a pandemic's perceived risk and setting standards for assessing performance can be beneficial for preventive planning, and appropriate educational interventions could be implemented (Molavi-Taleghani et al., 2020; Arefi et al., 2022).

Another factor of the designed tool was affected social relations. Several incidents of stigmatization of HCWs have emerged throughout this pandemic worldwide. In Mexico, for example, it was discovered that doctors and nurses utilize bicycles because they were allegedly denied access to public transportation and were the targets of physical assaults (Bagcchi, 2020). Healthcare professionals' social relations studies demonstrated that HCWs' families are psychologically impacted due to the pandemic (Lau et al., 2005; Amakiri et al., 2020). HCWs endure social stigmatization despite being praised by the media as heroes and suffer extreme anxiety and concern for their safety and the well-being of their family, friends, and coworkers. Although HCWs are more prone to seek peer psychological assistance, they also gain from being aware of the availability of official psychological support (Duffy et al., 2022). To tackle the COVID-19-related social stigma, the World Health Organization (WHO) emphasizes fostering a culture that encourages honest communication between individuals and HCWs (Bagcchi, 2020).

Work pressure was another factor. Pandemics placed extreme demands on HCWs. When pressure is high, they have had to manage a more significant number of patients with high mortality rates. They have had difficulties providing care while adhering to strict infection control procedures and not always

TABLE 2 Exploratory factor analysis of HCWCIOS.

Factors	Items	Factor loading	Eigen value	Variance (%)
1. Inadequate preparedness	Q40: I feel that my organization cannot manage these patients.	0.853	9.800	10.792
	Q38: Protocols and guidelines are not fully implemented.	0.694		
	Q32: My workplace does not have a detailed plan to face the crisis caused by this pandemic.	0.664		
	Q37: The protective and preventive measures implemented in my work environment are ineffective in preventing the spread of this disease.	0.639		
	Q41: I feel that there is not enough program in our region to deal with this disease.	0.626		
	Q39: My colleagues have not taken the recommended prevention and control of infection seriously.	0.569		
	Q35: I have not received enough training on infection control and how to use personal protective equipment.	0.532		
	Q24: The rules regarding the epidemic of this disease have confused me.	0.481		
2. Lack of knowledge	Q46: I do not have enough knowledge about patient care.	0.804	4.262	9.712
	Q44: I do not have enough knowledge about the prognosis and mortality rate of this disease.	0.705		
	Q43: I do not know the signs and symptoms of this disease well enough.	0.700		
	Q47: I do not know enough to prevent and care for myself against this disease.	0.661		
	Q42: I do not know enough about this disease's causative agent, such as its nature and ways of transmission.	0.643		
	Q45: I do not know enough about the drug treatment of this disease.	0.574		
	Q36: Most of the time, there is no one to answer my questions about this disease.	0.486		
3. Risk perception	Q3: I feel anxious while interacting with infected people.	0.853	3.051	8.220
	Q4: When communicating with infected people, the fear of transmitting the disease worries me.	0.853		
	Q6: If one of my colleagues gets this disease, I feel threatened.	0.709		
	Q14: It worries me that I do not know when the disease will subside.	0.525		
	Q7: I feel that I have to reduce my social activities due to the spread of this disease.	0.467		
	Q12: I am worried about the unintentional transmission of the disease to my family, friends, and colleagues.	0.415		
4. Affected social relations	Q17: I think others may stay away from my family because of my job and the possibility of getting sick.	0.733	2.209	6.622
	Q15: I think others avoid me because of my job.	0.685		
	Q19: The fear of being a disease carrier has made me stay away from my family and friends.	0.580		
	Q16: I feel that my family avoids me because I work in the hospital.	0.569		
	Q18: I am afraid to inform my family about the level of risk I am facing of being infected.	0.461		
	Q30: It is challenging for me to meet physiological needs (eating, drinking, hygiene, rest, etc.) while working.	0.402		

(Continued)

TABLE 2 (Continued)

Factors	Items	Factor loading	Eigen value	Variance (%)
5. Work pressure	Q25: There are not enough human resources to carry out the affairs and demands in this situation.	0.648	1.985	6.131
	Q27: My workload has increased.	0.508		
	Q26: There are more conflicts between my colleagues and me in the work environment.	0.502		
	Q23: I feel that the organization I work for will not pay attention to my needs if I get sick.	0.499		
	Q28: Against my will, I have to work overtime.	0.498		
	Q21: I am worried that my manager and colleagues will not treat me properly if I get infected.	0.402		
6. Absenteeism	Q8: I think it is better for me to be absent from work in order not to get sick.	0.604	1.797	5.031
	Q31: I have not accepted that facing all kinds of diseases is part of the nature of my profession.	0.586		
	Q9: I feel I have to change my job because of the spread of this disease.	0.585		

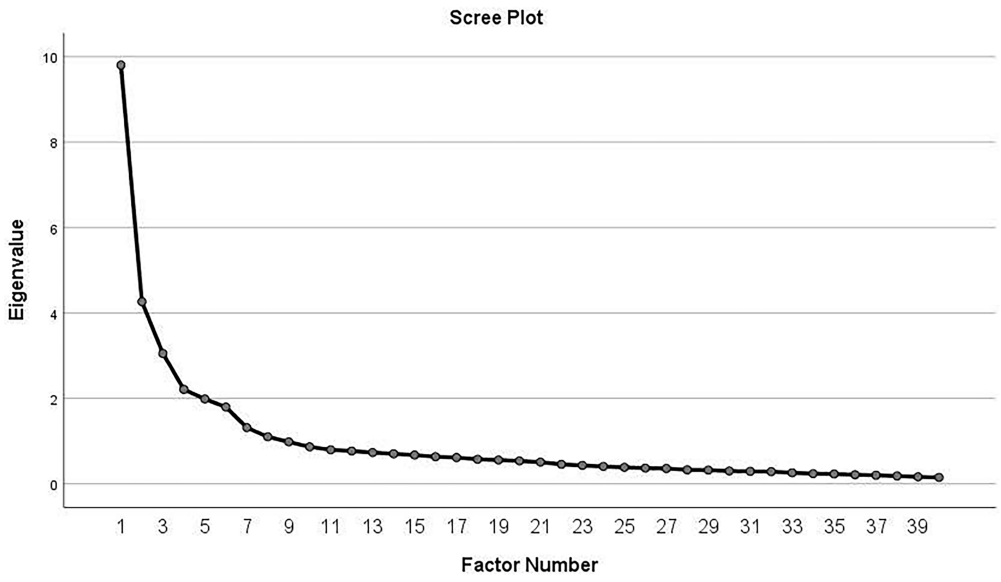

FIGURE 1
Scree plot. Based on the scree plot, six factors were proposed for extraction in the EFA of the HCWCIOS.

wearing enough personal protective equipment. As a result of their redeployment into new positions, teams, or wards, many have been operating in unfamiliar settings without the established social support of their peers (Billings et al., 2021). Some studies have depicted that the unique demands of world crises and high-stress levels placed HCWs at additional risk for mental health problems (Lai et al., 2020; Greene et al., 2021).

The last but not most minor factor of HCWCIOS was absenteeism. During the SARs outbreak, several reports revealed HCWs in Toronto and Hong Kong either shied away from physical examinations of ill patients or refused to work with them because the risk they posed was too significant. At the height of China's SARS outbreak, at least one hospital struggled to sustain services due to absenteeism, among which some were driven by concerns about getting sick (Shiao et al., 2007). More than 80% of HCWs in New York City were willing and/or able to report to work during a mass casualty or environmental disaster. However, only 57–68% would be willing to do so during a SARS or smallpox outbreak, according to a recent survey assessing their readiness for duty during a catastrophic disaster (Qureshi et al., 2005). Fears for one's safety and the responsibilities of the family are frequently the leading causes

TABLE 3 Reliability coefficient and internal consistency of HCWCIOS.

Factor	No. of item	Cronbach's alpha coefficient	ICC	CI, 95%
				Lower – Upper
1	8	0.854	0.851	0.878–0.881
2	7	0.858	0.860	0.830–0.885
3	6	0.864	0.828	0.795–0.857
4	6	0.817	0.723	0.624–0.804
5	6	0.754	0.705	0.618–0.771
6	3	0.735	0.709	0.625–0.773
Total	36	0.912	0.880	0.854–0.901

of potential absenteeism during a pandemic, and the absenteeism rate doubles when a family member is infected (Seale et al., 2009).

The present research used a robust methodological and statistical approach to provide a valid tool for HCWs' concerns in infectious outbreaks.

4.1. Limitations and strengths

The specific design to assess the HCWs' concerns in infectious outbreaks was one of the strengths of this study. Moreover, an acceptable population diversity was recruited from different cities in Iran for the psychometric evaluation of the tool.

The most significant limitation of the current study was that access to participants was limited due to the spread of COVID-19. Furthermore, the present study was only conducted in Iran, and it is preferable to include other countries and cultures to demonstrate its trustworthiness because cultural factors can influence HCWs' concerns. More studies are recommended to investigate this scale's conceptual structure and to gather more evidence regarding the tool study's psychometric properties.

5. Conclusion

A 36-item HCWCIOS has good psychometric properties and is suitable for measuring HCWs' concerns during a pandemic.

Data availability statement

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

Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee of Lorestan University of Medical Sciences, Khorramabad, Iran (IR.LUMS.REC.1399.007). The patients/participants provided their written informed consent to participate in this study.

Author contributions

SY: conceptualization, methodology, data curation, writing – original draft preparation, review and editing, supervision, and project administration. MK: conceptualization, methodology, writing – original draft preparation, and review and editing. FE: formal analysis and methodology. TC: data curation and methodology. ES: formal analysis, writing – original draft preparation, review and editing. 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.

Publisher's note

Supplementary material

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How COVID-19 pandemic period influences on the selected mental health parameters of Polish respondents?

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Introduction: There are many different articles about COVID-19 pandemic period and its influence on people and their behavior. Nevertheless, there is little research on the slightly later period of the pandemic, that is, the time when specific adaptation mechanisms in society should start to take place.

Methods: Our research was conducted by means of an online survey. Four hundred and eighty five adults participated, including 349 (71.96%) women and 136 (28.04%) men. The Buss-Perry aggression scale, Alcohol Use Disorders Identification Test and Generalized Anxiety Disorder 7 scale were used. The results were statistically processed using Statistica 13.3 software.

Results: Within the study population, positive correlations were noted between anxiety and generalized aggression, anger, hostility, physical and psychological aggression. In the female group, anxiety correlates positively with generalized aggression, anger, hostility, verbal and physical aggression. Among male subjects, anxiety correlates positively with aggression, anger, and hostility. Alcohol consumption has a significant association with verbal aggression. Statistically, more women experience anxiety, more men have inflated scores on the AUDIT scale and on verbal and physical aggression. Younger people are more likely than older people to experience anxiety and have inflated scores on hostility. Those with secondary education scored significantly higher on the GAD-7 scale and the aggression scale (and all subscales except anger) compared to respondents with higher education.

Discussion: As a result of adaptation to the COVID-19 pandemic, anxiety is no longer a factor in increased evels of alcohol consumption. The pandemic has not affected differences in alcohol consumption between men and women. The presence of a positive correlation between anxiety and aggression and the sociodemographic structure of those characterized by increased aggression are also unchanged. Anxiety directly influences aggressive behavior in a relatively strong way. Appropriate health-promoting measures should be implemented to protect the public from the negative effects of the COVID-19 pandemic.

KEYWORDS

COVID-19, mental health, anxiety, aggression, alcohol consumption, adaptation

1. Introduction

COVID-19 is an infectious disease whose first cases were described in Wuhan, China (Wu et al., 2020; Zhou et al., 2020). Its most common symptoms include fever, fatigue, dry cough, muscle pain, and dyspnea. Gastrointestinal symptoms are also important and may precede the others (Wang et al., 2020). In addition to these, the SARS-CoV-2 virus can also attack many other organs and systems such as the heart, kidneys, liver, and nervous system—both central and peripheral (Renu et al., 2020; Andalib et al., 2021). Symptoms originating from the latter include headache, hyposmia or anosmia, taste disturbances, encephalopathy, epilepsy, impaired consciousness, cerebrovascular events (both haemorrhagic and ischemic stroke), meningitis and encephalitis, or even Guillain-Barre syndrome. Long-term complications are also highly likely, but have not yet been fully studied due to the relatively short duration of the pandemic (Abboud et al., 2020). It cannot be taken out of the equation that they will also include mental health. During the COVID-19 pandemic, many studies have also been conducted to determine its impact on many different aspects of life in different socio-demographic groups, also among Polish students (Almeida et al., 2020; Chen et al., 2021; Jones et al., 2021; Juchnowicz et al., 2021; Sitarz et al., 2021; Thatrimontrichai et al., 2021). Research among the latter group indicates elevated levels of anxiety, stress and depressive symptoms during the greatest constraints of the lockdown period. However, as the second cross-sectional study showed, the students coped in different ways with the symptoms they encountered, but did not avoid them (Juchnowicz et al., 2021; Sitarz et al., 2021). Despite the pandemic adaptation mechanisms observed in society, it is difficult to find scientific studies on this topic. For this reason, the authors of this article decided to conduct a relevant project.

Adaptation, related disorders or adaptability can be considered on many different paths. In the context of illness, two of the most important can be distinguished. The first relates to the individual's response to the illness, and the second, more global, relates to the general pattern of response to severe stress. According to accepted theory, everyone has a certain level of tension in which he or she feels comfortable—both emotionally and in terms of certain behaviors, standards of living, etc. Any stimulus that disrupts this, triggers the body to adapt to the new situation and—if possible—to take it as a new "level zero." In the case of illness or severe stress, this mechanism can be disrupted producing a general adaptation syndrome. It is always characterized by the same three phases of the stress response, these being alarm response, resistance and exhaustion. In a way, the reaction to serious illness created for health psychology fits into this theory, in which one can distinguish the phases: a search for meaning, a search for mastery and a process of self-enhancement (Odgen, 2004; Myers, 2010). This is reflected in psychiatry, where one can find diagnoses in the field of adaptive reaction within some symptoms like anxiety, restlessness, depression, tension, tearfulness or sleep disorders (Gałecki and Szulc, 2018). In the case of prolonged stress, there is no clear time limit set for when full adaptation to the surrounding conditions would occur—this is due to the fact that every organism reacts—within the framework presented—differently.

Research on the co-occurrence of anxiety and alcohol dependence was noted as early as the '80s (Wilson, 1998), and it is contemporaneous with a variety of careful analyses, including biochemical analyses, which have revealed a likely common source of anxiety and alcohol dependence in amygdala dysfunction. This may explain the abuse of alcohol while experiencing high anxiety, as well as the occurrence of anxiety as a symptom of abstinence syndrome in alcohol dependence (Gilpin et al., 2015). In view of the facts presented, it seems that alcohol consumption, on the one hand, may be modified against the background of adaptive response to the COVID-19 pandemic, and on the other hand—according to numerous reports, it may have already been modified by the very presence of the pandemic and the restrictions associated with lockdown (Ramalho, 2020). Moreover, numerous studies conducted so far have shown that increased alcohol consumption increases aggression in various mechanisms. Interestingly, as Kuypers reports, this mechanism is not so obvious and so well researched for other psychoactive substances (Kuypers et al., 2020). It is very likely that the COVID-19 pandemic also contributed to the increase in violence, as the study found that such a mechanism occurs as a result of natural disasters (Molyneaux et al., 2019). What is more—the cited study concerns the effects of disasters, so the increased level of aggression in this mechanism seems to be delayed in relation to the COVID-19 pandemic.

A separate, but equally important, issue is the inclusion of the parameters under study in a comparative analysis designating specific socio-demographic groups. In addition to disrupting the interrelationships between the variables studied, the pandemic may also have left its mark on the reduction, or increase, of differences between men and women, younger and older people. Similar studies, but at a slightly different time, were conducted, for example, in Estonia (Tamson et al., 2022), and the variability of mental health status during the COVID-19 pandemic among different demographic groups (Blanchflower and Bryson, 2022).

The aim of our study was to identify the links between anxiety, aggression and the level of alcohol consumption over a period of more than 2 years since the first case of COVID-19 was diagnosed in Poland. This period was selected due to the fact that, according to Heitzman, the specific form of acute stress response associated with COVID-19 should last much longer than that adopted in accordance with the ICD-10 criteria (World Health Organisation, 1993; Heitzman, 2020). Therefore, it is difficult to determine the exact time of society's adaptation to the new situation, and research related to this phenomenon is increasingly needed. We conducted our study from 5 February 2022 to 6 March 2022. During this time, 650,709 new cases of COVID-19 were recorded in Poland, 6,229 people died, and 957,913 people recovered. These data come from the statistics kept by the Polish Ministry of Health.

2. Materials and methods

Our project was entirely carried out *via* the Internet in order to obtain as many respondents as possible from various regions of Poland. The survey form was shared *via* social media sites such as Facebook. A total of 1,267 respondents completed the online survey, but only 485 met the inclusion criteria, of whom 349 (71.96%) were women and 136 (28.04%) were men. The exact socio-demographic structure of the studied population is presented in Table 1. At this point, it should be noted that the presented study is a separate project from previously conducted similar research (Florek et al., 2021). Before sending the questionnaires, the authors contacted the Bioethics Committee at the Medical University of Silesia in Katowice in order to obtain its opinion whether this project requires the appropriate consent. Having examined our letter, the committee decided that due to the nature of the examination, such consent was not required.

The criteria for inclusion in the study were informed consent to participate in the project and the age of 18. The respondents gave their consent by accepting a detailed instruction placed at the beginning of

TABLE 1 The socio-demographic structure of the studied population.

	Number of respondents	Percentage value (%)
Total	485	100
Sex		
• Female	349	71.96
• Male	136	28.04
Domicile		
• A city with over 200,000 inhabitants	224	46.19
• City with 50,000–200,000 inhabitants	113	23.30
• A town with less than 50,000 inhabitants	70	14.43
• Village	78	16.08
Age		
• 55+	20	4.12
• 36–55	142	29.28
• 26–35	177	36.49
• 18–25	146	30.10
Education		
• Higher	328	67.63
• Secondary	141	29.07
• Vocational	2	0.41
• Primary	10	2.06
• No answer	4	0.82

the survey. It contained all the necessary information, including a notification of the possibility of resigning from participation in the project at any stage without any consequences. No personal data was collected for the purposes of the study, and multiple participation in the study was eliminated through a control question that had to be answered appropriately. The criteria for exclusion from the study included therapy with a psychiatrist in the last 6 months prior to the survey, as well as the presence of events within 12 months that caused major changes in the respondents' lives. Relevant questions regarding the presented variables were placed in the initial survey, and all people who met them were excluded.

In this study, psychometric scales were used exactly as in the project carried out in 2020 (Florek et al., 2021). The GAD-7 scale used to measure the intensity of anxiety contains 7 questions, on which respondents answer on a 4-point scale, and the result is their simple sum (Spitzer et al., 2006). The AUDIT is the screening test to initially identify alcohol dependence and consists of 10 questions. Answers are on a three- or five-point scale, the simple sum of which is the final score (Saunders et al., 1993). To test the level of aggression, the Polish adaptation of the Buss-Perry Aggression Scale was used, in which 29 statements were included, and the respondents expressed their attitude toward them on a five-point scale. The results are obtained by inverting the scores of two questions and the sum of the remaining ones for the full scale of generalized aggression and by summing up the points from selected questions for specific subscales (Buss and Perry, 1992; Siekierka, 2005). Statistical analysis was performed with the use of Excel 365 and Statistica 13.3. The owner of the software license is the Medical University of Silesia in Katowice. In order to assess the normal distribution for the examined variables, a graphical plot was made each time and the Shapiro–Wilk test was applied. Due to the presence of abnormal distributions, the Spearman's rank correlation test was used to calculate the correlation. For generalized aggression, a linear regression model was used. An analysis of variance, the assumptions of regression linearity were checked using the residual distribution analysis, the Durbin-Watson test, and the variance stability was confirmed on the appropriate graph. Comparative analyses for normal distributions were carried out using the Student's t-test, while for variables with non-normal distributions, the Mann Whitney *U*-test was used. For comparisons of more than 2 groups of independent variables, a Kruskal-Wallis ANOVA was used. The chi-square test was used for variables obtained after converting the raw scale scores using the respective norms. Statistical considerations were made at the significance level of $\alpha < 0.05$.

3. Results

Within the entire study population, there was a positive correlation between anxiety and generalized aggression, anger and hostility, as well as weak positive correlation between anxiety and physical and verbal aggression. The discussed relationships are presented in Table 2. Among the studied linear regressions, one statistically significant regression model of generalized aggression in the light of anxiety was obtained, which is presented in Table 3.

In the group of women, anxiety correlated positively with generalized aggression, anger and hostility, and weakly positively correlated with verbal and physical aggression, which basically corresponds to the entire study population. Among male respondents, only a moderately positive correlation with aggression and anger, and a strongly positive correlation with hostility was noted in terms of anxiety. An average negative correlation between alcohol consumption and verbal aggression was also shown. These results are presented in Table 4. Female respondents showed higher levels of anxiety than male respondents. In contrast, alcohol consumption and levels of physical and verbal aggression were higher in the male study group, as shown in Table 5. The data between the other parameters—generalized aggression, hostility and anger—were also analyzed, but no statistically significant differences became apparent.

When analyzing the group of people aged 18–25, anxiety correlations were noticed, corresponding to those shown among the surveyed men. There was no correlation between alcohol consumption and other scales. The correlations among respondents aged 26–35 generally corresponded to those reported for the entire study population. Interesting results were obtained among people aged between 36 and 54, where generally correlations are similar to the men group excluding alcohol. Due to the small size of the group of people over 55 (19 respondents), the correlation analysis was abandoned due to the high risk of obtaining results that could be misleading. In the comparative analysis, the levels of anxiety and generalized aggression were significantly higher among younger respondents (18–25 years) than among the other age groups (Table 6). Moreover, in the analysis of raw hostility scores, hostility was higher among respondents of this age relative to respondents aged 36–55 years (Figure 1).

A fairly strong positive correlation between anxiety and aggression and anger, and a strong correlation with hostility was identified among rural residents (Table 7). It is similar among city dwellers between 50,000 and 200,000 inhabitants (Table 8). On the other hand, among respondents from cities with less than 50,000 inhabitants, anxiety has

TABLE 2 Relationships between the severity of anxiety, the level of alcohol consumption and aggression.

N=485	Anxiety	Alcohol	Generalized aggression	Verbal aggression	Physical aggression	Anger	Hostility
Anxiety	1.000	−0.067	**0.369***	**0.110***	**0.103***	**0.348***	**0.467***
Alcohol		1.000	0.020	0.004	−0.018	0.032	0.015
Generalized aggression			1.000	**0.674***	**0.704***	**0.841***	**0.789***
Verbal aggression				1.000	**0.442***	**0.524***	**0.330***
Physical aggression					1.000	**0.469***	**0.379***
Anger						1.000	**0.546***
Hostility							1.000

*Statistically significant result at $p < 0.05$.

TABLE 3 Regression model of generalized aggression toward severity of anxiety.

Predictor	b	b SE	Beta	Beta SE	t	*p*
Constant	60.080	1.325	---	---	45.356	**<0.001***
Anxiety	0.142	1.219	0.042	0.364	8.582	**<0.001***

*Statistically significant result at $p < 0.05$; SE, Standard Error; Corr. R-squared = 0.1323; $F(1.483) = 73.643$; $p < 0.001$; error of estimation = 16.373.

TABLE 4 Relationships between the severity of anxiety, the level of alcohol consumption and aggression among men.

N=136	Anxiety	Alcohol	Generalized aggression	Verbal aggression	Physical aggression	Anger	Hostility
Anxiety	1.000	−0.096	**0.384***	0.000	0.150	**0.330***	**0.557***
Alcohol		1.000	−0.151	**−0.213***	−0.049	−0.077	−0.128
Generalized aggression			1.000	**0.566***	**0.694***	**0.848***	**0.759***
Verbal aggression				1.000	**0.355***	**0.460***	**0.169***
Physical aggression					1.000	**0.481***	**0.342***
Anger						1.000	**0.522***
Hostility							1.000

*Statistically significant result at $p < 0.05$.

a weak positive correlation with anger and hostility (Table 9). The correlations among inhabitants of cities with more than 200,000 inhabitants look slightly different—among them, anxiety correlates positively with aggression, anger and quite strongly with hostility, and alcohol consumption has a weak negative correlation with physical aggression, which is presented in Table 10. Comparative analysis did not reveal any significant differences between the study groups.

Due to the size of individual groups, it was decided to analyze only people with secondary and higher education (see Table 1). Among people with secondary education, anxiety correlates positively with aggression, anger and hostility, while in the group of people with higher education, there is a moderate correlation of anxiety with aggression and anger. What is more, anxiety correlates weakly positively with physical aggression and quite positively with hostility in this group. In the light of the previously presented results, these results can be assumed to be the same as for the entire study group. The situation is similar with the division into health care workers, among whom anxiety correlates positively with aggression, anger, and strongly positively with hostility. The correlations of anxiety in the group of non-health care workers were moderate and positive with aggression, anger, and moderate and strongly with hostility. Taking these two divisions of the study population into account, the comparative analysis did not reveal any significant differences between health care workers and people of different occupation. However, analysis of the raw data from the scales highlighted statistically significant differences between those with secondary and tertiary education, as shown in Table 11.

4. Discussion

When analyzing the relationships between the parameters studied, it can be seen that the level of alcohol consumption is practically irrelevant in the study population. However, with reference to the 2020 study, a strengthening of the correlation between anxiety and aggression and its components becomes apparent (Florek et al., 2021). A decrease in the role of alcohol consumption is also evident in the regression analysis, where only the effect of anxiety level on generalized aggression was shown. Interestingly, numerous studies conducted to date indicate an increase in alcohol consumption levels during the COVID-19 pandemic (Murthy and Narasimha, 2021; Roberts et al., 2021). As reported by Grossman et al. the increased alcohol consumption during this period in the United States was primarily influenced by stress (Grossman et al., 2020). It is worth

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TABLE 5 Comparative analysis of the standardized scores of the scales used for the groups of men and women, $p<0.05$.

N=485	Men (*n*=136)	Women (*n*=349)	*p*
Anxiety			**<0.001***
• No anxiety (0–4 points)	60	87	
• Mild anxiety (5–9 points)	45	145	
• Moderate anxiety (10–14 points)	19	71	
• Serious anxiety (15–21 points)	12	46	
Alcohol consumption			**<0.01***
• Low risk of dependence (0–7 points)	101	311	
• Risky consuming (8–15 points)	29	33	
• Harmful consuming (16–19 points)	3	2	
• Alcohol addiction (20–40 points)	3	3	
Verbal aggression			**<0.05***
• Very low scores	44	148	
• Low scores	0	0	
• Reduced scores	28	58	
• Average scores	15	24	
• Elevated scores	6	31	
• High scores	7	24	
• very high scores	36	64	
Physical aggression			**<0.01***
• Very low scores	69	241	
• Low scores	23	35	
• Reduced scores	7	14	
• Average scores	14	21	
• Elevated scores	5	7	
• High scores	9	8	
• Very high scores	9	23	

*Statistically significant result at $p < 0.05$; normalization of the aggression scale is based on 10 values not included in the table.

TABLE 6 Comparative analysis of standardized GAD-7 scale scores and generalized aggression when the study population was divided by age, $p<0.05$.

N=465	18–25 years (*n*=146)	26–35 years (*n*=177)	36–55 years (*n*=142)	*p*
Anxiety				**<0.05***
• No anxiety (0–4 points)	38	50	54	
• Mild anxiety (5–9 points)	49	72	59	
• Moderate anxiety (10–14 points)	33	35	19	
• Serious anxiety (15–21 points)	26	20	10	
Generalized aggression				**<0.05***
• Very low scores	70	87	83	
• Low scores	13	23	24	
• Reduced scores	6	9	5	
• Average scores	17	17	13	
• Elevated scores	2	6	5	
• High scores	9	9	1	
• Very high scores	29	26	11	

*Statistically significant result at $p < 0.05$; normalization of the aggression scale is based on 10 values not included in the table.

noting, however, that all the studies mentioned refer to the period of development of the pandemic—i.e., mainly 2020. There is little data in the literature on the later period. One study of US adolescents found that by June 2021, the drinking patterns created with the onset of the pandemic had already virtually disappeared (Pelham 3rd et al., 2022). Moreover, as a large meta-analysis has shown, there was a decline in global alcohol consumption levels during the pandemic, and evidence of an increase exists among those already abusing alcohol (Kilian et al., 2022). In light of the research presented here, our results appear to fit into global mechanisms of change in alcohol consumption. Most studies to date indicate that alcohol increases levels of aggression, particularly in men (Giancola et al., 2002, 2009). Our study shows the opposite, as alcohol consumption among male respondents correlates negatively with the intensity of verbal aggression, and negatively with physical aggression among residents of the largest cities. Referring to many years of research on aggression and its mechanisms, it should be noted that the indirect effect of alcohol has been best proven. In fact, the general aggression model developed is based on this effect. At this point, it should be noted that indirect effects are distinguished by the fact that alcohol makes it easier, so to speak, to provoke a person into aggressive behavior, while ethanol itself even reduces the level of both physical and psychological arousal that can stimulate aggressive behavior (Bushman, 1997; Anderson and Bushman, 2002). The latter property may cause the negative correlations highlighted in the different groups. In addition, it is possible that the continuing tension associated with the COVID-19 pandemic and any restrictions has lowered the threshold for provocation to aggression by different from alcohol mechanisms. However, this phenomenon would be quite new and requires further research. It should be emphasized, however, that the mechanisms discussed in the context of the presented results of our study only serve to illustrate the potential causes of certain correlations. Indeed, no statistically significant regression of alcohol consumption was evident, in contrast to the previous study (Florek et al., 2021). In the comparative analysis of alcohol consumption levels, it is noteworthy that more male respondents consume larger amounts of alcohol statistically. This fact is not surprising, as it fits the characteristics of the alcohol consumption pattern (Manwell et al., 2002) that is present in Poland and coincides with the reports of a study conducted at the beginning of the COVID-19 pandemic (Florek et al., 2022).

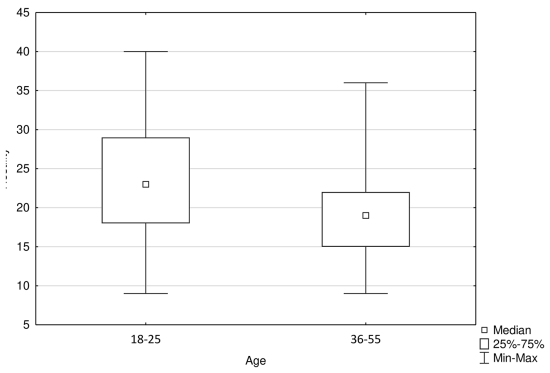

FIGURE 1
Significantly higher levels of hostility among 18–25 years old compared to 36–55 old respondents, $p < 0.001$.

TABLE 7 Relationships between the severity of anxiety, the level of alcohol consumption and aggression among rural residents.

N=136	Anxiety	Alcohol	Generalized aggression	Verbal aggression	Physical aggression	Anger	Hostility
Anxiety	1.000	0.024	**0.474***	0.203	0.175	**0.411***	**0.568***
Alcohol		1.000	0.150	0.120	0.109	0.163	0.035
Generalized aggression			1.000	**0.710***	**0.735***	**0.898***	**0.801***
Verbal aggression				1.000	**0.594***	**0.556***	**0.366***
Physical aggression					1.000	**0.584***	**0.361***
Anger						1.000	**0.670***
Hostility							1.000

*Statistically significant result at $p < 0.05$.

TABLE 8 Relationships between the severity of anxiety, the level of alcohol consumption and aggression among city dwellers with between 50,000 and 200,000 inhabitants.

N=136	Anxiety	Alcohol	Generalized aggression	Verbal aggression	Physical aggression	Anger	Hostility
Anxiety	1.000	−0.037	**0.363***	0.044	0.036	**0.372***	**0.483***
Alcohol		1.000	0.072	−0.013	−0.009	0.151	0.013
Generalized aggression			1.000	**0.648***	**0.610***	**0.752***	**0.736***
Verbal aggression				1.000	**0.266***	**0.517***	**0.268***
Physical aggression					1.000	**0.294***	**0.312***
Anger						1.000	**0.338***
Hostility							1.000

*Statistically significant result at $p < 0.05$.

TABLE 9 Relationships between the severity of anxiety, the level of alcohol consumption and aggression among city dwellers with less than 50,000 inhabitants.

N=136	Anxiety	Alcohol	Generalized aggression	Verbal aggression	Physical aggression	Anger	Hostility
Anxiety	1.000	−0.147	0.201	0.160	−0.001	**0.281***	**0.246***
Alcohol		1.000	0.151	0.165	0.191	0.020	0.119
Generalized aggression			1.000	**0.744***	**0.742***	**0.839***	**0.843***
Verbal aggression				1.000	**0.532***	**0.616***	**0.482***
Physical aggression					1.000	**0.455***	**0.512***
Anger						1.000	**0.603***
Hostility							1.000

*Statistically significant result at $p < 0.05$.

TABLE 10 Relationships between the severity of anxiety, the level of alcohol consumption and aggression among city dwellers with more than 200,000 inhabitants.

N=136	Anxiety	Alcohol	Generalized aggression	Verbal aggression	Physical aggression	Anger	Hostility
Anxiety	1.000	−0.099	**0.381***	0.099	0.131	**0.331***	**0.470***
Alcohol		1.000	−0.064	−0.059	**−0.150***	−0.040	0.000
Generalized aggression			1.000	**0.657***	**0.726***	**0.846***	**0.789***
Verbal aggression				1.000	**0.453***	**0.485***	**0.304***
Physical aggression					1.000	**0.501***	**0.394***
Anger						1.000	**0.568***
Hostility							1.000

*Statistically significant result at $p < 0.05$.

TABLE 11 Comparative analysis of the raw scores of the anxiety and aggression scales when the study population is divided by education.

Variable	Secondary education *n*=141			Higher education *n*=328			Z	Cohen's d	*p*
	Mean	SD	Median	Mean	SD	Median			
Anxiety	8.752	5.531	7.000	7.134	5.024	6.000	−2.929	−0.312	**<0.01***
Generalized aggression	72.461	17.885	72.000	67.595	16.903	67.000	−2.650	−0.283	**<0.01***
Verbal aggression	14.709	3.947	14.000	13.680	3.785	13.000	−2.473	−0.268	**<0.05***
Physical aggression	17.227	5.527	16.000	16.018	5.226	15.000	−2.364	−0.227	**<0.05***
Anger	17.596	6.175	18.000	17.460	6.012	17.000	−0.224	−0.022	0.823
Hostility	22.929	7.186	23.000	20.436	6.746	20.000	−3.338	−0.362	**<0.001***

*Statistically significant result at $p < 0.05$.

Undoubtedly, the correlation between aggression and anxiety is very important. As mentioned in the introduction, many researchers have wondered about the mutual influence of these two parameters. In our study, we showed within the whole study population a positive correlation between anxiety and generalized aggression and all its subscales. This correlation should not come as a surprise, as Chung reports that it already occurs in adolescents (Chung et al., 2019). However, interesting results were obtained among male respondents, those aged 36–55 years and residents of cities with more than 200,000 inhabitants, where anxiety does not correlate with verbal and physical aggression. These findings correlate with a study of drug treatment center inpatients, who were sociodemographically characterized by racial diversity, most of whom were single, unemployed, with low incomes and no more than a high school education (Dixon et al., 2017). In addition, other studies suggest low levels of empathy and fear of being judged as reasons for expressing aggression precisely in the form of anger and hostility rather than physical or verbal aggression (Loudin et al., 2003; Hanby et al., 2012). In light of the research presented here, however, it is reasonable to assume that the relationship between anxiety and aggression—however complex—did not change during the COVID-19 pandemic. In the comparative analysis, physical and verbal aggression are significantly higher in the male group. This fact, however, is not surprising anyway and, as a study among minors shows, it is already present in adolescents as young as 15 years old (Österman et al., 1998). It is noteworthy that in our survey, hostility in terms of raw scores came out significantly higher in younger people aged

18–25 compared to those aged 36–55. Furthermore, those with a secondary education had significantly higher levels of generalized aggression, physical aggression, verbal aggression and hostility and non-significantly anger compared to those with a higher education. With reference to the project carried out at the beginning of the COVID-19 pandemic in Poland, it can be concluded that these differences remained essentially unchanged (Florek et al., 2022). In terms of physical and verbal aggression they have strengthened, while in terms of anger they have weakened. However, this does not seem to be part of the adaptability to the COVID-19 pandemic discussed in this article.

The last parameter analyzed is anxiety intensity. It was mostly discussed above in the context of its influence on the level of alcohol consumption or aggression. However, it is worth paying attention to the regression model, which clearly shows the influence of anxiety on the level of generalized aggression and is essentially unchanged from the previous study (Florek et al., 2021). In the context of the research conducted to date (Mcmurran, 2011; Parrott et al., 2012), it seems surprising that this is the only statistically significant regression, as it is natural for both alcohol consumption and aggression to increase under the influence of anxiety. Indeed, there is evidence that anxiety and aggression may be regulated by the same neurohormones. Although the results of a study conducted in this regard were not conclusive in all circumstances, researchers have confirmed this relationship (Neumann et al., 2010). Furthermore, Granic's work highlights the frequent co-occurrence of anxiety and aggression in children (Granic, 2014). Given these reports, one may wonder whether the COVID-19 pandemic has not reinforced the most primary link among people, which is anxiety and aggression, bypassing an indirect factor like alcohol consumption. The higher severity of anxiety among females is not surprising, as there are numerous publications reporting on this variable (Bahrami and Yousefi, 2011; McLean et al., 2011; Bandelow and Michaelis, 2015). Furthermore, a study of 100 Iranian secondary school students shows that higher levels of anxiety are already found in girls aged 15–18 years (Bahrami and Yousefi, 2011). On the other hand. It seems to be an interesting difference in the severity of anxiety when dividing the group by age. It turned out that it is the youngest individuals who are most likely to experience anxiety. Studies to date (outside of the pandemic period) are inconclusive and indicate either that anxiety is highest in middle age (Bandelow and Michaelis, 2015) or that they do not specify age indicating a number of other factors modeling anxiety (Jorm, 2000). Compared to the study conducted during the COVID-19 pandemic, it should be noted that no significant difference in anxiety was highlighted between the study groups at that time. The situation is similar with the division by educational level. During the previous study, there were also no differences highlighted by conducting this one. This may mean that the COVID-19 pandemic has strong impact on anxiety in young people who are studying or who are in the process of studying or looking for their first job, i.e., at extremely important moments in their lives. In the light of the Norwegian study, this hypothesis seems quite plausible, as the researchers concluded that factors associated with higher education can protect against anxiety and depression practically throughout life (Bjelland et al., 2008), meaning that in a stressful situation such as the COVID-19 pandemic, people with lower education will be more susceptible to stress.

4.1. Limitations and strengths

Our survey has its limitations. It should be noted that it was conducted *via* the Internet. Although this methodology is increasingly used in various scientific works—including psychological and psychiatric research—it has its drawbacks. These include, first and foremost, the impossibility of observing the research participant and thus answering their questions. On the other hand, thanks to this form of survey, it was possible to reach a really large number of respondents, which, in the opinion of the authors, would not have been possible if the survey had been conducted in the traditional way. It is worth noting that people over 55 years of age were excluded from the analyses with the age division of the surveyed population due to the small size of this group (19 respondents). Of course, this is most likely due to the small percentage of older people using the Internet. However, this also has its advantages, as our study focuses on people of working age, i.e., those who may have been most affected by the pandemic due to, for example, changes in the nature of work, working hours, or certain redundancy movements. There was also a certain disproportionality, which could distort the analyses, in the division by place of residence. The largest group was made up of people living in cities with more than 200,000 inhabitants (208 respondents), while the smallest number of respondents were rural residents—69 people. Such a situation may have been due to the channels of transmission of information, as it was difficult for the authors to reach Internet forums or other sites that may be related to rural life in the broadest sense. Here, it is also worth noting that the pandemic probably made the least difference in the countryside—there was only a short period of time when people were not allowed to go out even into the forests in Poland. Outside of it—farms were generally able to function without much change. There was a similar problem when dividing the population into health care workers and others—here there were only 126 health care workers (and 359 others). Another observation concerns education. People with less than secondary education were missing from the study population. Perhaps people with lower education were not interested in participating in the scientific study or, as in the case of the rural population, the authors were unable to reach the websites that these people visit. For this reason, analyses of differences and correlations were only carried out in the groups of people with secondary and higher education.

Taking into account the above-mentioned limitations, it should be clearly stated that the survey was not conducted on a representative group of Polish society, and therefore—the results should not be translated to a wider group of society outside the respondents taking part in the survey. In addition, it is worth noting that the questionnaire did not include questions about the survey participants' contact with the COVID-19 disease. On the other hand, it should be emphasized that the disease and its limitations affected the vast majority of the population, as confirmed by numerous publications cited in this article (Almeida et al., 2020; Chen et al., 2021; Jones et al., 2021; Juchnowicz et al., 2021; Sitarz et al., 2021; Thatrimontrichai et al., 2021).

5. Conclusion

1. As a result of adaptation to the COVID-19 pandemic, anxiety is no longer a factor in increased levels of alcohol consumption.

Furthermore, increased alcohol consumption is not associated with increased aggressive behavior.
2. The pandemic has not affected differences in alcohol consumption between men and women. Still, more alcoholic beverages are consumed by men. Moreover, the presence of a positive correlation between anxiety and aggression and the sociodemographic structure of those characterized by increased aggression are also unchanged.
3. Anxiety directly influences aggressive behavior in a relatively strong way.

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 Bioethics Committee of the Silesian Medical University in Katowice. The patients/participants provided their written informed consent to participate in this study.

Author contributions

PD, SF, MP, and RP contributed to conception, design of the study, and wrote sections of the manuscript. SF and MP organized the database and wrote the first draft of the manuscript. SF and PD performed the statistical analysis. All authors contributed to manuscript revision, read, and approved the submitted version. All authors contributed to the article and approved the submitted version.

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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Social value of pathology: adapting primary health care to reduce stress and social anxiety in college students exposed to social distancing

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This article examined the impact of online education on the wellbeing and emotional health of college students. It considered the social value of stress and anxiety pathology as "normal" side effects throughout the COVID-19 lockdown. Factors appropriate for educational technology were selected and submitted for evaluation to a sample of 114 college students in a semi-structured questionnaire. This research found that educational content and delivery methods, as well as increased homework and time spent online, have potentially contributed to heightened levels of stress, depression, and social anxiety disorder among approximately one-third of students who have engaged in digital learning. The results also prove that young people were particularly susceptible to stress and social anxiety disorders during the lockdown, making them one of the most vulnerable social groups. To enhance the educational experience, several suggestions have been proposed, including adapting educational content, expanding Internet accessibility, providing appropriate homework, and adjusting schedules to accommodate students' educational capabilities. Voluntary routine mental health assessments of students, teachers, and staff and customized online counseling for vulnerable subjects are recommended as primary health care measures during online education.

KEYWORDS

healthcare, college students, online education, stress and anxiety, pathology introduction

1. Introduction

Mental illnesses were responsible for causing up to a 27% increase in the prevalence of anxiety and depression worldwide during the COVID-19 pandemic. The WHO estimated that successive lockdowns led to a 27.6% increase in cases of major depressive disorder (MDD) and a 25.6% increase in cases of anxiety disorders (AD) (WHO, 2022).

Of the many types of mental disorders, depression and anxiety were prevalent disorders among college students exposed to social distancing during the COVID-19 pandemic.

As such, anxiety and depression were declared to be prevalent by more than half of the participants of a sample of 1,173 students from a university in the North of England with PHQ-9 levels above the clinical cutoffs (Chen and Lucock, 2022). According to the data collected from a study at Texas A&M University using the Patient Health Questionnaire-9 and the General Anxiety Disorder-7 (GAD-7), of the 2,031 participants, 48.14% showed a moderate-to-severe level of depression, while 38.48% showed a moderate-to-severe level

of anxiety, and 18.04% reported experiencing suicidal thoughts (Wang et al., 2020). A nationwide cross-sectional survey study involving 821,218 college students in China found mental health problems among 45% of participants (Ma et al., 2020). Similarly, the GAD-7 scale measured a mental health risk value of 38.4% in a sample of 1,961 university students in Poland (Rogowska et al., 2021).

Similar results were reported for smaller samples. In Australia, a stress and anxiety study in a sample involving 109 college students showed that, if weighed against anxiety (GAD-7) and depression (PHQ-9), social anxiety presented a tougher correlation with a predilection for online social interaction. However, depression and anxiety had lower values if daily Internet use did not exceed 4 h (Hutchins et al., 2021). In Romania, social distancing appeared to cause stress and anxiety in up to 48% of a sample of 100 students that were surveyed the first week after returning to in-person education (Sava, 2022).

However, for face-to-face social network interaction, research revealed that up to 15% of university students showed clinically relevant levels of depressive symptoms, while 29% of them showed symptoms of social anxiety, as they usually avoided in-person relationships (Elmer and Stadtfeld, 2020). Clinical studies have also found that depression and anxiety diminished in subjects with greater online communication (Stuart, 2021). On a larger scale, it confirmed previous research that pointed out that cultural and social factors normalize individual anxiety within the youth population (Mikolajczyk, 2008).

Up to one-third of young people aged 15 to 29 exhibit social anxiety symptoms and prefer Internet use as a social interaction avoidance strategy. This behavior has become a "normalized" aspect of social life. It indicates that a similar percentage of college students surveyed in various social and cultural contexts, who reported experiencing stress and anxiety during the COVID-19 lockdown, would perceive such feelings as "normal" or anticipated pathology. However, it is important to note that this research does not provide concrete evidence for the decrease in sharing tendencies among previously non-anxious individuals during online education.

The evidence from this research suggests that Internet use is not clearly correlated with increased social anxiety disorder despite the fact that individuals with social anxiety symptoms prefer online interactions. In such cases, the Internet is viewed as a coping mechanism rather than a cause of anxiety. It is possible that people with introverted orientation may experience some exacerbation of anxiety, but the Internet paradox does not usually lead to a number of individuals with anxiety disorder-related symptoms (Kraut et al., 1998).

Therefore, negative cognitive beliefs predisposing anxious people to avoid unpleasant face-to-face social encounters (Clark and Wells, 1995) have to be reconciled with the positive results of online social interaction (Kraut et al., 2002; Hutchins et al., 2021). Using this perspective, it should eventually be explained to what degree social distancing as a public health measure and/or communication technology use as a substitute for in-person education are still responsible for up to 15% of students' stress and social anxiety out of the 45% overall value reported during the pandemic. Understanding this relationship can provide valuable insights to healthcare providers regarding the specific counseling needs of students, teachers, and staff.

2. Materials and methods

Sickness is intrinsically linked to the deterioration of social conditions. It represents a deviation from what institutionalized human response claims to be "normal." In other words, "some sort of pathology exists … whenever deviant behavior appears," for which social confinement is necessary.

For this reason, "the critical variable in the study of [health] deviance is the social *audience* rather than the individual *person*, since it is the audience which eventually decides whether or not any given action or actions will become a visible case of deviation" [Erikson, 2013 (1962)]. Illness is a deviation similar to crime, for which, as Durkheim stated, collective action to treat it is useful to the society as "a factor of public health, an integrative element in any health society" (Jones, 1986). The pandemic is cast as a sort of social anomie, a collective ill-health that needs public intervention.

As such, pathology has social value as it predicts the risk of illness, pinpoints vulnerable individuals, and informs public measures that need to be considered. It also implies that pathology is a "normal" occurrence during times of public sickness and that customized healthcare policies are needed.

Public health policies implemented to address the COVID-19 pandemic (as decided by audiences) varied from zero infection acceptance to social distancing and lockdowns, hospital treatment, mass vaccination, or a combination of these strategies. Zero public action was exceptional or localized. Therefore, social distancing, vaccination, medical treatment, and lockdowns became "normal" procedures intended to protect people from both physical and psychological health deviations. The prevailing social logic of illness is to limit its collective consequences as much as possible. Romania engaged in active health measures during the COVID-19 pandemic, including lockdown, vaccination, and hospital treatment for those in need.

Nevertheless, such measures are expected to mitigate the impact of illness and reduce individual stress and anxiety. As such, pathology related to depression, social anxiety disorder, and suicide may still emerge as residual outcomes. The WHO reported a 26% increase in mental disorders during the pandemic. College students were among the most exposed groups to the COVID-19 pandemic's side effects. One should notice that online counseling was occasionally used as a normal/necessary healthcare procedure during the pandemic. The consequences are reflected in the stress and social anxiety that surged during the lockdowns.

Therefore, this research highlights the pathology's social value in increasing public awareness of the vulnerabilities faced by young people during pandemics. It underscores the importance of implementing health measures that address youth vulnerabilities in the medium and long run.

To measure the impact of public policy on the wellbeing and mental health of college students during the lockdown and digital learning, educational technology factors were selected and submitted to Romanian college students' online evaluation in a semi-structured questionnaire. Alongside educational factors, a number of questions checked for situational (facilitating

conditions) and interactional factors such as perceived abilities to accomplish educational tasks under stress as well as worried about pandemics, individual anxiety, supported by family, missing friends and colleagues, and intent to leave university. Considering the public polarization that occurred during the pandemic, it is important to assess the pros and cons of public measures, including those implemented in Romania.

The measurement methodology mainly used three-point Likert scales, which improved polar points such enabling respondents to express their agreement and disagreement, as well as their likes and dislikes. The methodology also reinforced the inclusion of a neutral position. To ensure the reliability of the results, the Pearson Chi-square test of independence was conducted to verify mutual exclusiveness among the responses. This statistical test helped validate the relationship between variables and determine if there were any significant associations or dependencies among them.

3. Selecting measurement factors and subjects

During successive COVID-19 lockdowns in Romania, parents and pupils were confined at home for as long as 2 years. Physical and emotional circumstances such as worried about pandemics, sharing a room and computer with siblings, and too much time online are factors that affect online education. Trust in one's own abilities to perform distance education (self-efficacy), perceived relevance (motivation), and satisfaction with content (affect) are considered situational factors (Kemp et al., 2019). Social interactivity factors refer to student-teacher interactions, relationships with peers, missing colleagues, good feedback from professors and missing outdoor activities. Finally, facilitating, situational, and social interactivity factors are, in various degrees, related to the stress and social anxiety that individuals encounter during online sessions.

For this report, I selected the following factors: (a) comfortable and safe at home, (b) worried about pandemics, (c) perceived stress and anxiety, (d) lack of human (face-to-face) interactions, (e) missing colleagues, (f) time pressure, (g) good feedback from professors, and (h) abandon studies.

The survey measured students' individual experiences. A number of open-ended questions were also submitted for their consideration. The received answers were coded in fields according to the items above. Table 1 displays quantitative measurements. Table 2 presents qualitative data.

A total of 114 participants were asked to provide consent and fill out the questionnaire. The selected 100 students were extracted from the University of Bucharest and the Western University of Timisoara. Demographic data reflect main population characteristics regarding gender distribution (65 women and 35 men) and age ranking (from 19 to 26 years old with a mean of 22.6 for the selected sample of $n = 100$). Female ascendancy is specific to the social and humanistic studies of the selected universities. Respondents were not asked about their racial or ethnic identities, and they received no financial incentive to participate. They provided answers under conditions of anonymity, and no apparent bias was introduced. All participants attended at least two semesters of online education (one academic year).

TABLE 1 Distribution of perceived COVID-19 disruption*.

Frequency by sample item	More/same as before/less			$\chi 2$**	n
	UNIBUC	UTV	Aggregate		
Worried about pandemics	38/1/10	32/0/12	70/1/22	22.64	93
Stress	25/4/20	24/5/21	49/9/41	27.15	99
Missing most (colleagues)	34/11/5	30/1/19	64/12/24	44.48	100
Feedback from professors	15/25/10	5/41/1	20/66/11	53.84	97
Affect (satisfied with content)	3/31/15	2/24/24	5/55/38	39.58	98
Time pressure	42/2/1	46/1/0	88/3/1	160,88	92
Abandon studies	5/25/20	12/4/31	17/29/51	18.39	97

*Data collected in March 2022 at the end of the COVID-19 lockdown.
**The Chi-square test significance level is $\alpha = 0.05$, and the critical value is $\chi^2 = 5.99$.

4. Results and observations

As reported by the participants, with the COVID-19 lockdown and the switch to online education, a number of circumstantial, educational, and emotional-specific outcomes occurred. Worried about pandemics ranked first (69% value), followed by social anxiety (missing colleagues by 64%), stress (49%), time pressure due to online activities (almost 90% of students complained they spent too much time in front of the computer), and, finally, intentions to abandon studies (18%, see Table 1).

However, the same category factors returned certain positive feedback for supported by family (82%), comfortable and safer at home (60%), and protected against COVID-19 (39%, see Table 2). These factors also measured wellbeing during the pandemic.

Educational factors measurement returned several emotional health challenges, such as too much time spent on online schooling (38%), difficulties associated with focusing (32%), impersonal teaching (11%), and losing feedback from instructors (15%). Emotional challenges multiplied regarding social anxiety (64% of subjects reported missing friends and colleagues) and a lack of human interaction (50%). Female students reported a certain emotional overload. Nevertheless, to mitigate the negative impact of social distancing, online education increased the homework load, as students mentioned in both closed- (48%) and open-ended questions (42%). The results were contrary to expectations. Almost half of the students complained about increased assignments online, and it seems to be one of the main sources of social anxiety. The more time subjects spend online, the less capacity they have to focus, ultimately hindering their effectiveness in achieving educational goals.

5. Discussion

Soon after the March 2020 lockdown, with the online education switch, one research article pointed out that "students reported stress, anxiety, being worried about getting sick (COVID-19), and

TABLE 2 Qualitative emotional data display.

Field	Category	Students (*n*)		
		UNIBUC	UVT	Total
Safety and family	Comfortable and safer at home	28	32	60
	Supported by family	40	42	82
	Protected against Covid-19	21	18	39
Circumstantial	Worried about pandemics	37	32	69
	Too much time online	22	16	38
	Missing open air activities	11	20	31
Educational	Impersonal teaching	6	9	11
	Too busy schedule	23	28	51
	Missing study trips/internships	8	16	24
	Good feedback from professors	9	6	15
Emotional	Missing friends and colleagues	24	30	54
	Stress/difficulties to focus	14	18	32
	Lack of human interaction	23	27	50
	Increased assignments	18	24	42

*Data collected in March 2022 at the end of the COVID-19 lockdown.

changes in their mental health" (Aguilera-Hermida, 2020). Since Internet use has not been proven to be directly responsible for the rise in social anxiety (Kraut et al., 2002; Hutchins et al., 2021), it is necessary to explore other emotional challenges that could potentially be accountable (Elmer and Stadtfeld, 2020).

During successive lockdowns, universities created ad-hoc educational fields (digital social arenas) using computer communication technologies. The improvised solutions serve as contingency substitutes for in-person education, offering a temporary alternative. Digital educational platforms play a role in facilitating social interaction (facilitation), which is similar to the support provided by modern medical advocacy (Smith and Stewart, 2017). "Patients" felt safe at home (60%) and received family support (82%) while still taking part in their social and educational networks' activities.

However, in a variety of social and cultural contexts, almost half of the college students reported experiencing increased levels of stress and social anxiety during the online education period (Wang et al., 2020). Unfortunately, there was a lack of customized healthcare policies specifically aimed at addressing the surge in stress and social anxiety among college students. Consequently, irregular outcomes were eventually reported.

On the one hand, as Yen et al. (2012) also demonstrated well before the pandemic that "social anxiety is lower during online interaction than during face-to-face interaction, especially in subjects with high social anxiety [and] depression." Qualitative statements confirmed better social interaction online, as one female student stated, "I did not attend classes before, as I was anxious and shy, so online was better, and my relationship with professors had improved." One of her colleagues also stated that "At the beginning, I felt as in a permanent vacation, being able to stay all day with my family, and I felt safe from the virus."

On the other hand, even though students were at home, they often found themselves becoming inattentive as they spent more time on their regular educational tasks compared to traditional in-person education. One student at the University of Bucharest mentioned that the "Pandemic stole 2 years of my life" because online interaction consumed most of his/her time. A similar answer was mentioned by another student: "It was impersonal, and I was away from colleagues and professors." Such idiosyncrasies offer genuine symptoms of stress and anxiety that are associated with online social interaction indeed.

Subjects who constantly worried about pandemics (70%), who were missing colleagues (64%), and who experienced a lack of human interactions (50%) during online sessions were the first to report stress, resulting in an increase in social anxiety. There is no research to replicate similar social distancing conditions, but one could estimate that stress and anxiety can reach a mass scale in the absence of Internet service for as long as 2 years.

On the other hand, reasons for subjects reporting time pressure (80%), dissatisfaction with content (30%), and difficulties focusing (32%) were eventually related to the use of communication technologies. Nevertheless, they showed a positive attitude toward technology use (60%) and good motivation (40%) during online sessions (Sava, 2022).

This report revealed that content received, delivery methods, class assignments, and time spent online are responsible for a significant portion of the increased stress and anxiety experienced by college students during the COVID-19 lockdown. The majority of subjects in this research complained about spending too much time online. Moreover, 37% of students mentioned experiencing less satisfaction with content, while 42% perceived that increased homework was not justified. A number of subjects (18%) considered abandoning university. All of these results were recorded against 48% technology acceptance and 60% favorable attitudes toward Internet technology use. The paradox is that online education has side effects that are not due to technology use.

(Kraut et al., 1998) called it the "Internet paradox", i.e., a decline in the size of social circles and an increase in depression and loneliness among individuals who spend time online. Hutchins et al. (2021) proved that depression and anxiety had lower values if daily Internet use did not exceed a certain amount of time. There is no paradox if the time frame and content delivered are in the right range.

This research discovered that up to one-third of people aged 15 to 29 are susceptible to social anxiety symptoms. Online education is more of a coping mechanism for this group. Nevertheless, there is a surge of 15% in stress and social anxiety, which is associated with the COVID-19 pandemic. This study fills the research gap by showing that mental disorders increase as a side effect of online time and the delivery methods used during online education.

Digital learning served as a substitute for in-person education, yet online delivery only partially fulfilled students' expectations. The implications of this study are twofold: first, online education proved to be beneficial for young subjects with a predisposition for social anxiety and, second, it served as a compensatory measure for managing stress and anxiety in subjects exposed to successive lockdowns and public health risks. Further research is needed to strengthen and consolidate this finding within the negative cognitive theory debate. It appears reasonable to advocate for the inclusion of healthcare policies that address mental disorders associated with digital learning. For a certain number of students, online counseling seems necessary, just as online learning is for others.

6. Conclusions

The interruption of in-person education confirmed communication technology's important complementary role as a digital substitute for human interaction. Regarding the stress and social anxiety that presumably escalated during COVID-19, this report found no explicit evidence that communication technology was responsible. Other things being equal, up to one-third of young people aged 15 to 29 prefer to use Internet communication technologies to avoid face-to-face interaction. The remaining part reported that stress and social anxiety disorders were considered secondary effects of healthcare measures to confine the pandemic and improper technology use. This research found that content and delivery methods, along with increased homework and time spent online, can potentially rise individual pathologies of stress, depression, and social anxiety disorder for up to one-third of students exposed to digital learning.

It is up to various cultural and social contexts to diminish this subsidiarity. Healthcare policies should be developed alongside new educational apps and policies. We propose designing applications to enhance online education, making delivery routines more tailored to students' needs, adapting educational content for online and smartphone use, increasing Internet accessibility, ensuring appropriate homework, and adjusting schedules to accommodate students' educational capabilities. Online programs aimed at reducing stress and social anxiety are necessary educational programs. Finally, this research recommends using online education as a complement to in-person education, with the latter remaining the core of higher education.

Data availability statement

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

Ethics statement

The studies involving human participants were reviewed and approved by Institutional Review Board Statement: University of Bucharest # SAS 562-2022. The patients/participants provided their written informed consent to participate in this study.

Author contributions

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

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The sub-samples used in this research are relevant to the university students' cohort they were selected from. The same limitation applies to the discussion of results. However, conclusions have been submitted, anticipating that they will be useful for other interested parties. The author expresses gratitude to colleagues and students who participated in the study and provided consent for the discussion and publication.

Conflict of interest

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

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Mental health in Canadian children and adolescents during COVID-19 pandemic: the role of personality and, coping and stress responses

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In December 2019, the Coronavirus Disease (COVID-19) pandemic first emerged in China and quickly spread to other countries. Previous studies have shown that the COVID-19 pandemic and the consequences have negatively impacted the mental health of adults. Individual differences such as personality could contribute to mental health. Furthermore, coping and responses to stress may affect an individual's response to the pandemic. In the past, studies have only investigated this relationship in adults. In the current study, we examine how personality traits (using the Five-Factor Model as our framework) and Coping and Response to COVID-19 stress are related to the mental health of Canadian children and adolescents during the pandemic. Using parent reports of 100 preschoolers and 607 6–18-year-old children, we performed multiple regression analysis to explore how personality traits predict the effects of COVID-19 on mental health. The results showed that personality traits are associated with the mental health of Canadian youth during the COVID-19 pandemic. In preschoolers, Neuroticism and Agreeableness predicted the most mental health problems, and in 6-18-year-old children, Extraversion negatively predicted the most mental health problems. Also, Openness to Experience was the weakest predictor of mental health status in Canadian youth. These findings could be useful in understanding children's responses to the COVID-19 pandemic and could assist public health services delivering mental health services specifically tailored to children's personalities during and after this pandemic.

KEYWORDS

COVID-19, pandemic, mental health, personality, big 5 personality traits, extroversion, neuroticism

Introduction

The Novel Coronavirus (COVID-19) epidemic started in China in December 2019 and was declared a global pandemic in early 2020, by World Health Organization (2020). Several studies have documented that the public's mental health has deteriorated since the outbreak of COVID-19 in early 2020 (Hossain et al., 2020; Jiao et al., 2020; Gadermann et al., 2021; Kumar and Nayar, 2021). According to Statistics Canada, based on a Survey on COVID-19 and Mental Health, one in four (25%) Canadians expressed symptoms of depression, anxiety, or post-

traumatic stress disorder (PTSD) in spring 2021, compared with one in five (21%) in fall 2020 (Statistic Canada, 2021).

Only a relatively small number of children have been physically affected by the disease (She et al., 2020), with most showing only mild symptoms compared to adults (Nigg et al., 2020). Nevertheless, some of the public health policies, like the containment measures, could negatively affect children's mental health. The COVID-19 pandemic has brought significant educational and social disruptions to children around the world. For instance, in Canada, school closures affected 5.7 million children and youth attending elementary and secondary school (Statistic Canada, 2021). Even when schools remained open, students' experiences of schooling were changed dramatically. For instance, in order to prevent the spread of COVID-19, curriculum delivery methods have changed, social distancing measures have been implemented during classes and recess and mask-wearing has been mandated across Canada (Vaillancourt et al., 2021). Moreover, many parents were forced to work from home due to the pandemic and although some children could benefit from increased interactions with them, many have experienced increased levels of emotional distress (Sprang and Silman, 2013; Xie et al., 2020). Having to stay at home could also disturb children's sleep/wake cycles, and physical exercise activities, and lead to excessive use of technology (Xie et al., 2020). The pandemic has also been associated with an increase in family economic stressors and parental unemployment, which could result in short- and long-term mental health effects in children (Costello et al., 2003). Furthermore, domestic violence and emotional, physical, or sexual abuse are more likely to occur in a situation like the pandemic (Ramaswamy and Seshadri, 2020; Ali et al., 2021).

Children's development has also been impacted by the drastic changes in all aspects, particularly the interruptions to the development of skills that are fundamental for optimum growth and wellness (Araújo et al., 2021). For instance, children and youth are spending less time interacting with peers and adults compared with before the pandemic (McNamara, 2021), resulting in immediate adverse consequences (Moore et al., 2020), such as negative effects on cognitive development (Deoni et al., 2022), socio-emotional development (Egan et al., 2021), academic performance (Davies and Aurini, 2021) and mental health (Kang et al., 2021).

Not all individuals have been equally affected by the pandemic. Several studies have shown that individual differences such as personality traits could predict differences in psychosocial and mental health outcomes, and the well-being of adults before the pandemic (Albuquerque et al., 2012; Strickhouser et al., 2017; Bucher et al., 2019) and also during the pandemic (Proto and Zhang, 2021; Shokrkon and Nicoladis, 2021). Moreover, personality traits could influence the coping style individuals select in different stressful situations (van Berkel, 2009) as coping is a dynamic process that changes with time as a consequence of varying demands and perceptions of the situation (Moos and Holahan, 2003). Nonetheless, a limited number of studies have explored the contribution of personality and coping to the impacts of the pandemic on the well-being of children and adolescents. Personality is defined as a set of mental structures and adaptive strategies acquired throughout life via socialization and the further expression of temperament within individuals (Rothbart et al., 2000). In this study, we are testing how personality traits, using the Five-Factor Model (FFM; McCrae and Costa, 1987), are associated with the mental health of children and adolescents during the COVID-19 pandemic in Canada. The FFM is one of the most widely recognized summaries of human personality traits (Eysenck, 1992; Goldberg, 1993) consisting of the five dimensions of Neuroticism (or Emotional Instability vs. Stability), Extroversion (vs. Introversion), Openness to Experience (or unconventionality), Agreeableness (vs. Antagonism), and Conscientiousness (or Constraint vs. Disinhibition) (Goldberg, 1992). The FFM framework has been shown to be valid and applicable to children as young as preschool age (Abe and Izard, 1999; Halverson et al., 2003; Asendorpf and Denissen, 2006; Grist and McCord, 2010). Understanding how personality affects children's mental health during the COVID-19 pandemic may assist public health services to implement services tailored to each child's personality.

Also, alongside the personality traits, we are interested in examining the contribution of Coping and Response to Stress on the mental health of Canadian youth as coping could have a central role in determining the impact of the pandemic (Buheji et al., 2020), as how one responds to stress could have significant long-term and immediate consequences (Corbett et al., 2021). Coping consists of cognitive and behavioral strategies used to manage stress (Biggs et al., 2017). There are two types of coping strategies: adaptive and maladaptive (Compas et al., 2017). Adaptive strategies including primary control engagement coping (in which one attempts to modify the stressor directly or modify one's response to the stressor, for example, by solving problems) and secondary control engagement coping (which focuses on adjusting to the problem, for example, using cognitive reorganization) have been found to significantly reduce the risk of negative mental health outcomes (Carver et al., 1989; Connor-Smith et al., 2000; Rosenberg et al., 2011). In contrast, maladaptive strategies including disengagement coping (which involves attempts to suppress arousal, for example, using avoidance), involuntary engagement coping (which involves involuntary emotional and physiological stress, for example, using distracting thoughts and sympathetic arousal), and involuntary disengagement coping (which involves attempts to disengage from one's emotions, for example using through emotional numbing) have been linked to adverse mental health outcomes (Compas et al., 1997; Connor-Smith et al., 2000; Matthews et al., 2016). Therefore, the coping behaviors and strategies used by children and adolescents play an important role in maintaining an appropriate mental health adjustment in a situation like the current pandemic (Idoiaga et al., 2020), therefore, we will investigate their contribution to children's mental health.

The present study

In this study, we are interested in to see how personality traits contribute to mental health of children from preschool to adolescence. Online questionnaires were sent to parents of 2–18-year-old children living across Canada using Qualtrics, a survey platform, distributed via social networks and from the email listings of the University of Alberta. Prior to participating in the study, parents consented through Qualtrics to a question asking "Do you wish to continue the survey, if you do your consent to participate is implied," with two options of "I consent" and "I do not wish to continue." The study was approved by the Research Ethics Board at the University of Alberta (Pro00100751). The data used in this study is available in the Figshare repository for other researchers to use. Participation in our study was voluntary and ten random participants received a $50 gift card of their choice.

In our study, we analyzed the data of children under 6 and over 6 separately for two reasons: (1) the personality measurement we used differed for the two groups and (2) we believe children being in school vs. out of school could have various impacts. For instance, containment measures and policies were different for daycares and schools and also, school-aged children are often able to use technology independently to contact friends remotely.

Materials and methods

Participants

A sample of 100 parents of preschool children (80 mothers, 18 fathers, and 2 other caregivers; mean age = 33.75 years [SD = 5.73; range 18 to 48 years]) were recruited for this study who completed parent reports of questionnaires during June and July 2021. The children of participants were 52 males, and 48 females; mean age = 3.52 years [SD = 1.14; range 2 to 6 years]. To make sure our preschooler's study is not under powered, we used GPower software application. This power analysis is undertaken to determine the minimum sample size required. The required power was set at 1-$\beta = 0.80$. Level of significance was set at $\alpha = 0.05$. Effect size was kept at the range value of 0.15 and the number of predictors is taken as 12. Power analysis revealed that in order to achieve, power of 0.80, a total sample size of $n = 44$ is needed for our study.

Also, 607 parents of 6-18-year-old children participated in our study (350 mothers, 257 fathers; mean age = 37.56 years [SD = 3.47; range 21 to 58 years]) and completed parent reports of questionnaires. The children of participants were 307 males, and 300 females; mean age = 12.55 years [SD = 3.47; range 6 to 18 years]. All participants were required to: (1) reside in Canada; and (2) consent to participate.

Measures

Mental health

Mental health was assessed using parents' reports on the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997). We used the age-appropriate versions of SDQ for parents of preschoolers and 6–18-year-old children. The SDQ asks questions about positive and negative characteristics displayed by the child in the past 6 months in five categories: Emotional Symptoms (e.g., often unhappy, downhearted), Conduct Problems (e.g., fights with other children), Hyperactivity/Inattention (e.g., constantly fidgeting or squirming), Peer Relationship Problems (e.g., tends to play alone) and Prosocial Behavior (e.g., considerate of other people's feelings). There are five items in each subscale, and the parent/care giver rates each item as either: Never = 0, Somewhat True = 1, or Certainly True = 2. The Total Difficulties score is generated by adding up the values of the first four scales, leading to a possible score between 0 and 40, where higher scores indicate an increasing level of behavioral difficulties. A total SDQ score of 17 or higher is considered abnormal. In a study by Croft et al. (2015), all sub-scales showed acceptable internal reliability of subscales ranging from $\omega = 0.66$ (Peer Relationship Problems) to $\omega = 0.83$ (Hyperactivity/Inattention) in preschool children. Another study on 6-17-year-old Canadian children found evidence for the factorial validity and reliability of the parent-rated SDQ and acceptable internal consistency ranging from 0.79 to 0.88 for the subscales (Hoffmann et al., 2020).

Personality

Preschoolers' measurement

The M5–PS–35 is a five-factor personality questionnaire that has been validated for use in preschool populations (Grist et al., 2012). The M5-PS-35 includes items such as "is friendly towards peers" (Extraversion), "loves to help people" (Agreeableness), "completes tasks successfully" (Conscientiousness), "is afraid of many things" (Neuroticism), and "adapts to new activities" (Openness to Experience). Each question uses a 5-point Likert-type scale, ranging from Inaccurate to Accurate. Grist et al. (2012) showed that the revised and shortened version shows strong construct validity and improved internal reliability, internal consistency values are E = 0.77; A = 0.90; C = 0.87; N = 0.79; O = 0.71.

6–18-year-olds measurement

Personality of 6–18-year-old children was measured by parents' reports on the Big Five Questionnaire for Children (BFQ-C) which is a 65-item questionnaire that measures the Big Five in children and adolescents (Barbaranelli et al., 2003). The traits are Extraversion (e.g., "I easily make friends"), Agreeableness (e.g., "I trust in others"), Conscientiousness (e.g., "I like to keep all my school things in order"), Neuroticism/Emotional instability (e.g., "I easily get angry") and Openness/Intellect (e.g., "I easily learn what I study at school"). Items are scored on a five-point Likert scale ranging from 1 = almost never to 5 = almost always. For each factor, individual item scores are combined to yield a total score. A study by Vreeke and Muris (2012) found that parent report on the BFQ-C was found to have good alphas for Extraversion (0.79), Agreeableness (0.87), Conscientiousness (0.88), Neuroticism (0.86), and Openness (0.86).

Coping and response to stress

Coping and Responses to Stress Questionnaire (RSQ) COVID-19 (Connor-Smith et al., 2000), a multidimensional questionnaire, is adapted to specific stressors or domains of stress, in this case, the COVID-19 pandemic. There are 57 items categorized into five factors (Connor-Smith et al., 2000). For each item, participants are asked: *How much do you do this?* On a scale of 1 to 4: 1 (Not at All), 2 (A Little), 3 (Some), and 4 (A lot). The five total factors include three types of *coping*: Primary Control Engagement Coping: (i.e., emotional expression, emotion regulation, and problem-solving); Secondary Control Engagement Coping (i.e., acceptance, cognitive restructuring, distraction, and positive thinking); and Disengagement Coping (i.e., avoidance, denial, and wishful thinking). The RSQ includes two types of involuntary responses to *stress*: Involuntary Engagement (i.e., emotional arousal, impulse action, intrusive thoughts, physiological arousal, and rumination) and Involuntary Disengagement (i.e., cognitive interference, emotional numbing, escape, and inaction). Each of the five factors—Primary Coping, Secondary Coping, Disengagement Coping, Involuntary

TABLE 1 Preschool sample demographics characteristics.

Demographics	Options	Percentage
Child's gender		
	Male	52%
	Female	48%
Job Status		
	Not employed	14%
	Temporary/Part-time Employment	13%
	Full-time Employment	30%
	Student	43%
Social interactions		
	Not Affected	10%
	Somewhat Affected	50%
	Largely Affected	40%
Sibling Issues		
	Did not have sibling issues	89%
	Did have sibling issues	11%

TABLE 2 6–18-year-olds sample demographics characteristics.

Demographics	Options	Percentage
Income change		
	Yes, it has decreased	51.7%
	Yes, it has increased	39.5%
	No change	8.7%
Job status		
	Not employed	31.6%
	Temporary/Part-time Employment	28.7%
	Full-time Employment	33.9%
	Student	5.8%
Domestic conflict		
	Yes	85.5%
	No	14.5%
Social interactions		
	Not Affected	69.5%
	Affected	30.5%
Sibling issues		
	Did not have sibling issues	53.2%
	Did have sibling issues	46.8%

Engagement, and Involuntary Disengagement—is calculated as a ratio score of the total stress response items endorsed. Therefore, Primary Coping, for example, represents the propensity of an individual to use this coping style relative to the four other factors. The RSQ has demonstrated excellent internal consistency, test–retest reliability, and convergent and construct validity (Compas et al., 2017; Coiro et al., 2021).

Demographic variables

All participants were asked to provide the following demographic information: parents' age, their current job status and if there has been a change in their income over the last 2 months if they had pre-existing mental health issues, children's age and gender, and the number of children in the family and birth order of children.

Our participants were also asked specific questions about their experiences with the COVID-19 pandemic, for example, if they or anyone living in their household were diagnosed with COVID-19, whether they experienced domestic conflicts as a consequence of the pandemic, how the pandemic interfered with their social interactions, if the loss of childcare services affected them and if the children experienced any issues with their siblings. We reasoned that children's mental health could be affected by the personal experiences people have with the COVID-19 pandemic. Table 1 (preschoolers) and Table 2 (6–18-year-old children) provide additional demographic information.

Statistical analyses

Following are the results of all analyses conducted in SPSS (Version 28). In order to investigate the relationship between personality traits with mental health (positive and negative attributes), first, we calculated Pearson correlation coefficients between personality traits on one hand and Total Difficulty scores, Emotional Symptoms, Hyperactivity/Inattention, Peer Relationship Problems, and Prosocial Behaviors on the other, as well as demographic factors. The variables with at least one significant association with outcome variables are presented in Table 3 (preschoolers) and Table 4 (6–18-year-old children).

A hierarchical multivariate regression model was then used to assess the relationship between independent variables and outcome variables. Among demographic variables and Coping and Response to COVID-19 Stress factors, those significantly associated with the dependent variables (Total Difficulty scores, Conduct Problems, Emotional Symptoms, Hyperactivity/Inattention, Peer Relationship Problems, and Prosocial Behaviors) during bivariate analyses were entered into the first and the second models of the hierarchical regression models. The five Coping and Response to COVID-19 Stress factors, Primary Coping, Secondary Coping, Disengagement Coping, Involuntary Engagement, and Involuntary Disengagement were entered in the second block in order to control for potential confounding variables (Table 5 for preschoolers and Table 6 for 6–18-year-old children show the final block of the three hierarchical regression analyses).

We entered the (correlated) demographic variables and Coping and Response to COVID-19 Stress variables into the first and second blocks to control for them, as we reasoned that those demographic variables and Coping and Response to COVID-19 Stress play a critical role in determining the impact of the pandemic on children. Finally, after controlling for demographics and Coping and Response to COVID-19 Stress variables, the five personality traits were entered into the model.

TABLE 3 Means, standard deviations, and correlations between demographics variables, coping and stress responses, and personality traits in preschoolers.

	MEAN (SD)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Child Gender 1.1 Male Female	–	- REF																			
2. Job Status 2.1 Part-time No Job	–	-02 REF	–																		
3. Social Interactions 3.1 Largely No Change	–	-11 REF	0.02	–																	
4. Sibling Issue 4.1 No Yes	–	0.08 REF	0.05	−0.21**	–																
5. Primary Control Coping	0.31 (0.14)	0.20	0.06	0.07	0.23*	–															
6. Secondary Control Coping	0.32 (0.13)	−0.01	0.07	−0.06	0.11	0.02	–														
7. Disengagement Coping	0.13 (0.12)	−0.10	−0.08	−0.09	−0.21*	−0.46**	−0.43**	–													
8. Involuntary Engagement Coping	0.10 (0.10)	−0.05	−0.14	0.01	−0.13	−0.42**	−0.47**	0.04	–												
9. Involuntary Disengagement Coping	0.09 (0.07)	−0.03	−0.04	−0.01	−0.00	−0.54**	−0.39**	0.14	0.49**	–											
10. Openness	4.17 (0.63)	0.10	0.03	−0.06	0.13	0.17	0.39**	−0.05	−0.32**	−0.29**	–										
11. Extraversion	4.29 (0.75)	0.14	0.05	0.03	0.00	0.17	0.42**	−0.15	−0.39**	−0.42**	0.52	–									
12. Neuroticism	2.84 (0.83)	−0.11	−0.03	0.12	−0.16	−0.21*	−0.23*	−0.01	0.41**	0.23*	−0.34**	−0.36**	–								
13. Agreeableness	3.28 (0.66)	0.01	0.20*	−0.16	0.30**	0.27**	0.15	−0.14	−0.26*	−0.18	0.24*	−0.00	−0.38**	–							
14. Conscientiousness	3.66 (0.63)	0.16	0.12	−0.04	0.19*	0.26*	0.18	−0.12	−0.26*	−0.31**	0.41**	0.26**	−0.40**	0.58**	–						
15. Emotional Symptoms	2.58 (2.55)	−0.18	−0.01	−0.01	−0.03	−0.28**	−0.24*	0.01	0.48*	0.32*.	−0.31**	−0.42**	0.65**	−0.20*	−0.37**	–					
16. Conduct Problems	2.31 (1.44)	−0.01	−0.10	0.20*	−0.36**	−0.21*	−0.23*	0.05	0.30**	0.24*	−0.22*	−0.12	0.49**	−0.62**	−0.42**	0.39**	–				
17. hyperactivity/ inattention	5.65 (2.43)	−0.04	−0.25*	0.10	0.17	−0.14	−0.08	0.05	0.25*	0.06	−0.14	0.13	0.23*	−0.58**	−0.58**	0.20*	0.42**	–			
18. Peer relationship problems	4.12 (1.64)	−0.19*	−0.01	−0.04	−0.05	−0.10	−0.17	0.01	0.27*	0.21*	−0.25*	−0.32**	−0.30**	−0.19	−0.30**	0.50**	0.27**	0.13	–		
19. Prosocial behavior	7.74 (2.10)	0.11	0.07	0.08	0.33**	0.23*	0.24*	−0.27**	−0.17	−0.24*	0.33**	0.37**	−0.17	0.24*	0.39**	−0.15	−0.22*	−0.21*	−0.22*	–	
20. Total difficulties score	14.66 (5.68)	−0.16	−0.14	0.07	−0.21*	−0.27*	−0.25*	0.04	0.47**	0.29**	−0.33**	−0.25**	0.60**	−0.55**	−0.61**	0.78**	0.69**	0.66**	0.64**	−0.28**	

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TABLE 4 Means, standard deviations, and correlations between demographics variables, coping and stress responses and personality traits in 6–18-year-old children.

	MEAN (SD)	1	2	3	4.1	4.2	5	6	7.1	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	21
1. Parent's age	37.56 (5.98)																								
2. Child's age	12.55 (3.47)	0.11**																							
3. Income Change Decrease No change	–	−0.06 REF	0.03																						
4. Job Status 4.1. Part-time 4.2. Student No Job	–	−0.04 0.01	0.01 −0.14**	0.14** −0.15**	– −0.15**																				
5. Domestic issues Yes No		−0.35** REF	0.07	0.25**	0.14**	−0.38**																			
6. Social interactions Yes No change	–	−0.07 REF	−0.00	0.09*	0.04	−0.13**	0.20**																		
7. Sibling issue Yes No		−0.10* REF	0.07	−0.02	−0.00	−0.07	0.14**	0.02																	
8. Primary control coping	0.16 (0.03)	0.17**	−0.03	−0.09*	−0.04	0.30**	−0.46**	−0.12**	−0.14**																
9. Secondary control coping	0.21 (0.03)	0.23**	−0.03	−0.13**	−0.08*	0.24**	−0.52**	−0.08*	−0.14**	0.30**															
10. Disengagement coping	0.15 (0.02)	−0.09*	0.01	0.01	0.01	−0.01	0.12**	0.03	0.02	−0.31**	−0.26**														
11. Involuntary engagement coping	0.25 (0.03)	−0.13**	0.02	0.13**	0.06	−0.26**	0.46**	0.10*	0.16**	−0.51**	−0.66**	−0.07													
12. Involuntary disengagement coping	0.20 (0.03)	−0.23**	0.04	0.08*	0.05	−0.29**	0.46**	0.08*	0.11**	−0.57**	−0.56**	−0.01	0.24**												
13. Openness	40.47 (6.34)	0.15**	−0.11**	−0.11**	−0.09*	0.28**	−0.47**	−0.12**	−0.12**	0.39**	0.35**	−0.12**	−0.32**	−0.36**											
14. Extraversion	40.98 (6.62)	0.17**	−0.16**	−0.13**	0.06	0.30**	−0.49**	−0.10**	−0.13**	0.37**	0.33**	−0.13**	−0.26**	−0.36**	0.45**										
15. Neuroticism	38.36 (5.92)	−0.15**	0.00	0.03	0.00	−0.27**	0.28**	0.03	0.12**	−0.23**	−0.32**	0.04	0.32**	0.22**	−0.13**	−0.21**									

(Continued)

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TABLE 4 (Continued)

	MEAN (SD)	1	2	3	4.1	4.2	5	6	7.1	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	21
16. Agreeableness	41.22 (6.96)	0.18**	−0.09*	−0.19**	−0.09*	0.43**	−0.55**	−0.16**	−0.16**	0.39**	0.37**	−0.06	−0.34**	−0.40**	0.47**	0.42**	−0.22**	-							
17. Conscientiousness	39.91 (6.10)	0.09*	−0.00	−0.07	−0.08*	0.15**	−0.26**	−0.09*	−0.16**	0.27**	0.19**	−0.06	−0.20**	−0.22**	0.29**	0.25**	−0.15**	0.33**							
18. Emotional symptoms	4.64 (2.06)	−0.14**	0.02	0.06	−0.01	−0.21**	0.31**	0.10*	0.11**	−0.19**	−0.35**	0.06	0.30**	0.22**	−0.15**	−0.21**	0.20**	−0.19**	−0.15**	-					
19. Conduct problems	4.34 (2.22)	−0.23**	0.11**	0.17**	0.13**	−0.37**	0.56**	0.06	0.12**	−0.38**	−0.35**	0.11**	0.28**	0.40**	−0.31**	−0.42**	0.22**	−0.47**	−20**	0.25**					
20. Hyperactivity/ inattention	4.99 (2.02)	−0.09*	−0.00	0.00	0.00	−0.13**	0.11**	0.02	0.01	−0.16**	−0.17**	0.06	17**	0.12**	−0.17**	−0.05	0.18**	−0.11**	−0.23**	0.16**	0.12**				
21. Peer relationship problems	4.70 (2.24)	−0.20**	0.01	0.18**	0.12**	−0.28**	0.49**	0.11**	0.03	−0.30**	−0.33**	0.05	0.30**	0.30**	−0.32**	−0.35**	0.20**	−0.36**	−0.14**	0.23**	0.33**	0.09*			
22. Prosocial behavior	5.51 (2.11)	0.16*	−0.09*	−0.19**	−0.16**	0.31**	−0.41**	−0.10*	−0.05	0.28**	0.26**	−0.01	−0.26**	−0.28**	0.33**	0.31**	−0.14**	0.44**	0.16*	−0.10*	−0.32**	−0.08*	−0.24**	-	
23. Total difficulties score	18.66 (5.44)	−0.26**	0.05	0.16**	0.10**	−0.40**	0.59**	0.12**	0.11**	−0.41**	−0.47**	0.11**	0.42**	0.42**	−0.38**	−0.42**	0.32**	−0.46**	−0.28**	0.64**	0.69**	0.52**	0.67**	−0.30**	-

Results

Preschool children

The means, standard deviations, and correlations between personality traits, Coping and Response to COVID-19 Stress variables, and SDQ subscales are presented in Table 3. Extraversion, Agreeableness, Openness to Experience, and Conscientiousness are all positively correlated with each other and negatively correlated with Neuroticism, except for Extraversion and Agreeableness.

As can be seen in Table 5, Openness to Experience is not related to any of the SDQ subscales when controlling for demographic factors and Coping and Response to COVID-19 Stress variables. Extraversion is positively and significantly related to Hyperactivity/Inattention and Prosocial Behavior. Neuroticism is positively and significantly related to Total Difficulties score, Emotional Symptoms, and Conduct Problems. Agreeableness was negatively and significantly related to Total Difficulties score, Conduct problems, and Hyperactivity/Inattention. Conscientiousness is negatively and significantly related to Total Difficulties score, and Hyperactivity/Inattention.

On top of the demographics and Coping and Response to COVID-19 Stress variables, the personality traits, explained 60% of the variance of total difficulty score, 51% of Emotional Symptoms, 54% of Conduct Problems, 54% of Hyperactivity/Inattention, 22% of Peer Relationship Problems, and 39% Prosocial Behavior.

6–18-Year-old children

The means, standard deviations, and correlations between personality traits, Coping and Response to COVID-19 Stress variables, and SDQ subscales are presented in Table 4. Extraversion, Agreeableness, Openness to Experience, and Conscientiousness are all positively correlated with each other and negatively correlated with Neuroticism.

As can be seen in Table 6, Openness to Experience is negatively related to Hyperactivity/Inattention when controlling for demographic factors and Coping and Response to COVID-19 Stress variables. Extraversion was negatively and significantly related to Total Difficulty score, Conduct Problems, and Peer Relationship Problems and also positively related to Hyperactivity/Inattention. Neuroticism was positively and significantly related to total difficulty score and Hyperactivity/Inattention. Agreeableness was negatively and significantly related to Conduct Problems and positively related to Prosocial behaviors. Conscientiousness was negatively and significantly related to Total Difficulty score, and Hyperactivity/Inattention.

On top of the demographics and Coping and Response to COVID-19 Stress variables, the personality traits, explained 46% of the variance of the Total Difficulty score, 17% of Emotional Symptoms, 40% of Conduct Problems, 11% of Hyperactivity/Inattention, 28% of Peer Relationship problems, and 27% Prosocial behavior.

Discussion

Preschool children

The results of preschoolers' data show that on top of the demographic variables and Coping and Response to COVID-19

TABLE 5 Hierarchical regression analysis (standardized beta weights) of personality traits in relation to SDQ subscales, controlled for demographics and coping and stress responses variables for preschoolers.

	Total Difficulty			Emotional			Conduct			Hyperactivity			Peer			Prosocial		
	Beta	95% CI		Beta	95% CI		Beta			Beta	95% CI		Beta	95% CI		Beta	95% CI	
Gender Male Female	N/A			N/A			N/A			N/A			−0.10 REF	−0.98	0.31	N/A		
Job status part-time No Job	N/A			N/A			N/A			−0.10 REF	−1.92	0.40	N/A			N/A		
Social interactions largely No Change	N/A			N/A			0.11 REF	−0.16	0.93	N/A			N/A			N/A		
Sibling issue No Yes	0.09 REF	−0.73	2.86	N/A			−0.20* REF	−1.76	−0.14	N/A			N/A			0.31* REF	0.80	3.55
Primary control coping	0.01	−7.16	8.39	−0.05	−4.70	2.83	0.05	−1.64	2.80	N/A			N/A			0.01	−7.04	8.00
Secondary control coping	−0.00	−8.76	8.62	0.01	−3.93	4.44	−0.04	−2.88	1.93	N/A			N/A			0.13	−1.80	5.67
Disengagement Coping	N/A			N/A			N/A			N/A			N/A			N/A		
Involuntary engagement Coping	0.20*	0.27	23.76	0.18	−0.87	10.50	0.01	−3.02	3.45	0.18*	0.14	8.67	0.08	−2.75	5.35	0.08	−2.69	5.52
Involuntary disengagement Coping	−0.00	−15.80	15.58	0.02	−6.86	8.35	0.14	−0.1.68	7.19	N/A			0.00	−5.16	5.24	0.17	−1.80	9.24
Openness	0.02	−1.53	2.05	0.06	−0.62	1.18	−0.00	−0.51	0.47	0.02	−0.64	0.84	−0.06	−8.17	0.49	0.10	−0.48	1.20
Extraversion	0.02	−1.36	1.78	−0.10	−1.11	0.41	0.04	−0.34	0.52	0.30**	0.35	1.67	−0.18	−1.01	0.19	0.34**	0.28	1.76
Neuroticism	0.32**	1.02	3.58	0.54**	1.07	2.30	0.21*	0.03	0.74	−0.03	−0.64	0.45	0.12	−0.23	0.74	0.08	−0.38	0.81
Agreeableness	−0.21*	−3.61	−0.16	0.15	−0.23	1.43	−0.47**	−1.53	−0.56	−0.27**	−1.78	−0.25	−0.01	−0.71	0.62	0.09	−0.51	1.13
Conscientiousness	−0.30**	−4.63	−0.88	−0.18	−1.62	0.15	0.03	−0.42	0.59	−0.47**	−2.6	−1.04	−0.12	−1.03	0.38	0.13	−0.40	1.33

N/A: not applicable.

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

Total difficulty: $R^2 = 0.06$ for block 1 ($F(1,100) = 5.40$; $p < 0.05$); ΔR^2: 0.20 for block 2 (Fchange$(5,100) = 5.73$; $p < 0.001$). $\Delta R^2 = 0.34$ for block 3 (Fchange$(10,100) = 11.34$; $p < 0.001$). Emotional Problems: $R^2 = 0.23$ for block 1 ($F(4,100) = 6.04$; $p < 0.001$); ΔR^2: 0.28 for block 2 (Fchange$(9,100) = 8.92$; $p < 0.001$). Conduct: $R^2 = 0.20$ for block 1 ($F(2,100) = 10.78$; $p < 0.001$); ΔR^2: 0.08 for block 2 (Fchange$(6,100) = 5.28$; $p < 0.001$). $\Delta R^2 = 0.26$ for block 3 (Fchange$(11,100) = 7.79$; $p < 0.001$). Hyperactivity/inattention: $R^2 = 0.05$ for block 1 ($F(1,100) = 4.89$; $p < 0.05$); ΔR^2: 0.05 for block 2 (Fchange$(2,100) = 4.87$; $p < 0.05$). $\Delta R^2 = 0.44$ for block 3 (Fchange$(7,100) = 13.81$; $p < 0.001$). Peer problems: $R^2 = 0.00$ for block 1 ($F(1,100) = 0.53$; $p > 0.05$); ΔR^2: 0.08 for block 2 (Fchange$(5,100) = 1.37$; $p > 0.05$). $\Delta R^2 = 0.14$ for block 3 (Fchange$(10,100) = 2.12$; $p < 0.05$). Prosocial: $R^2 = 0.16$ for block 1 ($F(1,100) = 0.16$; $p < 0.001$); ΔR^2: 0.07 for block 2 (Fchange$(5,100) = 4.92$; $p < 0.001$). $\Delta R^2 = 0.16$ for block 3 (Fchange$(10,100) = 4.72$; $p < 0.001$).

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TABLE 6 Hierarchical regression analysis (standardized beta weights) of personality traits in relation to SDQ subscales, controlled for demographics and coping and stress responses variables for 6–18year-old children.

	Total Difficulty			Emotional			Conduct			Hyperactivity			Peer			Prosocial		
	Beta	95% CI		Beta	95% CI		Beta			Beta	95% CI		Beta	95% CI		Beta	95% CI	
1. Parent's age	−0.05	−0.10	0.01	−0.03	−0.03	0.02	−0.03	−0.04	0.01				−0.02	−0.03	0.01	0.03	−0.01	0.03
2. Child's age	N/A			N/A			0.04	−0.01	0.06	N/A			N/A			−0.03	−0.06	0.02
3. Income change Decrease Increase	0.01 REF	−0.88	0.61	N/A			0.02	−0.19	0.40	N/A			0.05	−0.10	0.56	−0.07	−0.62	0.00
4. Job status 4.1. Part-time 4.2. Student No Job	−0.01 –0.13** REF	−5.01	−1.61	N/A − 0.09*	−1.66	−0.06	0.02 –0.10**	−0.19 –1.78	0.45 –0.28	N/A − 0.08	−1.56	0.04	0.03 –0.05	−0.19 –1.30	0.52 0.31	−0.07 0.08*	−0.66 0.02	0.01 1.58
5. Domestic issues Yes No	0.24** REF	2.44	5.36	0.11*	0.03	1.38	0.28**	1.20	2.46	−09	−1.21	0.15	0.26**	1.05	2.44	−0.10*	−1.32	−0.00
6. Social interactions Yes No change	−0.01 REF	−0.84	0.61	0.04	−0.14	0.54	N/A			N/A			0.01	−0.29	0.40	0.00	−0.31	0.34
7. Sibling issue Yes No	−0.01 REF	−0.80	0.55	0.04	−0.14	0.49	0.03	−0.16	0.42	N/A			N/A			N/A		
Primary control coping	−0.63*	−225.07	−1.88	0.02	−7.04	9.68	−0.30	−70.83	26.00	−0.06	−12.89	4.07	−0.01	−9.20	7.73	−0.01	−8.79	7.37
Secondary control coping	−0.82*	−233.44	−11.90	−0.19**	−18.86	−2.77	−0.30	−66.30	29.79	−0.10	−13.97	2.34	−0.01	−9.06	7.73	−0.07	−12.18	3.32
Disengagement coping	−0.42	−214.68	8.10	N/A			−0.15	−63.29	33.32	N/A			N/A			N/A		
Involuntary engagement coping	−0.60	−207.81	14.81	0.08	−3.15	13.27	−0.30	−67.91	28.63	0.01	−7.72	8.92	0.06	−4.28	12.33	−0.09	−13.99	1.77
Involuntary disengagement coping	−0.54	−207.94	13.72	0.00	−8.31	9.30	−0.14	−58.91	37.23	−0.03	−11.55	6.55	0.03	−6.00	11.84	−0.08	−14.10	2.83
Openness	−0.03	−0.09	0.03	0.04	−0.01	0.04	0.05	−0.00	0.04	−0.12**	−0.07	−0.01	−0.05	−0.05	0.01	0.06	−0.06	0.05
Extraversion	−0.08*	−0.13	−0.00	−0.05	−0.04	0.01	−0.13**	−0.07	−0.01	0.10*	0.00	0.06	−0.10*	−0.06	−0.00	0.08	−0.00	0.05
Neuroticism	0.07*	0.00	0.13	0.04	−0.01	0.04	0.01	−0.02	0.03	0.11**	0.01	0.06	0.03	−0.01	0.04	0.02	−0.01	0.03
Agreeableness	−0.05	−0.10	0.01	0.05	−0.01	0.04	−0.15**	−0.08	−0.02	0.04	−0.01	0.04	−0.06	−0.05	0.00	0.23**	0.04	0.10
Conscientiousness	−0.09**	−0.13	−0.02	−0.06	−0.05	0.00	0.00*	−0.02	0.02	−0.19**	−0.09	−0.03	0.03	−0.01	0.04	−0.02	−0.03	0.02

N/A: not applicable

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

Total difficulty: $R^2 = 0.39$ for block 1 ($F(7,607) = 52.89$; $p < 0.001$); ΔR^2: 0.05 for block 2 (*F*change(12,607) = 37.87; $p < 0.001$). $\Delta R^2 = 0.02$ for block 3 (*F*change(17,607) = 29.39; $p < 0.001$). Emotional Problems: $R^2 = 0.11$ for block 1 ($F(5,607) = 15.36$; $p < 0.001$); ΔR^2: 0.05 for block 2 (*F*change(9,607) = 12.58; $p < 0.001$). $\Delta R^2 = 0.01$ for block 3 (*F*change(14,607) = 8.60; $p < 0.001$). Conduct: $R^2 = 0.34$ for block 1 ($F(7,607) = 43.63$; $p < 0.001$); ΔR^2: 0.03 for block 2 (*F*change(12,607) = 28.21; $p < 0.001$). $\Delta R^2 = 0.03$ for block 3 (*F*change(17,607) = 22.30; $p < 0.001$). Hyperactivity/inattention: $R^2 = 0.02$ for block 1 ($F(3,607) = 5.44$; $p = 0.001$); ΔR^2: 0.03 for block 2 (*F*change(7,607) = 4.66; $p < 0.001$). $\Delta R^2 = 0.06$ for block 3 (*F*change(12,607) = 6.22; $p < 0.001$). Peer problems: $R^2 = 0.25$ for block 1 ($F(6,6,007) = 33.08$; $p < 0.001$); ΔR^2: 0.01 for block 2 (*F*change(10,607) = 21.06; $p < 0.001$). $\Delta R^2 = 0.02$ for block 3 (*F*change(15,607) = 15.16; $p < 0.001$). Prosocial: $R^2 = 0.20$ for block 1 ($F(7,607) = 21.64$; $p < 0.001$); ΔR^2: 0.02 for block 2 (*F*change(11,607) = 15.01; $p < 0.001$). $\Delta R^2 = 0.05$ for block 3 (*F*change(16,607) = 13.32; $p < 0.001$.

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Stress, personality traits predicted substantial variance in the effects of COVID-19 on the mental health of preschoolers in Canada which will be discussed in greater detail in the following section.

Among the five Coping and Response to COVID-19 Stress factors, Involuntary Engagement Coping (or stress reactivity) was the only variable that was significantly associated with SDQ subscales of the Total Difficulties score and Hyperactivity/Inattention (see Table 5). Involuntary Engagement Coping is characterized by involuntary emotional and physiological stress, for example through intrusive thoughts, rumination, impulsive actions, and physiological arousal, out of one's control. Previous studies have also shown associations between maladaptive stress response of Involuntary Engagement Coping with greater psychopathology (Singer et al., 2000) and mental issues such as anxiety, depression, internalizing problems, and aggression (Wolff et al., 2009; Dufton et al., 2010; Blöte et al., 2022). Moreover, children who are highly reactive experience greater illness rates in situations of increased stress (Boyce et al., 1995) similar to the COVID-19 situation happening now.

Mental health and personality traits in preschoolers

Neuroticism

Among the big 5 personality traits, Neuroticism predicted the most SDQ difficulty subscales (Total Difficulty, Emotional Symptoms, and Conduct Problems) among these preschoolers. Neuroticism is a personality trait characterized by a disposition to experience negative emotions which manifests itself through feelings of anxiety, anger, sadness, and tension (John et al., 2008). In Study 1, Neuroticism predicted the Total Difficulties score, namely the sum of Emotional Symptoms, Conduct Problems, Hyperactivity/Inattention, and Peer Relationship Problems scores. Neuroticism has long been linked to psychopathology and evidence suggests that Neuroticism reflects a common vulnerability contributing to the development and maintenance of a variety of mental illnesses (Sauer-Zavala et al., 2017). Generally, Neuroticism has been found to be a risk factor for developing emotional disorders such as depression and anxiety (Lahey, 2009; Agh-Yousefi and Maleki, 2011; Andrés et al., 2016). To explain the vulnerability to emotional problems, some studies have shown that anxiety sensitivity, intolerance of uncertainty and worry, and rumination could be vulnerability markers related to Neuroticism (Sexton et al., 2003; Broeren et al., 2011). Also, Neuroticism could also be a predictor of conduct disorder as according to Eysenck's biological theory of personality, Neuroticism is associated with higher psychobiological reactivity in the face of frustration and greater sympathetic arousal (Eysenck, 1963). Consequently, Neuroticism tends to follow a susceptibility to stress, inefficiency in dealing with frustration, and difficulty controlling impulses (Abbasi, 2016), in this case, in a situation like the COVID-19 pandemic.

Agreeableness

Agreeableness, recognized as an important facet of mental health, showed negative associations with Total Difficulties, Conduct Problems, and Hyperactivity/Inattention among the preschoolers in this study. Children with high scores in Agreeableness tend to be cooperative, considerate, empathic, trustworthy, courteous, well-regulated, caring, friendly, and compliant, and exhibit good interpersonal skills (Kochanska and Kim, 2020). Generally, higher scores in Agreeableness in children and adolescents have been associated with improved developmental outcomes, and lower scores in Agreeableness have been associated with multiple symptoms of psychopathology and externalizing and internalizing behavior problems (Laursen et al., 2002, 2010). Studies have also shown a negative association between high scores of Agreeableness and bullying, aggressive and delinquent behaviors, and social problems (Ehrler et al., 1999; Bollmer et al., 2006; Nigg et al., 2020). Previous studies have also shown negative associations between Agreeableness and Hyperactivity and Inattention symptoms (Gomez and Corr, 2014; Nigg et al., 2020).

Conscientiousness

Conscientiousness negatively predicted Total difficulty and Hyperactivity among the preschool children. Conscientiousness is characterized by restraining impulses, effortful attention, planned behavior, organization, and goal-oriented behavior (Krieger et al., 2020). In general, individuals who score higher in Conscientious tend to experience less stress and mental health issues when compared to individuals who score lower in Conscientiousness (Wehner et al., 2016). Previous studies have also found a link between low Conscientiousness and Attention-Deficit Hyperactivity Disorder (ADHD) symptoms in some children and adolescents (Cukrowicz et al., 2006; Martel et al., 2009; De Pauw and Mervielde, 2011; Nigg et al., 2020). The inhibitory aspect of Conscientiousness is associated with self-regulation and impulse control which could possibly be indicative of some kind of top-down regulating mechanism (DeYoung, 2010).

Extraversion

Extraversion, a trait that has shown strong correlations with mental health outcomes, showed positive associations with Hyperactivity/Inattention and Prosocial Behaviors. Typically, a child with a tendency to Extraversion is likely to be externally focused, and socially active and could be described as outgoing, talkative, assertive, and energetic (Smith et al., 2021). The findings on the associations between Extraversion and Hyperactivity/Inattention have been inconsistent across the literature. Even though some studies have found no significant associations between Hyperactivity/Inattention and Extraversion in children, adolescents, and adults (Martel et al., 2008; De Pauw and Mervielde, 2011; Gomez and Corr, 2014), some have shown strong links between hyperactive–impulsive symptoms and Extraversion (Martel, 2009; Tackett et al., 2012; Gomez and Corr, 2014). Moreover, a study by Gomez and Corr (2014) indicated that positive emotionality (similar to FFM/Extraversion) was associated with inattention, but not with hyperactivity-impulsivity. A possible explanation for the inconsistency of the associations between ADHD symptoms and Extraversion could be that the relationship may be masked when hyperactive, inattention, and impulsive symptoms are not analyzed separately. Moreover, a possible explanation of the positive association between Extraversion and Hyperactivity/Inattention could be related to the COVID-19 situation and the consequences. For instance, children who score higher on Extraversion, usually enjoy social situations, like playing in groups and spending time with their friends but as a result of COVID-19 and the containment measures, they had to spend more time at home, as a result, they might display this suppressed social energy as hyperactivity and inattention symptoms. However, more research is needed to verify this speculation.

Extraversion was the only predictor of Prosocial Behavior in preschoolers. This result is in line with previous studies showing this positive association in children and adolescents (Tariq and Naqvi, 2020; Gómez Tabares and Narvaez Marin, 2022). A possible explanation could be that Extraversion is usually considered a very positive trait (Salmon, 2012), and individuals who score higher on Extraversion usually experience more warmness and positivity (Nguyen et al., 2013), greater social/emotional responsivity (O'connor and Cuevas, 1982), and more positive affect (Morrone et al., 2000), which could be manifested in Prosocial Behavior in children.

Openness to experience

Openness to Experience did not predict any of the mental health domains in preschoolers.

6–18-Year-old children

In 6-18-year-olds, the Total Difficulty score of children was predicted positively by Neuroticism and predicted positively by Extraversion and Conscientiousness. Conduct problems are negatively predicted by Extraversion and Agreeableness. Hyperactivity/Inattention was positively predicted by Extraversion and Neuroticism and negatively predicted by Openness to Experience and Conscientiousness. Peer Relationship Problems are negatively predicted by Extraversion and Prosocial Behavior was positively predicted by Agreeableness. Emotional Symptoms are not predicted by any of the personality traits.

Among the five Coping and Response to COVID-19 Stress factors, Primary Control Coping and Secondary Control Coping are significantly associated with some SDQ subscales (see Table 6). Primary Control Coping is negatively associated with Total Difficulties score, and Secondary Control Coping is negatively associated with Total Difficulties score and Emotional Symptoms. Adaptive coping responses in children include Primary Control Coping (problem-solving, emotional expression, and emotional modulation), and Secondary Control Coping (acceptance, cognitive restructuring, positive thinking, and distraction) (Connor-Smith et al., 2000). Primary Control Coping and Secondary Control Coping are associated with significantly less psychosocial problems, with Secondary Control strategies particularly beneficial for stressful situations that are beyond one's control (such as COVID-19 situation) (Compas et al., 2017). This is consistent with previous research showing that lower levels of Primary Control Coping and Secondary Control Coping are linked with higher amounts of internalizing symptoms, depression, anxiety, distress, and negative affect in youth (Connor-Smith and Compas, 2004; Evans et al., 2015; Bettis et al., 2016).

Mental health and personality traits in 6–18-year-old children

Extraversion

Extraversion appears to be the strongest predictor of mental health variables in 6-18-year-old children, showing negative associations with Total Difficulty score, Conduct Problems, and Peer Problems and positive associations with Hyperactivity/Inattention. Extraversion is generally linked with higher states of good health (Jokela et al., 2013), as well as mental health (Carver and Scheier, 2014). In the context of the pandemic, this could be explained by the connection found between a higher level of Extraversion and active coping strategies in the form of active problem-solving (Karimzade and Besharat, 2011). Moreover, Extraversion plays a significant role in receiving social support or seeking help during difficult times, such as during the pandemic (Burešová et al., 2020).

There are mixed results regarding the relationship between Extraversion and Conduct Problems. Eysenck and Eysenck (1985) suggested that individuals who score higher on Extraversion are less likely to form conditioned responses than more Introverted individuals, therefore, they are less able to take advantage of aversive conditioning, less sensitive to conditioned stimuli for punishment and are more prone to exhibit antisocial behavior. They also suggested that children with conduct disorder score higher on Extraversion (Eysenck and Eysenck, 1985). More recent studies have also found associations between lower scores of Extroversion with antisocial delinquent behaviors (Krishna, 1993; Komulainen, 2015; Morizot, 2015). However, there are also studies showing no evidence to support Eysenck's claim that higher scores in Extraversion are associated with delinquent and antisocial behaviors (Fonseca and Yule, 1995; Cale, 2006; Homann, 2019). A possible explanation for the negative association of Conduct Problems and Extraversion in our participants could be related to the COVID-19 situation. For instance, more introverted children who had a few friends at school lost connection with them during the pandemic due to school closures and more Introverted children usually do not reach out to other people (such as siblings and other family members) to fulfill their social needs. It is possible that they manifest their loneliness as aggressive behavior and fighting with others. In contrast, more extroverted children are more likely to reach out to family and friends to satisfy their interpersonal needs in times of school closure. However, more research is needed to test this hypothesis.

As explained in the Study 1 discussion, results are mixed regarding the associations between Extraversion and Hyperactivity/Inattention. The positive relationship between Extraversion and Hyperactivity/Inattention could be explained in the context of the global pandemic, and more Extroverted children and adolescents might manifest their suppressed social energy (as a result of social restriction) as Hyperactivity and Inattention symptoms.

Our results also showed that Extraversion is negatively and significantly associated with Peer Relationship Problems. Our findings are in line with earlier studies finding that adolescents who score higher in Extraversion tend to form and maintain friendships and wider social networks, and to be socially competent (Selfhout et al., 2010). Extraversion is associated with peer acceptance and friendship (Jensen-Campbell et al., 2002), better social interactions (Cheng and Furnham, 2002), sociability, and social interest (Elphick et al., 1998).

Conscientiousness

Conscientiousness predicted Total Difficulty and Hyperactivity/Inattention in 6-18-year-olds, as well as in preschoolers. This is in line with previous studies showing that Conscientiousness is associated with Inattention in children (Martel et al., 2008, 2009) and Hyperactivity-Impulsivity in adolescents (Martel et al., 2009). As explained in Study 1 discussion, a possible explanation could be that

Hyperactivity/Inattention could be associated with executive control and Conscientiousness, indicative of underlying top-down regulatory processes (Nigg, 2010).

Neuroticism

Neuroticism is positively associated with Total Difficulty score and Hyperactivity/Inattention in 6-18-year-olds. Overall, Neuroticism is directly related to psychopathology, and individuals who score higher in Neuroticism are more likely to develop Axis I psychopathology, particularly the common mental disorders including mood, anxiety, substance use disorders, and also schizophrenia, bipolar disorder, and ADHD (Gale et al., 2016). Our results are consistent with previous studies showing associations between Neuroticism and Hyperactivity/Inattention (Martel et al., 2010; Krieger et al., 2020). High Neuroticism has also been linked with the persistence of hyperactivity and inattention during adolescence (Miller et al., 2008).

Agreeableness

Agreeableness showed negative associations with Conduct Problems and Positive associations with Prosocial Behaviors. The concept of Prosocial Behavior overlaps substantially with the construct of Agreeableness and it is even sometimes considered a form of Agreeableness (Graziano and Eisenberg, 1997). Prosocial tendencies contribute to responsible and helpful behavior, constructs defining Agreeableness (Caspi et al., 2005). Agreeableness has been consistently associated with Prosocial Behaviors during childhood (Graziano et al., 1997) and adolescence (Shiner, 2000). Our results regarding the negative associations of Agreeableness with Conduct Problems are in line with previous studies (Ehrler et al., 1999; Bollmer et al., 2006; Nigg et al., 2020). Some studies have also shown that Agreeableness in childhood could predict Aggressive behavior and Conduct symptoms in adolescence (Shiner, 2000; Gleason et al., 2004).

Openness to experience

Openness to Experience is negatively and significantly associated with Hyperactivity/Inattention in 6-18-year-olds. Openness to Experience refers to the degree to which an individual actively seeks out new experiences and accepts and explores new situations (Pervin, 2003). Generally, individuals who score higher on Openness to Experience are more likely to experience higher psychological well-being (Jacobsson et al., 2021). There are some studies in adults showing a negative relationship between Openness to Experience and Hyperactivity/Inattention (Smith and Martel, 2019; Blanken et al., 2021), and some showing no associations (Krieger et al., 2020; Nigg et al., 2020). We only found one study on 8–12-year-old children, showing that children with Hyperactivity/Inattention symptoms were consistently rated as having lower Openness to Experience (Casher, 2016). A possible explanation for this negative association is that Openness to Experience is generally related to higher performance of children in school and on cognitive tests and is also related to some elements of intellect (Nave et al., 2017).

General conclusion

As of today, more than 6.6 million people have died from the coronavirus COVID-19 outbreak (Worldometers, 2022) and the global COVID-19 pandemic and the consequent economic recession and social restrictions have adversely affected the mental health of many people including children. Studies have reported various mental health problems among children and adolescents exposed to the COVID-19 pandemic, including anxiety, stress, depression, panic, irritation, impulsivity, loneliness, fatigue, and confusion (Hossain et al., 2020; Jiao et al., 2020; Theberath et al., 2022).

There are some studies showing the contribution of personality traits to well-being of adults during the pandemic (Shokrkon and Nicoladis, 2021; Lo et al., 2022; Odachi et al., 2022), however, our study seems to be the first study investigating this relationship in children. The results of our two studies showed that personality traits in children and adolescents contribute to their mental health status during the pandemic. In preschoolers, Neuroticism and Agreeableness predicted the most Difficulty subscales of SDQ, and in 6-18-year-old children, Extraversion predicted the most Difficulty subscales of SDQ. Also, Openness to Experience was the weakest predictor of mental health status in Canadian youth. Moreover, in preschoolers among the mental health subscales, the Total Difficulty score and Hyperactivity/Inattention seem to have the strongest associations with personality traits and Peer Relationship Problems have the weakest associations. In 6-18-year-olds, Total Difficulty scores and Conduct Problems are most strongly associated with personality traits, and Hyperactivity/Inattention is least strongly associated with personality traits.

In comparing the results of preschoolers and 6–18-year-old children, we can observe different patterns. Specifically, in 6–18-year-old children, Extraversion is associated negatively with 3 Difficulty subscales of SDQ, however, this association is not observed in preschool children. A possible explanation could be related to the experience of schooling that older children had. For example, it could be that more Extraverted school-aged children found more friends at school and maintained their friendships during the pandemic using the social media, as a result they were able to better maintain their positive mental health compared to more Extraverted preschoolers who did not have the experience of schooling.

There are some limitations to the current study that should be considered. Despite aiming for participants from all over Canada, the majority of our sample resided in Alberta (the province where the study was conducted). The second limitation of this study is that our data were collected only at one point in time during the second year of COVID-19, and since it was summer, people were more likely to spend time outdoors which could affect the results of our study. These limitations could limit the generalizability of our results.

Regardless of the mentioned limitations, our study has important implications, as it is necessary to understand how personality traits contribute to the mental health and well-being of children in order to provide them with mental health care that is tailored to their personality traits. The results of our study could help public health services provide mental health services that are personality-appropriate during and after this pandemic. More individually appropriate child and adolescent mental health treatment at all phases of the pandemic is an unmet urgent need for long-term mental health impacts of children and adolescents.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found below: https://figshare.com/articles/dataset/PRESCHOOL_covid_sav/22305910.

Ethics statement

The studies involving human participants were reviewed and approved by the Research Ethics Board at the University of Alberta (Pro00100751). The patients/participants provided their written informed consent to participate in this study.

Author contributions

AS was responsible for the conceptualization, data collection, and analysis as well as the manuscript composition. EN was responsible for the supervision, reviewing, and editing. 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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Emotional control and factors differentiating it in the adult population of Poland during the COVID-19 pandemic

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Introduction: The public health crisis related to the COVID-19 pandemic has had a negative impact on the mental health of both individuals and entire populations. The source of stress was not only the fear of getting sick, but also the restrictions introduced, such as: mass lockdown, the need to maintain social distance, quarantine or the mandatory use of personal protective equipment. Their introduction and maintenance caused various emotional reactions which often resulted in undesirable behavior leading to infections spreading.

The aim of the study: The aim of the study was to analyze the level of emotional control depending on selected factors related to the pandemic and the introduced restrictions.

Materials and methods: The study covered 594 adult Poles. To evaluate knowledge about COVID-19 and attitudes toward the implemented restrictions, the questionnaire prepared by the authors was used. To determine the level of control of anger, depression and anxiety the Courtauld Emotional Control Scale (CECS) was used, and to estimate the level of perceived stress the Perceived Stress Scale (PSS-10) was applied.

Results: In the entire analyzed group, the general level of emotional control was 51.82±12.26, with anxiety being the most suppressed emotion (17.95±4.99), whereas the least suppressed emotion was anger (16.35±5.15). The average stress level in the studied group was 20.5±5.3. The level of perceived stress did not differentiate the level of emotional control. It was found that the higher level of the knowledge about the pandemic and methods of prevention, the higher emotional control, especially in the anxiety subscale (high level of knowledge – 18.26±5.36 vs. low level of knowledge - 15.09±3.6; p =0.02). People reporting difficulties in reconciling remote work with home duties were less able to control anger (14.63±4.98) than people without such problems (16.71±4.12; p =0.007).

Conclusion: Proper education improving knowledge about COVID-19 and methods of prevention may enhance the control of emotions in the population. Possible future preventive measures aimed at limiting the spread of SARS-CoV-2 infections or other infectious diseases should also take into account possible excessive mental burden caused by private and professional duties.

KEYWORDS

emotional control, anger, anxiety, depression, stress, COVID-19

Introduction

The public health crisis related to the COVID-19 pandemic has had a negative impact on the mental health of both individuals and entire populations. Numerous studies conducted so far have indicated that the COVID-19 pandemic was a significant source of stress, both for the general population and various social or professional groups surveyed. It was also associated with a higher incidence of depression, anxiety, PTSD and sleep problems (post-traumatic stress disorder) (Kumar and Nayar, 2020; Dragan et al., 2021; Li et al., 2021; O'Connor et al., 2021; Fountoulakis et al., 2022; Luo et al., 2022). Initially, the main source of stress for the general public was the fear of being infected and fear for the health and life of loved ones. To protect people from the new disease, the governments of almost all countries have introduced various restrictions, such as closing state borders, mass lockdown, the need to maintain social distance, prohibition of group gatherings, quarantine or the mandatory use of personal protective equipment. The main purpose of these measures was to limit the spread of infections. The introduced restrictions resulted in large, unprecedented changes in everyday life, the way of working, teaching, learning and social functioning. Often, like sadly in the case of many people, they contributed to the loss of jobs and the deterioration of their financial situation (Vinkers et al., 2020; Fountoulakis et al., 2022).

Initially, due to the common fear of falling ill with an unknown, new disease, the introduction of restrictions met with great approval and understanding which, as they were maintained for longer, decreased and caused various negative emotional reactions (powerlessness, discouragement, sadness, anger, fear, anxiety, etc.), which often translated into denying the danger of the pandemic, undermining the sense of the introduced restrictions, rebellion in the form of deliberate non-compliance with them or spreading conspiracy theories about the pandemic or coronavirus vaccines (Czeisler et al., 2020; Hagen et al., 2022; Kim et al., 2022; Szuster et al., 2022; Turska-Kawa and Pilch, 2022; Zhang et al., 2022).

In situations where negative emotions can come to the fore, especially if they can translate into non-compliance with anti-epidemic recommendations, it seems necessary to identify factors that may affect and modify their control. On one hand, expressing negative emotions is a beneficial phenomenon which is recommended in many forms of psychotherapy, as their long-term suppression may become the basis of many psychosomatic disorders (Doliński, 2006; Juczyński, 2012; Kim et al., 2022). On the other hand, uncontrolled expression of negative emotions, especially anger and fear, may turn into aggression directed not only toward loved ones, but also other people, e.g., non-compliance with the anti-epidemic restrictions (Abadi et al., 2021). This, in turn, can make it harder to fight the spread of infection.

The aim of the study was to analyse the level of emotional control depending on selected factors related to the COVID-19 pandemic and the introduced restrictions, such as personal experience related to the pandemic, the use of preventive measures, the subjective feeling of stress during the pandemic, and knowledge about the pandemic.

Materials and methods

Study design

In the period from March to June 2021 (during the third wave of the pandemic in Poland), a cross-sectional epidemiological study on a group of adult Poles was conducted using the questionnaire designed by authors, Courtauld Emotional Control Scale (CECS) and the Perceived Stress Scale (PSS-10). These questionnaires were distributed using the Internet surveying technique CAWI (Computer Assisted Web Interview). This study was a part of another larger survey on experienced emotions related to the COVID-19 pandemic, from which it was spun off in the end of April 2021 and from that time on conducted independently.

The survey was fully anonymous and voluntary, and respondents were informed about it in the initial instructions for the survey. Respondents could opt out of the survey at any time. Inclusion criterion constituted a consent of respondent for filling out the questionnaire and age above 18. The upper age limit was not defined. Non-probability sampling technique, where subjects of the study recruit future subjects from among their acquaintances (snowball sampling), was applied. During the study 629 filled out questionnaires were collected. Twenty nine questionnaires were excluded from the analysis due to lack of completeness and failure of meeting the subjects' age criterion. Only six questionnaires were filled out by people with vocational or elementary educational level. Due to the small number of these respondents, it was decided to exclude these questionnaires from the analysis as well. Finally, the group of respondents included 594 persons, including 468 women (78.8%).

Research tools

The author's questionnaire collected the basic demographic data (gender, age, educational level, marital status, place of residence, professional status, having minors under surveillance, financial status), information on being infected with the SARS-CoV-19 virus, possible hospitalization for this reason, being in quarantine or experiencing the death of a loved one due to COVID-19. The respondents were also asked whether they lost their jobs, their earnings or working hours were reduced, they had to work more than before the pandemic or they switched to remote work due to the introduced restrictions. The questions in the author's questionnaire concerned also the issue of vaccination and the use of preventive measures by the respondents (wearing masks, keeping distance, hand disinfection, disinfection of purchased goods or leaving them in "quarantine"). With the questions: "Is COVID-19 contagious?," "How is COVID-19 transmitted?," "Can pets spread COVID-19 to human?," "Can COVID-19 be spread by insects bites?," "How can we protect ourselves from COVID-19?," "Is there a treatment to remove the cause of COVID-19?" the level of knowledge about the COVID-19 pandemic and its prevention was verified. One point was awarded for each correct answer. Respondents could score a maximum of 9 points. It was assumed that people who scored 8–9 points had high knowledge about COVID-19, those with 5–7 points had average knowledge, and those who scored 4 or less had low knowledge about COVID-19.

The Courtauld Emotional Control Scale (CECS), in the version compatible with the Polish adaptation by Juczyński, was used. This tool contains 21 sentences that are divided into 3 subscales. Each of them contains seven statements that concern the manner of showing anger, depression, and fear. The scale is designed to test adults, both healthy ones and patients, and it serves to measure respondents' control of anger, anxiety, and depression in difficult life situations. By marking the most suitable answer, respondents assess how often they express emotions in a way provided in the questionnaire on a 4-point

scale from "almost never" - 1 point to "almost always" - 4 points. For each of the subscales, results are calculated separately. The sum of the results in each of the subscales ranges within 7–28 points. After summing the results of all three subscales, a general coefficient of emotional control is obtained, which determines the researched person's conviction about their ability to control their reactions in a situation in which they experience the negative emotions. The total coefficient is in the range of 21–84 points. The higher the score, the more suppressed the emotions are. The reliability (Cronbach's alpha) of the Polish version of the CECS is 0.80 for anger control; 0.77 for depression control; 0.78 anxiety control, and 0.87 for the general coefficient of emotional control (CECS) (Juczyński, 2012).

The 10-item Perceived Stress Scale (PSS-10), developed by S. Cohen for measurement of self-perceived stress related to someone's own situation, was used. Each item is scored on a 5-point Likert scale (0-never; 4-very often). The total score ranges between 0 and 40. Higher scores reflect high stress levels. Cronbach's alpha of the Polish version of the PSS-10 is 0.86 (Juczyński and Ogińska-Bulik, 2012).

Statistical analysis

The statistical analyses were performed using the TIBCO Statistica 13.3 programme. Demographic characteristics of respondents and quality data were summarized in absolute numbers and percentage. Due to low number of respondents who declared divorced/widowed both these groups were merged. The following three categories of occupational activity were defined: employed (persons who at the time of the survey were occupationally active and had a job), students, and unemployed (respondents who at the time of the survey were not occupationally active and were not students).

The results of the Courtauld Emotion Control Scale (CECS), each subscale of the CECS and PSS-10 were demonstrated as mean values with standard deviation (SD). The Shapiro–Wilk test was applied to check normality. Distribution of all quantitative data appeared to diverge from the normal pattern, therefore methods of non-parametric statistics were used (Mann –Whitney U test and the Kruskal-Wallis test with post-hoc tests). The analysis of significance of the differences between the mean values in the compared groups was performed in observance with the rules of the chosen test. Correlation between qualitative variables were calculated using the rho-Spearman coefficient which measures the strength and direction of correlation between variables. In all of the analyses, the results were accepted as significant in cases when the probability value p was smaller than the accepted significance level 0.05 ($p < 0.05$).

Results

In our study, respondents of the female gender constituted over three quarters of the surveyed group. Almost 40% of the respondents were at the age of 18–29. The average age of the respondents was 36.4 (SD = 13.3). The majority of respondents lived in cities. Three quarters of the respondents had higher education. Most of the respondents were employed. One out of five people reported having at least one chronic disease. More than half of the respondents assessed their financial situation as good. Detailed characteristics of the respondents is given in Table 1.

TABLE 1 Sociodemographic characteristics of the analyzed group.

Variables	*n* (%)
Gender	
Female	468 (78.8%)
Male	126 (21.2%)
Age (in years)	
18–29	236 (39.7%)
30–39	130 (21.9%)
40–49	150 (25.3%)
>50	78 (13.1%)
Place of residence	
City	520 (87.5%)
Village	74 (12.5%)
Educational level	
Middle	154 (25.9%)
Higher	440 (74.1%)
Marital status	
Married	274 (46.1%)
Never married	286 (48.2%)
Divorced/widowed	34 (5.7%)
Professional activity	
Employed	386 (65.0%)
Student	140 (23.6%)
Professionally inactive	68 (11.4%)
Chronic diseases	
Yes	122 (20.5%)
No	472 (79.5%)
Minors under surveillance	
Yes	243 (40,9%)
No	351 (59.1%)
Financial status	
Very good	102 (17.2%)
Good	302 (50.8%)
Mediocre	164 (27.6%)
Bad and very bad	26 (4.4%)

The overall result of the Courtauld Emotional Control Scale (CECS) in the entire analyzed group of adults was 51.82 ± 12.26, with fear being the most suppressed emotion (17.95 ± 4.99), whereas the least suppressed emotion was anger (16.35 ± 5.15). For suppression of depression the entire group scored 17.52 points (SD = 4.74). There was no difference in emotional control between women and men, both in general coefficient (CECS) and all three subscales. Similarly, place of residence, educational level, professional activity, and financial status did not differentiate the general level of emotional control in general coefficient (CECS) and all three subscales.

The general level of emotional control was not differentiated by age, although significant differences were found in the control of anger

and depression, depending on the age of the respondents. *Post hoc* tests revealed that people aged 30–39 were significantly less able to control anger and depression compared to those aged 18–29 (respectively: $p = 0.016$, $p = 0.05$) and to control depression compared to respondents aged over 50 ($p = 0.03$). Married people inhibited anger (15.62 ± 5.13) and depression (16.88 ± 4.81) to a lesser extent, especially in comparison to divorced and widowed people (respectively: 18.36 ± 4.40; $p = 0.04$; 19.53 ± 5.06; $p = 0.04$). Statistical analysis also showed that people who had minors under surveillance suppressed anger in a significantly lower manner compared to those without children (respectively: 15.60 ± 5.11 vs. 16.87 ± 5.13; $p = 0.03$). Detailed data on the emotional control in the studied group, depending on the sociodemographic characteristics, are presented in Table 2.

In our study, 12.8% of the respondents admitted that they had been infected with COVID-19. Out of this group, only 6 people were hospitalized. The conducted statistical analyses did not show any significant impact of the COVID-19 infection or COVID-19-related hospitalization on the level of emotional control of the respondents. It was also reported that 18.2% of respondents were in quarantine at least once. These people were characterized by lower suppression of anxiety than respondents who were not subject to such an obligation (16.93 ± 4.88 vs. 18.17 ± 4.98, $p = 0.02$). Nearly 42% of the survey participants admitted that they had personally known someone who died from COVID-19. These people obtained a significantly higher general coefficient CECS (53.41 ± 12.40), as well as higher rates of anger suppression (17.05 ± 5.14) and depression suppression (18.03 ± 4.83) compared to those who did not lose a loved one due to COVID-19 ($p < 0.05$).

Respondents were also asked about the impact of the pandemic on professional issues. It was reported that 6.0% of respondents lost their jobs due to the pandemic or were forced to close their businesses. It was also found that 10.4% of the survey participants were affected by limiting activity of company in which they were employed or working part-time. The same number of people were affected by the reduction in wages. In turn, 8.4% of respondents admitted that they work more than before the pandemic. Less than 20% of respondents admitted that they faced difficulties related to the need to reconcile work and/or remote learning with home duties, including childcare. From the group of factors related to professional issues, losing a job and working more than before the pandemic were associated with significantly lower suppression of anxiety, but did not modify the suppression of anger and depression or the general index of emotional control. In turn, people experiencing difficulties in reconciling remote work with home duties achieved a significantly lower value of the general coefficient of emotional control (CECS) compared to people who did not report such difficulties (49.14 ± 11.53 vs. 52.38 ± 12.36, $p = 0.01$). Particularly large differences were visible in the anger suppression subscale. Detailed data on emotional control, depending on the difficulties experienced during the pandemic are presented in Table 3.

A quarter of the surveyed participants admitted that they had been vaccinated against the SARS-CoV-2 virus. These people were characterized by a significantly higher level of depression suppression (18.17 ± 4.11) compared to those who had not been vaccinated (17.32 ± 4.57; $p = 0.04$). Differences in overall CECS score and suppression of anger and anxiety between vaccinated and unvaccinated subjects were not statistically significant. Out of the group of people who were not vaccinated at the time of the study, almost half declared their willingness to be vaccinated as soon as possible. These people obtained higher values of both the general CECS emotion control coefficient and in all subscales, but the differences were not statistically significant. Over 93% of respondents admitted that they always wear masks in public places, none of the respondents declared that they never wear masks in such places. It was reported that 67.7% of participants declared wearing a mask at all times in public places, such as streets, parks, etc. The frequency of using masks in public outdoor and indoor places did not differentiate the level of emotional control in terms of any of the analyzed factors.

The obligation to maintain social distance in public spaces was always or almost always obeyed by 63.3% of respondents. In the case of outdoor public places, social distancing was always or almost always observed by slightly more than half of the respondents. People who never respected social distancing, both indoors and outdoors, had lower average values of all indicators of emotional control, but only in the case of anger suppression, the existing differences between those, who kept their distance in outdoor public places and those who never did so, were statistically significant ($p = 0.03$). Almost 60% of respondents declared that they always or almost always disinfect their hands before entering public spaces. The use of this prophylactic measure did not differentiate either the general coefficient of emotional control or anger suppression, depression suppression, and anxiety suppression. Similarly, the level of emotional control was not differentiated by the disinfection or leaving purchased goods in "quarantine," which was always or almost always done by 18.2% of participants. Detailed data on the level of emotional control depending on the frequency of using various preventive measures limiting the spread of SARS-CoV-2 infections are presented in Table 4.

The average perceived stress level in the studied group was 20.5 ± 5.3. The level of perceived stress did not differentiate the general coefficient of emotional control ($R = -0.022912$; $p = 0.6$), anger suppression ($R = -0.078530$; $p = 0.05$), depression suppression ($R = 0.055603$; $p = 0.2$) and anxiety suppression ($R = -0.033698$; $p = 0.4$).

In the test of knowledge about COVID-19 and measures of its prevention, the average number of points scored was 7.29 ± 1.59. More than half of participants (56.9%) scored 8 and 9 points in the knowledge test. The average level of knowledge on these aspects characterized 36.4% of participants of the study, and four or less points were obtained by 6.7% of the participants. Statistical analysis revealed that the higher level of knowledge, the higher value of the general coefficient of emotional control and the anger and anxiety suppression indexes. *Post hoc* tests indicated the existence of statistically significant differences in the general coefficient of emotional control between people with low level of knowledge and respondents with high level of knowledge about COVID-19 (45.67 ± 11.76 vs. 52.95 ± 11.63). People with low level of knowledge were characterized by low suppression of anger and anxiety (14.43 ± 5.67 and 15.09 ± 3.60, respectively) compared to people with average and high knowledge. The Spearmann rho correlation coefficient between the general coefficient CECS and knowledge about COVID-19 was 0.2318 at $p = 0.001$, for the subscale of anger suppression: $R = 0.2336$ at $p < 0.0001$, and for the subscale of anxiety suppression: $R = 0.2169$ at $p = 0.003$. The analysis showed no correlation between the level of knowledge and the depression suppression subscale. Detailed data are presented in Table 5.

TABLE 2 Emotional control of the studied group depending on sociodemographic data.

	General coefficient CECS		Anger suppression		Depression suppression		Anxiety suppression	
	Mean value ±SD	*p* value	Mean value ±SD	*p* value	Mean value ±SD	*p* value	Mean value ±SD	*p* value
Gender								
Women	51.34 ± 12.39	0.1	16.13 ± 5.15	0.1	17.41 ± 4.83	0.3	17.80 ± 5.09	0.3
Men	53.60 ± 11.70		17.19 ± 5.10		17.92 ± 4.36		18.49 ± 4.57	
Age (in years)								
18–29	53.14 ± 11.45	0.07	17.25 ± 5.09	**0.02**	18.04 ± 4.53	**0.03**	17.85 ± 4.93	0.5
30–39	48.85 ± 12.37		14.89 ± 5.27		16.35 ± 4.93		17.60 ± 4.70	
40–49	50.87 ± 11.66		15.92 ± 4.84		16.99 ± 4.41		17.96 ± 4.98	
>50	54.64 ± 14.63		16.92 ± 5.28		18.90 ± 5.21		18.82 ± 5.70	
Place of residence								
City	51.65 ± 12.40	0.5	16.32 ± 5.23	0.6	17.54 ± 4.79	0.9	17.80 ± 4.99	0.1
Village	53.00 ± 11.35		16.59 ± 4.63		17.38 ± 4.35		19.03 ± 4.95	
Educational level								
High	51.36 ± 12.26	0.3	16.07 ± 5.05	0.6	17.30 ± 4.66	0.9	17.99 ± 5.00	0.1
Middle	53.14 ± 12.25		17.17 ± 5.38		18.13 ± 4.92		17.84 ± 4.99	
Marital status								
Never married	52.63 ± 11.43	0.08	16.82 ± 5.17	**0.02**	17.89 ± 4.55	**0.03**	17.92 ± 4.85	0.9
Married	50.40 ± 12.89		15.62 ± 5.13		16.88 ± 4.81		17.91 ± 5.13	
Divorced/widowed	55.06 ± 11.76		18.36 ± 4.40		19.53 ± 5.06		18.59 ± 5.21	
Professional activity								
Student	53.37 ± 10.56	0.4	17.34 ± 4.80	0.1	18.06 ± 4.65	0.5	17.97 ± 5.02	0.9
Employed	51.43 ± 12.36		16.13 ± 5.12		17.41 ± 4.66		17.89 ± 4.97	
Professionally inactive	50.85 ± 14.79		15.59 ± 5.88		17.00 ± 5.36		18.26 ± 5.18	
Chronic diseases								
Yes	50.43 ± 13.48	0.4	15.62 ± 5.29	0.2	17.05 ± 5.15	0.6	17.75 ± 5.10	0.7
No	52.18 ± 11.93		16.54 ± 5.11		17.64 ± 4.63		18.00 ± 4.97	
Minors under surveillance								
Yes	50.78 ± 12.99	0.2	15.60 ± 5.11	**0.03**	17.10 ± 4.98	0.2	18.07 ± 5.23	0.5
No	52.54 ± 11.71		16.87 ± 5.13		17.81 ± 4.55		17.86 ± 4.83	
Financial status								
Very good	52.86 ± 12.50	0.2	16.71 ± 5.39	0.7	17.33 ± 4.94	0.09	18.82 ± 4.93	0.2
Good	50.42 ± 11.79		15.95 ± 4.85		16.97 ± 4.55		17.50 ± 5.03	
Mediocre	53.44 ± 12.95		16.79 ± 5.55		18.50 ± 4.76		18.15 ± 5.07	
Bad and very bad	53.77 ± 11.66		16.92 ± 5.27		18.38 ± 5.24		18.46 ± 4.03	

SD – standard deviation; Statistically significant differences have been marked in bold.

Discussion

The aim of this study was to examine the level of emotional control in a group of adult Poles during the third wave of the COVID pandemic and the restoration of many anti-epidemic restrictions. Previous studies on emotional control during the pandemic were conducted in a group of healthcare professionals and nursing students. However, these surveys did not include the general population. Therefore, similar analysis conducted in the group of general population may shed a new light upon the current state of knowledge in this area of research.

In a study by Bidzan et al. (2020) which was conducted in the first days after the declaration of a pandemic in Poland among hospital employees, the average level of emotional control was 49.74. In turn, in both studies by Malinowska-Lipień et al. (2021a,b), conducted among nurses during the second wave of the pandemic in Poland, the average level of emotional control was much higher and oscillated around 54. On the other hand, the average level of emotional control

TABLE 3 The level of emotional control in the studied group depending on the selected experiences related to the COVID-19 pandemic.

	General coefficient CECS		Anger suppression		Depression suppression		Anxiety suppression	
	Mean value ±SD	*p* value	Mean value ±SD	*p* value	Mean value ±SD	*p* value	Mean value ±SD	*p* value
COVID-19 infection								
Yes (*n* = 76)	51.82 ± 12.42	0.9	17.00 ± 5.30	0.2	17.39 ± 4.94	0.8	17.42 ± 4.82	0.3
No (*n* = 518)	51.83 ± 12.23		16.27 ± 5.12		17.55 ± 4.71		18.02 ± 5.01	
Hospitalization due to COVID-19								
Yes (*n* = 6)	47.67 ± 4.59	0.4	16.33 ± 1.37	0.9	15.33 ± 2.25	0.1	16.00 ± 2.68	0.2
No (*n* = 70)	52.52 ± 12.87		16.31 ± 5.40		18.13 ± 5.04		18.08 ± 5.38	
Being in quarantine								
Yes (*n* = 108)	50.44 ± 12.21	0.2	16.04 ± 4.97	0.5	17.48 ± 4.88	0.9	16.93 ± 4.88	**0.02**
No (*n* = 486)	52.14 ± 12.24		16.43 ± 5.19		17.54 ± 4.70		18.17 ± 4.98	
Death of a loved one due to COVID-19								
Yes (*n* = 249)	53.41 ± 12.40	**0.006**	17.05 ± 5.14	**0.005**	18.03 ± 4.83	**0.02**	18.33 ± 4.95	0.08
No (*n* = 345)	50.60 ± 11.99		15.85 ± 5.12		17.13 ± 4.63		17.62 ± 4.98	
Loss of job/closure of business								
Yes (36)	49.00 ± 11.32	0.1	16.44 ± 4.59	0.7	16.94 ± 4.96	0.6	15.61 ± 4.38	**0.03**
No (558)	52.00 ± 12.32		16.35 ± 5.19		17.56 ± 4.73		18.10 ± 4.99	
Limitation of job activities / reduction of work hours								
Yes (*n* = 62)	51.97 ± 10.14	0.9	16.97 ± 4.89	0.3	17.74 ± 4.83	0.7	17.26 ± 4.22	0.2
No (*n* = 532)	51.80 ± 12.50		16.28 ± 5.19		17.50 ± 3.82		18.02 ± 5.06	
Increased workload								
Yes (50)	48.60 ± 9.77	0.2	15.52 ± 4.27	0.4	16.64 ± 3.98	0.3	16.44 ± 3.82	**0.02**
No (544)	52.12 ± 12.44		16.43 ± 5.23		17.60 ± 4.80		18.09 ± 5.07	
Reduction of earnings								
Yes (62)	52.48 ± 14.37	0.7	17.19 ± 5.30	0.3	17.61 ± 5.50	0.9	17.68 ± 5.22	0.7
No (532)	51.74 ± 12.02		16.25 ± 5.14		17.51 ± 4.65		17.98 ± 4.97	
Remote work								
Yes (160)	51.27 ± 10.91	0.6	15.87 ± 4.79	0.3	17.22 ± 4.21	0.4	18.17 ± 4.47	0.7
No (434)	52.02 ± 12.74		16.53 ± 5.28		17.63 ± 4.92		17.87 ± 5.17	
Difficulties in reconciling remote work/learning with home duties								
Yes (102)	49.14 ± 11.53	**0.01**	14.63 ± 4.99	**0.007**	17.12 ± 4.38	0.4	17.39 ± 4.73	0.2
No (492)	52.38 ± 12.36		16.71 ± 5.12		17.60 ± 4.81		18.07 ± 5.04	

SD – standard deviation; Statistically significant differences have been marked in bold.

in a group of nursing students, in a study conducted at a similar time as research described in the present study, was about 51points in Poland, 51.40 in Spain and 52.69 in Slovakia (Kupcewicz et al., 2022a,b). The result obtained in this study (51.82) indicated an average level of emotional control and was comparable to the above-mentioned studies. However, the obtained result was slightly higher than the values obtained during the standardization tests of the CECS questionnaire, which were carried out in 1998 in the general population (Juczyński, 2012). In those studies, the average general coefficient of emotional control for women was 49.97, and for men 51.42 (in this study: 51.34 and 53.6, respectively). The higher value of the general coefficient of emotion control in this study, compared to normalization studies, resulted primarily from a slightly greater suppression of depression in both genders (women: 17.41 vs. 16.88, men: 17.92 vs. 16.85) and anger by men (17.19 vs. 16.19). The level of anxiety suppression during both studies was at a similar level. Existing differences in emotion control between genders, similarly to normalization studies but opposite to study by Malinowska-Lipień et al. (2021b), were not statistically significant.

The results of normalization studies clearly indicated the intensification of subjective control of all three emotions with age (Juczyński, 2012). This conclusion is only partially consistent with the results obtained in this study which showed that the lowest suppression of anger and depression was found in people aged 30–39 years old. It is probably related to having small children, and the need to combine remote work with looking after them when nurseries and kindergartens were closed (which took place during the study). Respondents reporting difficulties in combining these two

TABLE 4 Level of emotional control depending on application of prophylactic measures.

	General coefficient CECS		Anger suppression		Depression suppression		Anxiety suppression	
	Mean value ±SD	*p* value	Mean value ±SD	*p* value	Mean value ±SD	*p* value	Mean value ±SD	*p* value
Vaccination against COVID-19								
Yes (*n* = 146)	53.07 ± 11.94	0.2	16.68 ± 5.05	0.4	18.17 ± 4.11	**0.04**	18.22 ± 4.90	0.4
No (*n* = 448)	51.43 ± 12.33		16.26 ± 5.18		17.32 ± 4.57		17.85 ± 5.01	
Willingness to vaccinate at the earliest convenience								
Yes (*n* = 269)	52.37 ± 12.44	0.2	16.62 ± 5.19	0.2	17.59 ± 4.71	0.1	18.16 ± 5.02	0.2
No (*n* = 88)	50.41 ± 13.81		16.50 ± 5.33		16.59 ± 5.10		17.32 ± 5.49	
I do not know (*n* = 91)	50.68 ± 10.36		15.62 ± 4.94		17.33 ± 4.80		17.73 ± 4.39	
Wearing a mask in indoor public places								
Always or almost always (*n* = 556)	51.83 ± 12.16	0.9	16.37 ± 5.20	0.9	17.55 ± 4.69	0.6	17.92 ± 4.95	0.7
Sometimes or occasionally (*n* = 38)	51.63 ± 14.01		16.16 ± 4.41		17.05 ± 5.49		18.42 ± 5.59	
Wearing a mask in outdoor public places (streets, parks etc.)								
Always or almost always (402)	52.06 ± 11.87	0.3	16.47 ± 5.11	0.2	17.49 ± 4.64	0.8	18.10 ± 4.71	0.3
Sometimes or occasionally (140)	51.93 ± 12.83		16.60 ± 5.24		17.87 ± 4.72		17.46 ± 5.39	
Never or almost never (52)	50.40 ± 13.65		15.12 ± 5.02		16.76 ± 5.67		18.52 ± 5.66	
Keeping distance in outdoor public places								
Always or almost always (314)	51.72 ± 12.78	0.2	16.39 ± 5.15	**0.03**	17.38 ± 4.81	0.7	17.94 ± 5.05	0.4
Sometimes or occasionally (196)	53.02 ± 10.88		17.03 ± 5.16		17.93 ± 4.44		18.06 ± 4.74	
Never or almost never (84)	49.85 ± 13.02		14.80 ± 4.78		17.07 ± 5.19		17.98 ± 5.23	
Keeping distance in indoor public places								
Always or almost always (376)	52.06 ± 12.72	0.9	16.54 ± 5.06	0.7	17.52 ± 4.73	0.7	18.00 ± 5.14	0.7
Sometimes or occasionally (184)	52.03 ± 13.09		16.65 ± 5.09		17.34 ± 4.69		18.04 ± 4.48	
Never or almost never (34)	51.27 ± 11.23		15.92 ± 5.38		18.47 ± 5.21		16.88 ± 6.01	
Hand disinfection before entering public facilities								
Always or almost always (350)	53.97 ± 14.37	0.4	17.23 ± 6.35	0.2	18.67 ± 5.24	0.3	18.08 ± 6.02	0.8
Sometimes or occasionally (166)	51.95 ± 11.99		16.54 ± 5.04		17.33 ± 4.67		18.09 ± 4.59	
Never or almost never (78)	50.53 ± 11.75		15.54 ± 4.69		17.38 ± 4.61		17.60 ± 5.31	
Disinfection or leaving purchased goods in "quarantine"								
Always or almost always (108)	54.02 ± 12.69	0.2	17.07 ± 5.10	0.4	18.04 ± 4.86	0.2	18.91 ± 4.67	0.2
Sometimes or occasionally (162)	50.00 ± 12.33		15.90 ± 5.03		16.80 ± 5.04		17.30 ± 4.67	
Never or almost never (324)	52.00 ± 12.02		16.34 ± 5.23		17.70 ± 4.52		17.96 ± 5.22	

SD – standard deviation; Statistically significant differences have been marked in bold.

duties were significantly less likely to inhibit the feeling of anger. Remote work itself did not translate into differences in emotional control. Low suppression of anger in this particular group of people is not surprising. Anger is a feeling that can provide a sense of control. The individual can at least blame others (e.g., government), which is a state of mind that may be preferred to uncertainty: not knowing what will happen next (Abadi et al., 2021). The studies conducted so far clearly indicated that restrictions in the form of a deep lockdown accompanied by the transfer of parents to remote work from home and children to home (remote) learning have a deep and complex impact on families. Parenting challenges are compounded by the demands of working from home, economic hardships and layoffs, and social restrictions imposed on parents. It is believed that the profound changes in daily family life caused by the pandemic may fuel parental stress and family tensions (Clemens et al., 2020; Cluver et al., 2020; Calvano et al., 2022). In order to prevent this, it is necessary to develop effective and tailored family support programs, so that stress and emerging negative emotions do not find an outlet in the form of aggressive, violent behavior (Prokupek et al., 2023).

Similarly to results obtained by Malinowska-Lipień et al. (2021a) it was not found that the COVID-19 infection modified the level of emotional control. Out of the experiences related to the pandemic, only the death of a loved one due to COVID-19 significantly modified emotional control. The death of a loved one is one of the strongest life stressors. People who experienced the death of loved ones are characterized by a significant deterioration in physical and mental

TABLE 5 Level of emotional control in the studied group and knowledge on COVID-19 pandemic.

Level of COVID-19 knowledge	General coefficient CECS		Anger suppression		Depression suppression		Anxiety suppression	
	Mean value ±SD	*p* value	Mean value ±SD	*p* value	Mean value ±SD	*p* value	Mean value ±SD	*p* value
Low (≤ 4 points) ($n = 40$)	45.67 ± 11.76	**0.02**	14.43 ± 5.67	**0.03**	16.14 ± 5.39	0.09	15.09 ± 3.60	**0.02**
Average (5–7 points) ($n = 216$)	51.45 ± 12.87		15.97 ± 5.09		17.22 ± 4.85		18.26 ± 5.36	
High (8–9 points) ($n = 338$)	52.95 ± 11.63		16.92 ± 5.07		17.94 ± 4.52		18.09 ± 4.74	

Correlation
COVID-19 knowledge – general coefficient CECS: $R = 0.232$; $\boldsymbol{p = 0.001}$.
COVID-19 knowledge - anger suppression: $R = 0.234$; $\boldsymbol{p = 0.0009}$.
COVD-19 knowledge – depression suppression: $R = 0.167$; $p = 0.054$.
COVID-19 knowledge – anxiety suppression: $R = 0.217$; $\boldsymbol{p = 0.004}$.
SD – standard deviation; Statistically significant differences have been marked in bold.

well-being and social functioning, which may persist up to 4 years after the loss of a loved one (Liu et al., 2019).

The level of emotional control was positively correlated with the level of knowledge about COVID-19 and its preventive measures. Knowledge and awareness of the threats caused by COVID-19 (e.g., by experiencing the death of a loved one due to COVID-19) enhances greater suppression of emotions. Lack of knowledge translates into a lack of understanding of the introduced restrictions and their long maintenance (Miller et al., 2021; Rahman et al., 2022). This results in a lower level of emotional control which may be a reason to undermine the introduced restrictions and not comply with them. In the conducted research, it was noted that there was a tendency to lower suppression of emotions by people who never or almost never complied with the mandatory restrictions, especially in terms of keeping distance and hand disinfection, with statistically significant differences found only in the case of anger suppression depending on keeping distance in outdoor public places.

Controlling emotions also means being emotionally correct and it is a trait of highly socialized and highly educated individuals who rigidly adhere to social norms. Greater emotional control among people with higher knowledge may not mean suppressing them, but rather making an effort to reduce negative emotions appearing in a stressful situation, i.e., it is a manner of coping with stress. In other words, emotional arousal is slightly suppressed in order to take more constructive actions to change the stressful situation (Averill, 2004; Kappas, 2013; Janowski et al., 2014; Liu et al., 2023). In the case of pandemic, it may mean complying with the imposed restrictions in order to deal with the threat faster and return to normal life. It may also explain the lack of correlation in the studied group between the level of experienced stress and the level of emotional control. For some of the respondents, the reaction to high levels of stress will be expressing emotions (low suppression), for others inhibiting them. This suggestion, of course, needs to be verified in subsequent studies. In this study, strategies for coping with stress were not tested, and only such a study could clearly explain the observed relationships. Nevertheless, it seems that educational campaigns should be organized to explain in a simple, straightforward and calm way the threats related to the spread of the SARS-CoV-2 virus and the reasons for introducing certain restrictions. Increasing knowledge on this aspect may improve emotional control, not in the context of suppressing emotions, but rather as a way of coping with a difficult situation.

However, it is worth to acknowledge some potential limitations of the study. First, the research relies on self-report measures, which may introduce response biases and potential inaccuracies. Additionally, the study included only the adult population in Poland. It may affect the overall representativeness of the results. Limitations of the study include also the overrepresentation of people with high educational level and women among respondents. It should be noted that the study was conducted in the form of an online survey. This way of conducting research has some disadvantages that should be taken into account and which may affect the representativeness of the results too. These include, among others, exclusion from the study of people without access to the Internet, therefore the study includes people who are relatively wealthy, with higher than average knowledge on technology, and younger. Older people have less access to the Internet or are less familiar with it than younger people. Similarly, people with lower levels of education also have lower Internet access and computer skills. For this reason, the results and conclusions drawn from this study relate only to the studied group of respondents. There is no possibility of generalizing the obtained results onto the entire population (country or region), other contexts or age groups. However, both the results and the conclusions of the study can be treated as signal information, providing a basis for conducting similar studies in larger groups.

Moreover, many other factors may influence the emotional control. These factors include: type of personality, level of sociability, existence of mental disorders, strategy to cope with stress and physical activity (Janowski et al., 2014; Gogola et al., 2021; Markofski et al., 2022). These factors were not analyzed in this study. However, their potential impact on the observed results should be taken into account.

Conclusion

Proper education aimed at improving knowledge about COVID-19 and methods of prevention may enhance the control of emotions in the population. Possible future preventive measures aimed at limiting the spread of SARS-CoV-2 infections or other infectious diseases should also take into account possible excessive mental burden caused by private and professional duties.

Data availability statement

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

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

Author contributions

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

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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Impact of COVID-19 on employment: sociodemographic, medical, psychiatric and neuropsychological correlates

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Introduction: Given the nature of the persistent physical and neuropsychiatric symptoms reported in the literature, among individuals after acute COVID illness; there is growing concern about the functional implications of the Post-Acute Sequelae of COVID-19 (PASC). We aim to evaluate associations of sociodemographic, medical, psychiatric and neuropsychological factors with employment status post COVID-19.
Methods: 59 participants were administered a neuropsychiatric assessment and queried about employment status and occupational difficulties months after quarantine. Two levels of comparison were conducted: (1) Those who took time off work (TTO) to those with no time off (NTO); (2) Those who reported occupational performance suffered (PS) to those who did not (PDNS).
Results: TTO vs. NTO exhibited extensive differences across medical, psychiatric and neurocognitive domains. PS vs. PDNS differed on subjective measures of physical and cognitive symptoms, but not on objective testing.
Conclusion: Individuals who took time off beyond COVID-19 quarantine experience persistent physical, psychiatric, subjective and objective neurocognitive burden. In contrast, occupational impairment appears to reflect subjective complaints, but not objective measures. Clinical implications are discussed.

KEYWORDS

post-acute sequelae of COVID-19 (PASC), long covid, employment, employment impact, neuropsychiatric outcomes

1. Introduction

As the SARS-CoV-2 pandemic continues, there have been emerging concerns about the long-term impact of COVID-19, particularly the implications of long-term or persistent symptoms now known as the Post-Acute Sequelae of COVID-19 (PASC), commonly known as "Long COVID", or "Post-COVID Syndrome." Patients suffering from PASC describe their symptoms as both chronic and debilitating. As such, there have been calls to action in the popular press and among those in the field for more research investigating the prevalence and characteristics of this sequela (1–3). The World Health Organization has defined PASC "as the illness that persists after confirmed or suspected COVID-19 infection, usually within 3 months of infection onset, and with symptoms or effects that last at least 2 months with no other probable cause." Extensive literature has

characterized PASC's most commonly reported symptoms; muscle pain, weakness, dyspnea, fatigue, depression, PTSD, anxiety, sleep disturbance and impaired concentration, attention, and memory, among others (4–6). In their meta-analysis, Zeng et al. 2022 estimated that of 1,285,407 participants across 151 studies, one fifth of recovered COVID patients demonstrated psychiatric symptoms 12 months after recovery.

Given the nature of both the physical and neuropsychiatric symptoms reported in the literature, there is growing concern about the functional implications of PASC. One such concern is the impact of PASC on employment. The studies investigating the impact of PASC on patients' ability to work have fallen into three broad categories: (1) the impact of PASC on employment in patients hospitalized for their acute COVID illness, (2) the impact of PASC on employment in patients not hospitalized for their acute COVID illness, and (3) the impact of PASC on employment independent of acute COVID severity.

A large proportion of the literature focused on patients who had been hospitalized throughout the United States and Europe. Although one might hypothesize that due to increased disease severity, patients might have increased occupational impact, in most studies, a majority of previously employed hospitalized patients had returned to work by time of follow-up. Of hospitalized patients previously employed, 40%–69.1% reported returning to work within 1–7 months of follow-up (5, 7–9). However, other studies reported rates as high as 40% of hospitalized (8) and 44.8% of patients admitted to critical care (7) had not yet returned to work at the time of follow-up. In one new study, among those hospitalized who had not returned to work following discharge, 37.5% of those were currently on sick leave, 15% had been furloughed, and 2.5% were newly retired (9).

Fewer studies have focused on the occupational impact of PASC in those with mild, acute COVID symptoms. One Swedish study compared the difference in symptoms and functional impairment after mild COVID infection between healthcare workers who were continually seropositive to those who were continually seronegative for the SARS-CoV-2 IgG antibody throughout 8 months of follow-up (6). Notably, 11% of the seropositive cohort reported at least 1 severe symptom lasting 8 months or more, in addition to moderate to marked disruption in functional impairment on the patient-reported Sheehan Disability Scale, which compared to only 2% of the seronegative cohort (6). Moreover, 8% of the seropositive cohort reported moderate to marked disruption in their work-life due to long-term symptoms, in contrast to 4% of the seronegative cohort (6).

The literature investigating the employment impact of PASC independent of acute COVID severity, in general, reported that 11.5%–31% of participants were not working at 1–7 months follow-up (4, 10, 11). Of patients who had taken sick leave or paid time off of employment, one study reported that 66.1% of participants were on sick leave 1 month (12), 13.3% were on sick leave for at least 12 weeks (12) and 9% remained on sick leave throughout 4 months of follow-up (12). Others found 70% of participants on paid time off employment for 13 weeks or more (13).

While it is critical to understand the impact PASC has had on people's ability to return to work, it is equally important to understand how PASC has impacted occupational performance once individuals have returned. Among participants hospitalized for their acute COVID illness, 25% and 5% reported reduced hours or modified job responsibilities upon returning to work following hospital discharge (8, 9). In comparison, 45% of participants who had returned to work in studies independent of acute COVID severity reported requiring reduced hours after their acute illness (4). Likewise, 38.9% of patients across both hospitalized and non-hospitalized groups reported marked impairment upon return to work (10), whereas 8% of patients non-hospitalized with mild symptoms reported the same (6). Consistent with impaired performance at work, studies across varying severity of acute COVID illness reported that 11.8%–50% of patients experienced new or worsening, diminished activities of daily life (8, 10). While there is variability in the data presented, it is clear from the literature above that PASC substantially impacts both people's ability to return to employment and their occupational performance once they have returned.

As part of an ongoing study of the neuropsychiatric sequelae of PASC, we conducted an in-depth assessment of neuropsychological, medical, and psychiatric status. In addition, we inquired about employment status, time away from work after acute COVID infection, and self-attributed reasons for subjective impairment in occupational performance. From this data, we aimed to address some of the existing gaps in the literature about specific determinants of time away from work and functional impairment while at work. Our primary questions were:

1. What are the patterns and reasons for taking time off of work, as well as the factors that affect current work performance in the months after recovery from acute COVID-19?
2. How do individuals who took time off work beyond COVID quarantine compare to those who took no time off in terms of sociodemographic, medical, psychiatric and neuropsychological factors?
3. How do individuals who are currently working at the time of assessment and who say that their work performance has suffered differ from those who do not feel that their performance has suffered?

2. Methods

This study was conducted at New York Medical College/ Westchester Medical Center Health Network (WMC Health), in Valhalla, NY. It was approved by the Institutional Review Board of New York Medical College (Protocol #14400) as well as the WMC Health Clinical Research Institute. Data were obtained from the baseline assessment of participants recruited for a longitudinal study of neurocognitive, medical, and psychiatric sequelae of COVID-19. Participants were recruited via social media, flyers, email chains, and word-of-mouth. A subset of patients seeking care for "brain fog" were referred from the WMC Health Post-COVID-19 Recovery Program. All interested persons were screened via telephone to determine eligibility for participation by investigators (SL, SS) based on the following criteria: (1) Age at least 20 years old; (2) documented positive

COVID-19 nasopharyngeal test or positive antibody test prior to vaccination; (3) recovered from acute COVID-19 infection as per CDC recommendations (10–20 days after symptom onset and 24 h without fever); (4) completed minimum 8th grade education; (5) fluent in English; and (6) capable of signing informed consent. Persons with a prior diagnosis of a major neurocognitive disorder, traumatic brain injury with loss of consciousness, uncorrected visual/hearing deficits, intellectual disability, or unstable psychiatric symptoms were excluded.

Eligible participants met with the study assessors (SL, SS) who were trained to perform and score the assessment battery by co-PI (RD), a board-certified Neuropsychologist, and were supervised by the study PI (SF). During this visit, signed informed consent was obtained. Participants were compensated $40.00 for their time.

2.1. Study Measurements and Instruments

Sociodemographic measures included age, gender, race, relationship status, years of education and current employment.

Employment information collected included employment status pre-COVID illness, time taken off work, length of time away from work, self-reported reasons for taking time off, current employment status, current hours working, FMLA, disability, interest in returning to work, performance at work, self-attributed reasons for impaired performance at work and termination of employment questions. The questions related to employment were adapted from studies investigating determinants of employment in HIV infection (14, 15). Occupational Skill level was classified according to the International Standard of Occupations-08 (ISCO-08) (16).

Medical measures included self-reported medical history, including acute COVID-19 symptoms, treatment, and hospitalization, time since diagnosis and number of non-COVID medical comorbidities. COVID-19 symptom severity at the time of acute infection as well as at the time of the study appointment was determined by score on an instrument adapted from published CDC COVID-19 symptoms, assessing severity (absent, mild, moderate, severe) on 11 COVID-19 symptoms, which is scored from 0 to 33 (17). Participants were also administered the Lawton-Brody Instrumental Activities of Daily Living Scale (IADL) which measures increasing difficulty with practical aspects of everyday functioning on a scale of 0–8 (18), and the 11-item Chalder Fatigue Scale (CFS-11), which measures the severity of both mental and physical fatigue and is scored from 0 to 33. A cutoff score of >21 is considered clinically significant fatigue (19).

Psychiatric measures included pre-COVID-19 psychiatric and substance use disorder (SUD) history, current psychiatric medication use and self-report questionnaires to assess current psychiatric symptoms and disorders. Self-report questionnaires included the Patient Health Questionnaire-9 (PHQ-9), which queries DSM-IV major depression criteria and has a maximum score of 27 (20); the Endicott Quality of Life Enjoyment and Satisfaction Scale (Q-LES-Q), which queries overall life satisfaction in 14 areas and has a raw score range of 0–70 (21); the Post Traumatic Stress Disorder Checklist for DSM-5 (PCL-5) which has a maximum score of 80 (22); and the Generalized Anxiety Disorder-7 (GAD-7) questionnaire, which is scored from 0 to 21 (23). Scores on the questionnaires were categorized based on cut-off values in the medical literature. For PHQ-9, a score of ≥10 may indicate clinically significant depressive symptoms (20); for GAD-7, a score ≥10 indicates clinically significant anxiety symptoms (23); for PCL-5, a score of ≥33 indicates clinically significant PTSD symptoms (22).

The neuropsychological battery consisted of measures assessing specific cognitive domains that have been implicated in other infectious and clinical disease states (24–28). The battery included the Test of Premorbid Function (TOPF), to obtain an estimate of pre-COVID-19 intellectual function (29). Participants also completed the Patient Assessment of Own Function (PAOF), which queries subjective cognitive complaints yielding an average score of 0–5 for memory, language and communication, handedness, sensory-perception, and cognitive/intellectual functioning (30). For the study, the PAOF subscales most associated with everyday cognitive functioning, including memory, language and cognitive/intellectual/executive functioning served as measures of subjective cognitive complaints. Participants were administered neuropsychological tests assessing attention; auditory/verbal and visual immediate and delayed memory; visuospatial and constructional abilities; psychomotor speed; language; and executive function. The battery included the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) Form A (total and 5 subscale scores) (31) and Montreal Cognitive Assessment (MoCA) (32). RBANS scores were converted to standardized t-scores for analysis and MoCA total and subscale scores were utilized.

Analyses were conducted on a sample of 59 participants across two domains: (1) correlates and predictors of taking time off after the quarantine period, and (2) self-reported difficulties of current occupational functioning among participants currently working at time of assessment. The first domain was subcategorized into two cohorts: those who "Took Time Off" (TTO) and those who did not take time off or the "No Time Off" (NTO). The TTO cohort included individuals who took time off work for their long COVID symptoms beyond the required quarantine period, whereas the NTO cohort, included individuals who returned to work directly after the required COVID quarantine period. We compared sociodemographic characteristics, employment measures, and self-reported reasons for taking time off, medical metrics, psychiatric metrics, and neuropsychological testing metrics.

The second domain, in which we assessed the self-reported difficulties of current occupational functioning in long COVID patients currently working, was similarly was categorized into two cohorts—"Performance Suffered" (PS) and "Performance Did Not Suffer" (PDNS). The PS cohort included individuals who were currently working and previously employed prior to acute COVID infection but felt their occupational performance had suffered upon return from their acute illness due to their long COVID symptoms. The PDNS cohort, in turn, included individuals that were currently working but did not feel their occupational performance had suffered upon returning to work after their acute illness. We again compared the two cohorts on

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sociodemographic characteristics, employment measures, medical metrics, psychiatric metrics, neuropsychological testing metrics, and self-reported reasons of impaired occupational performance.

Data were analyzed using SPSS software (33). These included descriptive statistics (frequency, mean, standard deviation); Chi-square for group comparisons on categorical variables; independent and one-sample *t*-tests and analysis of covariance (ANCOVA) for group comparisons on continuous variables. Significant group differences in variables such as age and number of medical comorbidities were employed as covariates in group comparisons. Logistic regression with backward elimination was used to identify independent predictors of taking time off work. Variables within each measurement domain that bore the strongest difference between TTO and NTO groups were utilized as independent variables.

3. Results

3.1. Sociodemographic characteristics of entire sample

This study had a total of $N = 59$ participants recruited from both Post-COVID Recovery Program and community populations with 59.3% recruited in clinic and 40.7% recruited from the community. Participants had an average age of 42 years with 69.5% identifying as female and 30.5% as male. A majority of participants identified as White (71.2%), followed by Hispanic (13.6%), African American (6.8%), Asian/South Asian (6.8%) or, other (1.7%). Most participants (71.2%) indicated they were in a relationship or married, and all participants were living in a home or apartment. Participants had similar levels of education and had comparable occupational skill level as classified by the ISCO-08, with 61% of participants falling under the broad skill level 3 and 4 which is predominantly categorized as professionals.

3.2. Employment characteristics

Of participants previously employed prior to COVID illness (**Table 1** and **Supplementary Figure S1**), just over three-fourths reported being currently employed at the time of assessment. Over half of those previously employed reported currently working full time, and 16.9% of participants reported working part-time or less. Of those currently working almost half felt their employment performance had suffered since their return and 18.6% participants reported decreased hours. Ten previously employed participants reported not working at the time of assessment, and nine in ten reported loss of employment. Nine in ten participants previously employed and not working reported wanting to work, and six in ten reported taking steps to return to work.

Just less than half, of participants took time off work beyond required quarantine period for their persistent COVID symptoms (**Table 1** and **Supplementary Figure S1**). Of those previously employed who took time off (**Table 2** and **Supplementary Figure S1**), most had taken more than 8 weeks off, almost one-third had taken off 4–8 weeks, a quarter had taken off 4 weeks or less and only 7.1% had taken off less than 1 week of work. Just under half of participants who took time off reported using FMLA, while 17.9% reported being on disability. Three-fifths of participants who took time off reported currently working at the time of assessment, almost half of which reported working full time and 14.3% working part-time or less. Fifty percent of participants who had returned to work after taking time off, reported that they felt their employment performance suffered when they returned. About one-third of participants who had taken time off reported not working at the time of assessment, all of which reported wanting to work, and two-thirds reported taking steps to return to work. A quarter of participants who had taken

TABLE 1 Employment data of those who were employed prior to COVID illness.

Variable	Previously employed $N = 59$
Employment status	
Took time off, *n* (%)	28 (47.5%)
Currently working, *n* (%)	
Full time	35 (59.3%)
20–40 h	4 (6.8%)
10–20 h	4 (6.8%)
<10 h	2 (3.4%)
Not working, *n* (%)	10 (16.9%)
Lost employment	9 (15.3%)
Want to work	9 (15.3%)
Steps to return to work	6 (10.2%)
Employment performance suffered, *n* (%)	28 (47.5%)
Decreased hours, *n* (%)	11 (18.6%)

TABLE 2 Time off work & employment data of those who took time off.

Variable	Took time off $N = 28$
Time off	
Time off, *n* (%)	
<1 week	2 (7.1%)
1–4 weeks	5 (17.9%)
4–8 weeks	9 (32.1%)
>8 weeks	12 (42.9%)
Currently working, *n* (%)	
Full time	13 (46.4%)
20–40 h	2 (7.1%)
10–20 h	1 (3.6%)
<10 h	1 (3.6%)
Not working, *n* (%)	9 (32.1%)
Lost employment	6 (21.4%)
Want to work	9 (32.1%)
Steps to return to work	6 (21.4%)
FMLA, *n* (%)	13 (46.4%)
Disability, *n* (%)	5 (17.9%)
Employment performance suffered, *n* (%)	14 (50.0%)
Decreased hours, *n* (%)	7 (25.0%)

time off work reported decreased hours upon returning to work, while just over one-fifth reported loss of employment.

The most prevalent self-attributed reasons for taking time away from work were fatigue, concentration, memory and physical symptoms (Table 3 and Supplementary Figures S2, S3). The most highly self-reported reasons for impaired occupational performance were difficulties with fatigue, and motivation, followed by difficulties in attention, memory, concentration, multitasking and slowed thoughts.

3.3. Comparison of time off vs. no time off cohorts

3.3.1. Sociodemographic characteristics

The Took Time Off (TTO) cohort was significantly older than the No Time Off (NTO) cohort, but otherwise did not significantly differ in other sociodemographic characteristics (Table 4). While there were no significant differences between the two groups, the majority of participants in both groups identified as white, female and had similar levels of educational attainment.

3.3.2. Medical Characteristics

The TTO cohort reported significantly more severe acute COVID symptoms and persistent COVID symptoms compared to the NTO cohort (Table 4 and Supplementary Figure S4). Four patients in the sample were hospitalized, all of whom were in the TTO group. Similarly, there were significantly more participants in the TTO cohort who sought clinical care for post-COVID symptoms. However, there was no significant difference in the average number of comorbidities between the two groups.

TABLE 3 Self-attributed reasons for taking time off work and for occupational performance impairment among those currently working.

Variable	Took time off
	N = 28
Self-attributed reasons for taking time off	
Fatigue, *n* (%)	22 (78.6%)
Concentration, *n* (%)	20 (71.4%)
Memory, *n* (%)	19 (67.9%)
Systemic issues, *n* (%)	14 (50.0%)
Other, *n* (%)	9 (32.1%)
Self-attributed reasons for impaired occupational performance after acute illness	**Occupational Impairment** *N* = 28
Difficulties fatigue, *n* (%)	14 (50.0%)
Difficulties motivation, *n* (%)	12 (42.9%)
Difficulties attention, *n* (%)	11 (39.3%)
Difficulties memory, *n* (%)	11 (39.3%)
Difficulties concentration, *n* (%)	10 (35.7%)
Difficulties multitasking, *n* (%)	10 (35.7%)
Difficulties thoughts slowing, *n* (%)	10 (35.7%)
Difficulties other, *n* (%)	1 (3.6%)

TABLE 4 Characteristics of participants who reported taking time off of work beyond required quarantine due to persistent COVID symptoms compared to those who took no time off of work beyond required quarantine.

Variable	Time off	No time off	Statistic	*p**
	N = 28	*N* = 31		
Sociodemographic				
Age, m(sd)	47.43 (12.86)	38.32 (13.01)	*t* = −2.70	0.009
Female, *n* (%)	19.00 (67.9%)	22.00 (71.0%)	ch-sq = 0.07	0.800
Male	9.00 (32.1%)	9.00 (29.0%)		
Years Education, m(sd)	15.86 (2.24)	16.00 (2.13)	*t* = 0.25	0.800
In Relationship, *n* (%)	19.00 (67.9%)	23.00 (74.2%)	ch-sq = 2.22	0.530
Ethnicity, *n* (%)			ch-sq = 3.71	0.450
White	18.00 (64.3%)	24.00 (77.4%)		
Black	3.00 (10.7%)	1.00 (3.2%)		
Hispanic	4.00 (14.3%)	4.00 (12.9%)		
Asian	3.00 (10.7%)	1.00 (3.2%)		
Other	0.00 (0.0%)	1.00 (3.2%)		
Medical				
Acute Symptoms, m (sd)	20.36 (5.79)	14.58 (4.72)	*t* = −4.22	<0.001
Current Symptoms, m (sd)	9.07 (4.98)	4.39 (3.02)	*t* = −4.31	<0.001
# Comorbidities, m (sd)	1.57 (1.37)	1.23 (1.43)	*t* = −0.95	0.350
Hospitalized, *n* (%)	4.00 (14.3%)	0.00 (0.0%)	ch-sq = 4.75	0.030
Seeking Clinical Care, *n* (%)	22.00 (78.6%)	13.00 (41.9%)	ch-sq = 8.18	0.004
Chalder Fatigue Score, m(sd)	23.89 (6.40)	19.03 (7.07)**	*t* = −2.74	0.008
Meet Criteria Chalder Fatigue, *n* (%)	24 (85.7%)	11 (35.5%)	ch-sq = 15.50	<0.001
Chalder Physical Fatigue, m(sd)	15.29 (4.63)	12.20 (4.37)**	*t t* = −2.61	0.010
Chalder Mental Fatigue, m(sd)	8.61 (3.20)	7.17 (2.80)**	*t* = −1.83	0.070
IADLs, m (sd)	7.25 (1.27)	7.93 (0.26)**	*t* = 2.80	<0.009
Psychiatric				
Prior Psychiatric History, *n* (%)	13 (46.4%)	14 (45.2%)	ch-sq = 0.01	0.900
PHQ-9, m(sd)	13.43 (5.15)	7.68 (5.10)	*t* = −4.31	<0.001
Meet Criteria PHQ−9, *n* (%)	22 (78.6%)	11 (35.5%)	ch-sq = 11.08	<0.001
GAD-7, m(sd)	10.54 (5.70)	4.90 (4.14)	*t* = −4.37	<0.001
Meet Criteria GAD-7, *n* (%)	15 (53.6%)	4 (12.9%)	ch-sq = 11.15	<0.001
PCL-5, m(sd)	30.50 (14.50)	15.94 (12.51)	*t* = −4.15	<0.001
Meet Criteria PCL-5, *n* (%)	13 (46.4%)	3 (9.7%)	ch-sq = 10.05	0.002
Q-LES-Q, m(sd)	45.57 (13.70)	66.90 (18.53)	*t* = 4.98	<0.001
Neuropsychological				
TOPF, m(sd)	107.06 (12.56)**	107.04 (14.22)**	*t* = −0.00	0.100
PAOF Memory, m(sd)	2.62 (0.94)	1.42 (0.81)**	*t* = −5.19	<0.001
PAOF Language, m(sd)	1.89 (1.07)	1.14 (0.86)**	*t* = −2.96	0.004
PAOF Cognitive Intellectual, m(sd)	2.28 (1.17)	1.03 (0.85)**	*t* = −4.65	<0.001
RBANS Total, m(sd)	88.04 (15.58)	98.10 (13.22)	*t* = 2.68	0.010
MoCA Total, m(sd)	24.07 (2.48)	26.74 (2.18)	*t* = 4.41	<0.001

*$p \leq 0.05$ is significant, **Chalder Fatigue Score: Did Not Take Time Off: 19.03 (7.07) *n* = 30, **Chalder Physical Fatigue: Did Not Take Time Off: 12.20 (4.37) *n* = 30, Chalder Mental Fatigue Score: Did Not Take Time Off: 7.17 (2.80) *n* = 30, **IADL: Did Not Take Time Off: 7.93 (0.26) *n* = 29, **TOPF: Took Time Off: 107.06 (12.56) *n* = 18, **TOPF: Did Not Take Time Off: 107.04 (14.22) *n* = 23, **PAOF Memory: Did Not Take Time Off: 1.42 (0.81) *n* = 30, **PAOF Language: Did Not Take Time Off: 1.14 (0.86) *n* = 30, **PAOF Cognitive Intellectual: Did Not Take Time Off: 1.03 (0.85) *n* = 30.

TABLE 5 Multivariate logistic regression with backward elimination predicting odds of taking time off from work after acute COVID-19 quarantine versus immediate resumption of employment after quarantine.

Variable	Odds ratio	95% Confidence interval (lower bound)	95% Confidence interval (upper bound)	*p*-value
Peak Acute COVID-19 symptom score	1.18	1.02	1.37	0.027
Total MoCA Score	0.58	0.40	0.83	0.003
Age	Removed by backwards stepwise elimination.			
Chalder Fatigue Scale Score				
Current COVID Symptom Score				
GAD-7 Score				
RBANS Total Score				

Furthermore, the TTO cohort reported a significantly higher percentage of participants meeting criteria for clinically significant fatigue on the Chalder Fatigue Scale, as well as a significantly higher average Chalder Fatigue Score. Lastly, the TTO cohort reported a significantly lower average score on their ability to complete Instrumental Activities of Daily Life (IADLs) when compared to the NTO cohort.

3.3.3. Psychiatric characteristics

Although there was no significant difference in psychiatric history between the two groups, there were significant differences across depression, anxiety, and PTSD screening measures (**Table 4** and **Supplementary Figure S4**). The TTO group had on average higher scores on the self-report measure (PHQ-9), and were over twice as likely to meet criteria for clinically significant depression (78.7% vs. 35.5%) when compared to the NTO group. Similarly, the TTO group reported significantly higher levels of anxiety and PTSD symptoms, with higher average scores on the GAD-7 and PCL-5, respectively. The TTO group was 4× as likely to meet criteria for clinical anxiety (53.6% vs. 12.9%) and almost 5× as likely to meet criteria for clinically significant PTSD (46.4% vs. 9.7%) when compared to the NTO group. Moreover, the TTO cohort reported a significantly lower score on the Endicott Quality of life Scale.

3.3.4. Neuropsychological characteristics

Both groups were nearly identical in terms of estimated premorbid intellectual function; however the TTO cohort reported significantly higher levels of self-reported or subjective impairment on the cognitive intellectual, memory, and language PAOF subdomains (**Table 4** and **Supplementary Figure S4**). Consistent with their scores in subjective impairment, the TTO group had a significantly lower average total score on the RBANS, as well as the MoCA.

3.4. Predictors of time off

A univariate logistic regression model was developed using backward elimination to identify independent variables within each measurement domain (sociodemographic, medical, psychiatric and neuropsychological) that were the most significant independent predictors of having taken time off work beyond COVID quarantine. The most significant predictors in our model were acute COVID-19 symptom score and total MoCA score. For every 1-point increase in peak COVID symptom severity there was an 18% increased likelihood of taking time off, whereas, for each 1-point decrease in total MoCA score there was a 40% increase in the likelihood of taking time off (**Table 5**).

3.5. Comparison of performance suffered vs. performance did not suffer

3.5.1. Sociodemographic characteristics

While the PS group on average was 4 years older than the PDNS group, there were no significant sociodemographic differences between the cohorts (**Table 6**). Additionally, a majority of participants in both groups identified as white, female and had similar levels of education. Of important note, there was minimal overlap between the PS and TTO cohorts, meaning that individuals who felt there occupational performance suffered were just as likely to have taken time off of work beyond required quarantine as not.

3.5.2. Medical characteristics

On average, the PS cohort reported significantly more severe acute COVID symptoms and persistent COVID symptoms when compared to the PDNS cohort (**Table 6** and **Supplementary Figure S5**). As such, there were significantly more participants in the PS cohort who sought clinical care. Despite this, the two groups had no significant differences in the average number of medical comorbidities or the number of participants who had been hospitalized. While the PS cohort reported a significantly higher average score on the Chalder Fatigue Scale, there was no significant difference in the percentage of participants who met criteria for clinically significant fatigue. Finally, there was no significant difference between the PS and PDNS cohorts' ability to complete instrumental activities of daily life (IADLs).

3.5.3. Psychiatric characteristics

No significant difference was found between the PS and PDNS cohorts in terms of prior psychiatric history, or across screening measures for depression, anxiety, or PTSD (**Table 6** and **Supplementary Figure S5**). In contrast, the PS cohort had lower average scores on the Endicott Quality of life Scale when compared to the PDNS cohort.

3.5.4. Neuropsychological characteristics

The PS and PDNS groups did not significantly differ in estimated premorbid intellectual function, nor across neurocognitive assessments (**Table 6** and **Supplementary Figure S5**). The only significant difference found between the groups was in subjective higher order cognitive/executive function (PAOF Cognitive Intellectual subdomain), with the PS cohort reporting significantly higher levels of subjective impairment. Subjective impairment in memory and language (PAOF Memory, PAOF Language) did not significantly differ. In contrast to self-report measures, scores on more objective neurocognitive measures (RBANS and MoCA) were nearly identical.

4. Discussion

These results suggest that taking time away from work beyond the required quarantine period may predict impairment in psychiatric, neurocognitive and functional status. The self-reported reasons for taking time off, most notably physical symptoms and cognitive impairment, corresponded to assessment results. The

TABLE 6 Characteristics of participants who reported performance suffered at work due to persistent COVID symptoms compared to those who did not report their occupational performance suffered.

Variable	Performance suffered	Performance did not suffer	Statistic	*p**
	N = 28	*N* = 31		
Sociodemographic				
Age, m(sd)	44.50 (12.37)	40.97 (14.66)	*t* = −0.99	0.320
Female, *n* (%)	19.00 (67.9%)	22.00 (71.0%)	ch-sq = 0.07	0.800
Male	9.00 (32.1%)	9.00 (29.0%)		
Years education, m(sd)	15.86 (2.31)	16.00 (2.07)	*t* = 0.25	0.800
In relationship, *n* (%)	18.00 (64.3%)	24.00 (77.4%)	ch-sq = 2.39	0.500
Ethnicity, *n* (%)			ch-sq = 2.45	0.650
White	20.00 (71.4%)	22.00 (71.0%)		
Black	2.00 (7.1%)	2.00 (6.5%)		
Hispanic	3.00 (10.7%)	5.00 (16.1%)		
Asian	3.00 (10.7%)	1.00 (3.2%)		
Other	0.00 (0.0%)	1.00 (3.2%)		
Medical				
Acute symptoms, m(sd)	19.50 (5.06)	15.35 (6.11)	*t* = −2.82	0.007
Current symptoms, m(sd)	8.14 (5.13)	5.23 (3.79)	*t* = −2.50	0.020
# Comorbidities, m(sd)	1.75 (1.69)	1.06 (1.00)	*t* = −1.87	0.070
Hospitalized, *n* (%)	2.00 (7.14%)	2.00 (6.5%)	ch-sq = 0.01	0.920
Seeking clinical care, *n* (%)	21.00 (75.0%)	14.00 (45.2%)	ch-sq = 5.43	0.020
Chalder fatigue score, m(sd)	23.96 (5.36)	18.97 (7.80)**	*t* = −2.86	0.006
Meet criteria chalder fatigue, *n* (%)	21 (75.0%)	14 (45.2%)	ch-sq = 5.78	0.060
Chalder physical fatigue, m(sd)	15.39 (3.70)	12.10 (5.07)**	*t* = −2.84	0.006
Chalder mental fatigue, m(sd)	8.57 (2.36)	7.20 (3.50)**	*t* = −1.76	0.080
IADLs, m(sd)	7.50 (0.88)	7.69 (1.04)**	*t* = 0.74	0.460
Psychiatric				
Prior psychiatric history, *n* (%)	14 (50.0%)	13 (41.9%)	ch-sq = 0.39	0.540
PHQ-9, m(sd)	11.68 (5.11)	9.26 (6.30)	*t* = −1.61	0.110
Meet criteria PHQ-9, *n* (%)	19 (67.9%)	14 (45.2%)	ch-sq = 3.08	0.080
GAD-7, m(sd)	8.00 (5.11)	7.19 (6.12)	*t* = −0.54	0.590
Meet criteria GAD-7, *n* (%)	9 (32.1%)	10 (32.3%)	ch-sq = 0.00	1.000
PCL-5, m(sd)	25.39 (14.02)	20.55 (16.14)	*t* = −1.23	0.230
Meet criteria PCL-5, *n* (%)	9 (32.1%)	7 (22.6%)	ch-sq = 0.68	0.410
Q-LES-Q, m(sd)	51.50 (16.06)	61.55 (21.30)	*t* = 2.03	0.050
Neuropsychological				
TOPF, m(sd)	110.62 **(10.00)	103.30 (15.53)**	*t* = −1.78	0.080
PAOF memory, m(sd)	2.21 (1.03)	1.80 (1.06)**	*t* = −1.48	0.140
PAOF language, m(sd)	1.75 (1.04)	1.27 (0.98)**	*t* = −1.82	0.070
PAOF cognitive intellectual, m(sd)	2.05 (1.02)	1.24 (1.22)**	*t* = −2.75	0.008
RBANS total, m(sd)	93.11 (14.23)	93.52 (16.15)	*t* = 0.10	0.920
MoCA total, m(sd)	25.32 (2.25)	25.61 (3.03)	*t* = 0.42	0.670

*$p \leq 0.05$ is significant, **Chalder Fatigue Score: Performance Did Not Suffer: 18.97 (7.80) *n* = 30, **Chalder Physical Fatigue: Did Not Take Time Off: 12.10 (5.07) *n* = 30, Chalder Mental Fatigue Score: Did Not Take Time Off: 7.20 (3.50) *n* = 30,** IADLs: Performance Did Not Suffer 7.69 (1.04) *n* = 29, **TOPF: Performance Suffered: 110.62 (10.00) *n* = 21, **TOPF: Performance Did Not Suffer: 103.30 (15.53) *n* = 20, **PAOF Memory: Performance Did Not Suffer: 1.80 (1.06) *n* = 30, **PAOF Language: Performance Did Not Suffer: 1.27 (0.98) *n* = 30, **PAOF Cognitive Intellectual: Performance Did Not Suffer: 1.24 (1.22) *n* = 30.

strongest independent predictors of taking time off were severity of acute COVID illness and cognitive performance as assessed by the MoCA. In contrast, subjective impairment in occupational performance among those currently working appears to focus on subjective assessment of peak and current COVID-19 symptoms, fatigue, decreased motivation, and subjective difficulty with higher cognitive function, without evidence of neuropsychological difficulty on testing. These distinctions may have important implications for assessing and treating individuals who both took extended time off of work post COVID quarantine and those who are currently working but expressing difficulty.

Individuals in the TTO cohort reported significantly greater illness severity across multiple measures, including acute and persistent COVID symptoms, hospitalizations, and clinical fatigue when compared to the NTO cohort, despite there being no significant differences in the number of medical comorbidities between the two groups. This is also reflective in the greater frequency of diminished functional capacity on their IADLs. This appears to be consistent with reports that 11.8%–50% of PASC patients experienced new or worsening impairment in activities of daily life (8, 10), while 52.3%–78% reported experiencing persistent fatigue (4, 5, 11) and that those who were hospitalized with COVID-19 have higher rates of extended time from work and disability compared to those with milder illness (5, 6, 8–10).

Despite there being no significant differences in psychiatric history between the NTO cohort and TTO cohorts, the TTO cohort was 2–5× as likely to meet clinical criteria for depression, anxiety and PTSD post-COVID and scored significantly lower on the Endicott Quality of Life scale. The increased psychiatric morbidity post-COVID may be reflective of the increased disease burden and functional impairment experienced by those who took time off, culminating in a lower quality of life. These findings are consistent with those found in a recent meta-analysis, where Zeng et al. 2022 estimated one-fifth of recovered COVID patients demonstrated psychiatric symptoms within the year after recovery, with 18.3% exhibiting symptoms of depression, 17.9% PTSD, and 16.2% anxiety. Likewise, Garrigues et al. 2020 found patients with persistent COVID symptoms post-hospitalization had altered health related quality of life outcomes across mobility, self-care, usual activities, pain/discomfort and anxiety/depression.

Concordant with the increased disease severity, functional impairment and psychiatric burden, the TTO cohort reported significantly higher degrees of subjective difficulty with cognitive function and lower objective scores across all neurocognitive assessments, despite both groups having similar levels of education and pre-morbid intellectual function. The TTO cohort not only reported significantly higher levels of subjective impairment across the memory, language and cognitive intellectual POAF subdomains, but scored significantly lower on both the RBANS and MoCA total scores. In addition, the most prevalent self-attributed reasons for taking time from work included fatigue, concentration, and memory impairment. These findings validate that the subjective impairment felt by individuals who took time off is indicative of objective neurocognitive deficits. Comparably, previous literature reports cognitive deficits and memory impairment as some of the most frequently reported and most debilitating symptoms experienced with PASC, with concentration and cognitive difficulty reported by 19.7%–55% of participants and memory impairment experienced by 17.5%–51% of participants (4, 5, 34). Our prior research indicates that extremely low neurocognitive performance is present in nearly 40% of individuals seeking care for PASC, many of whom have taken extended time off from work and report significant current neurocognitive difficulty (35).

In contrast to the analysis of those who had taken extended time off, self-reported difficulty with current employment is largely a subjective assessment without objective correlates. Those who reported occupational impairment post-COVID did report significantly more severe acute and persistent COVID symptoms, fatigue, and subjective cognitive difficulty in executive functions as well as higher rates of seeking post-COVID care when compared to those who did not report occupational impairment. However, there were no objective differences in medical, psychiatric or neurocognitive status. For instance there were no differences number of comorbidities or in the number of hospitalizations between the groups, and while there was a significantly higher average scores of fatigue, there were no significant differences in the number of individuals who met criteria for clinically significant fatigue between the two groups.

While those who felt their occupational performance suffered reported lower average scores on the subjective assessment Endicott Quality of life Scale, there were no significant differences across depression, anxiety or PTSD between those who experienced occupational impairment and those who did not. Similarly, when looking at neurocognitive characteristics, those who reported occupational impairment reported significantly higher levels of subjective cognitive impairment. However, when compared to those who did not report occupational impairment there were no significant differences in pre-morbid intellectual function, level of education, subjective memory or language impairment, nor scores on objective neurocognitive assessments as seen in the RBANS and MoCA.

When looking at reports of diminished performance among those who are currently working at the time of assessment, it appears that this complaint largely reflects subjective reports of COVID symptom burden and fatigue as well as the subjective difficulty with executive functions. This is further reflected by the most prevalent self-attributed reasons for impaired occupational performance being identified as difficulties with fatigue and with motivation. In contrast to the analysis related to taking time off, objective measures of cognitive performance were not predictive of self-reported diminished work performance. Thus, efforts to enhance subjective work performance should likely focus on enhancing motivation, and diminishing overall physical symptom burden, particularly fatigue. It is likely that these factors, often associated with cognitive complaints (4, 5, 11, 34) contribute to subjective difficulties with planning and organization even though cognitive testing may not bear this out. Motivational factors appear to be important as well, however, the significance of this finding requires clarification. Overall, it is important to emphasize that reported difficulty with work performance should not be dismissed. These individuals report diminished quality of life and should have a thorough medical, psychiatric and neurocognitive workup to address any modifiable factors. Physical symptom mitigation, attempts to treat

fatigue, clarification of motivational factors and attention to specific executive function complaints should be addressed.

It is worth discussing that cognitive dysfunction, fatigue and motivational issues are not unique to PASC. Recent literature has called attention to a subset of disorders that share significant features with PASC; this includes Myalgic Encephalitis/Chronic Fatigue Syndrome (ME/CFS) and disorders of Autonomic Dysfunction (AD) such as, orthostatic intolerance and Postural Orthostatic Tachycardia Syndrome (POTS) (36–42). These disorders, while distinct, are highly correlative and consist of core symptoms of exertional intolerance, impaired functional ability, chronic fatigue and cognitive dysfunction; they are thought to stem from similar precipitating factors such as infectious illness and immune disorders (36–41). As previously discussed, cognitive complaints are often associated with diminished motivation, overall physical symptom burden and fatigue (4, 5, 11, 34). Thus it is important to note that our measure of motivation likely includes characteristics of cognitive dysfunction including apathy, executive dysfunction, and blunted emotional capacity. Given the significant overlap in symptoms between PASC and the aforementioned disorders, it is likely that the motivational issues reported with occupational impairment in the PS cohort, could be a downstream result of the fatigue and cognitive dysfunction by disease pathophysiology.

Exertional intolerance is an underlying commonality of PASC, PEM, ME/CFS, AD & POTS (36–45). Exertional intolerance is a non-specific descriptor used to encompass intolerance to any level of physical exertion or activity. This includes intolerance to exertion from minimal activity as seen in Post Exertional Malaise (PEM), as well as intolerance to exertion from the simple act of standing up seen with AD (36–46). A recent study reported that 58% ($n = 485$) of participants with PASC met criteria for ME/CFS (37), while another found that 79 out of 80 long-COVID patients met criteria for PEM (36). Similarly, another study reported AD in 61.1% long-COVID patients (47). Moreover, POTS and ME/CFS are known to be highly comorbid and have a well-documented association with cognitive impairment (41, 42).

Two potentially explanatory phenomena for the cognitive dysfunction, fatigue and motivational issues seen in PASC, are PEM and AD (37–42).While the pathophysiology of these disorders has not yet been established, circulatory impairment, chronic inflammation, auto-antibodies, neuroinflammation, elevated cytokine levels, direct viral invasion of CNS structures, and neurotransmitter dysregulation have been consistently hypothesized as potential etiologies for each the previously mention disorders (ie: AD, PEM, PASC, ME/CFS and POTS) (36–45). Many studies hypothesize that PEM and AD are potential etiologies for the neurological manifestations seen in PASC, due to the significant similarities ME/CFS and POTS share with PASC and the established correlation of chronic fatigue and cognitive impairment in these disorders, of which PEM and AD are respective hallmark features (39–42, 46–47). The significant exertional intolerance of PEM and AD, seen as a result of minimal activity, in addition to symptoms of cognitive dysfunction, and fatigue create a significant barrier to completing a typical workload and is likely to have a notable impact on work place performance.

Fatigue is the primary symptom associated with exertional intolerance (36–40). Although exertional intolerance was not directly measured in this study, the significantly increased overall fatigue, particularly, physical fatigue, indicated in both TTO and PS cohorts, suggests that physical fatigue may have been an indicator of exertional intolerance in the cohort. Despite an absence of significantly different levels of mental fatigue in the TTO and PS groups, both cohorts indicated higher levels cognitive difficulty. The TTO cohort demonstrated more severe cognitive deficits, with significant deficits in both objective and subjective measures. In contrast, the PS cohort endorsed higher levels of subjective- but not objective- cognitive impairment. This suggests that physical fatigue, not mental fatigue, may play a significant role in objective and subjective cognitive dysfunction. It could be asserted that the motivational issues and impaired occupational performance could be related to physiological issues we did not directly measure, such as AD and PEM.

There are some important limitations and strengths to the generalizability of the results in our dataset. At the time of study design, the pathophysiology of COVID-19 was still under investigation and little was known about PASC. As a result, this study did not include direct inquiry into exertional intolerance or AD. Other important limitations include a small sample size and somewhat homogenous sociodemographic characteristics of the participants. In addition, this study includes individual at higher levels of the employment spectrum and under-represents those at lower levels. We relied on retrospective reports of taking time off and the majority of participant assessments were conducted retrospectively, subsequent to participants taking time off. Particularly with respect to the TTO analyses, it cannot be determined for certain if results reflect a cause, effect or some combination. However, despite these limitations there remain some major strengths to the results of our study, which include inclusion of both community and clinic samples in our study population, and a very thorough assessment of medical, psychiatric and neurocognitive characteristics. Of particular strength is this studies use of objective neurocognitive assessments, the RBANs and MoCA, to evaluate actual cognitive performance.

In conclusion, despite its limitations, this study may shed light on factors that contribute to why individuals post-COVID take time away from work or feel their occupational performance has suffered, which is otherwise lacking from the literature to date. Furthermore, based on our clinical experience of treating many patients with PASC, we feel that our findings reflect the clinical realities. Those who took time off post-COVID beyond quarantine have persistent medical, psychiatric and neurocognitive difficulties. Such individuals appear to require close follow up to identify address modifiable factors across these domains, including attention to neurocognitive performance. In contrast, occupational impairment is most likely more reflective of subjective impairment and less substantiated by objective evidence. Such individuals still experience significantly diminished quality of life, require thorough work up for objective causes of physical symptoms, fatigue, and neurocognitive complaints. In addition, motivational factors regarding current employment should be clarified and addressed.

Data availability statement

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

Ethics statement

The studies involving human participants were reviewed and approved by Institutional Review Board of New York Medical College (Protocol #14400) and the WMC Health Clinical Research Institute. The patients/participants provided their written informed consent to participate in this study.

Author contributions

MT: Data analysis, Writing—original draft. SJF: Conceptualization, Methodology, Data analysis, Writing—original draft, Project administration, Supervision. RD: Conceptualization, Methodology, Writing—Review and Editing, Project administration, Supervision of neuropsychological assessment. SL: Conceptualization, Methodology, Data analysis, Writing—Review and Editing, Project administration. SS: Conceptualization, Methodology, Writing—Review and Editing, Project administration. LK: Conceptualization, Methodology, Supervision, Writing—Review and Editing. AS: Data analysis, Writing—Review and Editing. 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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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fresc.2023.1150734/full#supplementary-material

SUPPLEMENTARY FIGURE S1
Compares the employment status, time away from work, and working hours of those who took time off work (TTO) and those who did not (NTO).

SUPPLEMENTARY FIGURE S2
Self-attributed reasons for taking time off work.

SUPPLEMENTARY FIGURE S3
Self-attributed reasons for occupational performance suffered among those currently working.

SUPPLEMENTARY FIGURE S4
Comparison of medical characteristics between TTO vs NTO and PS vs. PDNS domains. Figure 4 (**A**). Compares variables measured in mean scores. Figure 4 (**B**). Compares variables measured in percentage number. *p < 0.05 is significant.

SUPPLEMENTARY FIGURE S5
Comparison of psychiatric characteristics between TTO vs. NTO and PS vs. PDNS domains. Figure 4 (**A**). Compares average PHQ-9 scores of major depression. Figure 4 (**B**). Compares average GAD-7 scores of generalized anxiety. Figure 4 (**C**). Compares average PCL-5 scores of PTSD. Figure 4 (**D**). Compares average Q-LES-Q scores of quality of life. *p < 0.05 is significant.

SUPPLEMENTARY FIGURE S6
Comparison of neuropsychological characteristics between TTO vs. NTO and PS vs. PDNS domains. Figure 4 (**A**). Compares average subjective neurocognitive scores self-assessed cognitive function across POAF subdomains. Figure 4 (**B**). Compares average objective neurocognitive total scores on the RBANs . Figure 4 (**C**). Compares average objective neurocognitive total scores on the MoCA. *p < 0.05 is significant.

SUPPLEMENTARY DATA SHEET 2
Employment questionnaire utilized to collect information on employment status pre-COVID illness, time taken off work, length of time away from work, self-reported reasons for taking time off, current employment status, current hours working, FMLA, disability, interest in returning to work, performance at work, self-attributed reasons for impaired performance at work.

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Older adults' coping strategies during the COVID-19 pandemic – a longitudinal mixed-methods study

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Introduction: Older age is a main risk factor for severe COVID-19. In 2020, a broad political debate was initiated as to what extent older adults need special protection and isolation to minimize their risk for SARS-CoV-2 infection. However, isolation might also have indirect negative *psychological* (e.g., loneliness, stress, fear, anxiety, depression) or *physical* (e.g., lack of exercise, missing medical visits) consequences depending on individual strategies and personality traits to cope longitudinally with this crisis.

Methods: To examine the impact of individuals' coping with the pandemic on mental health, a large sample of 880 older adults of the prospective longitudinal cohort TREND study were surveyed six times about their individual coping strategies in the COVID-19 pandemic between May 2020 (05/2020: M_{age} = 72.1, SD_{age} = 6.4, Range: 58–91 years) and November 2022 in an open response format. The relevant survey question was: *"What was helpful for you to get through the last months despite the COVID-19 pandemic?* E.g., *phone calls, going for a walk, or others."*

Results and Discussion: In total, we obtained 4,561 records containing 20,578 text passages that were coded and assigned to 427 distinct categories on seven levels based on qualitative content analysis using MAXQDA. The results allow new insights into the impact of *personal prerequisites* (e.g., value beliefs, living conditions), the *general evaluation of the pandemic* (e.g., positive, irrelevant, stressful) as well as the *applied coping strategies* (e.g., cognitive, emotional- or problem-focused) to deal with the COVID-19 pandemic by using an adapted Lazarus stress model. Throughout the pandemic emotional-focused as well as problem-focused strategies were the main coping strategies, whereas general beliefs, general living conditions and the evaluation were mentioned less frequently.

KEYWORDS

COVID-19, coping, Lazarus stress model, psychosocial factors, older adults

1. Introduction

In early 2020, the coronavirus (SARS-CoV-2) caused a global health crisis that challenged our health care systems, upended daily life, and led to economic and social upheaval, e.g., lockdowns, quarantine and hygiene regulations (Chen, 2020; Wu and McGoogan, 2020; State of Baden-Württemberg, 2023). Estimates indicate that more than 660 million people worldwide were infected with SARS-CoV-2 by January 2023, of which approximately 6.7 million were fatal (Abab et al., 2022; Johns-Hopkins-University, 2023). Although, most people had only mild to moderate diseases, a substantial minority had a higher risk for severe COVID-19 and adverse health outcomes, such as long- or post-COVID (Abab et al., 2022; Subramanian et al., 2022). Across several countries, mortality rates increased exponentially depending on age and multimorbidity (Bonanad et al., 2020; Chen et al., 2023). Early on, age had been identified as most significant risk factor for severe COVID-19 (Chen et al., 2023) because older adults also have a higher prevalence of chronic diseases such as type 2 diabetes (Zhu et al., 2020; Kompaniyets et al., 2021b), obesity (Kim et al., 2021; Kompaniyets et al., 2021a,b), coronary heart (Lippi and Henry, 2020; Kim et al., 2021), and neurocognitive diseases (Rosenthal et al., 2020; Kim et al., 2021). For instance, it was found that mortality risk increased up to 26% for adults with Alzheimer's disease and related dementias compared to 2019 (for adults without dementia the risk increased up to 12%, Gilstrap et al., 2022).

This sparked controversial debates about how to deal with an increased vulnerability for COVID-19 in older (or particularly frail) adults. It was claimed that these adults need both a special protection and isolation to minimize their risk of infection and they also need to maintain independence and autonomy to avoid negative *psychological* (e.g., depression, loneliness, anxiety), and *physical* consequences (e.g., lack of exercise, missing medical visits and using negative coping strategies, AgeUK, 2020; Chen, 2020; Promislow and Anderson, 2020; Chen et al., 2023). In Germany, point prevalence for a depressive episode in older adults was 7% (95% CI 4.4–10.6%), and for adults aged 75+ years even 17% (95% CI 9.7–26.1%, Luppa et al., 2012). Despite the expectation that social isolation would lead to a significant health care gap and increased depressive symptoms and loneliness, studies showed that the psychosocial well-being of older adults remained remarkably stable throughout the pandemic (Betsch et al., 2020; Röhr et al., 2020; Minahan et al., 2021; van den Besselaar et al., 2021; Dankowski et al., 2023). Psychological stress, however, was only elevated at the beginning of the pandemic and depended on health status, functional resources, individuals' participation/activity and living environment (Gaertner et al., 2021). In general, these results might be surprising if we consider the COVID-19 pandemic as a global health crisis in which individuals had to adapt quickly to changes in work, social activities, and quarantine restrictions (Giordano, 2020; Gaertner et al., 2021; Bhattacharjee and Ghosh, 2022). Several studies investigated how older adults coped with stress arising from the pandemic and to what extent individual characteristics, resilience and various coping strategies played a role in this – but only at one particular stage of the pandemic (e.g., Greenwood-Hickman et al., 2021; Bhattacharjee and Ghosh, 2022; Halamová et al., 2022; Iswatun et al., 2022; Kumar et al., 2022; Joseph et al., 2023). *Resilience,* thus, describes the capacity to recover quickly from difficult situations and stressful life events, whereby this in turn depends not only on the psychological prerequisites of the individual but can be considered as a dynamic process allowing positive adaptation in unknown situations such as the COVID-19 pandemic. *Coping* or *coping strategies* describe the active process and specific behavior that protects oneself to avoid negative experiences during stressful life events (Pearlin and Schooler, 1978; Carver et al., 1989; Chen, 2020). Since feelings of stress are a cumulation of thoughts, emotions, and behaviors taking into account internal and external demands, Lazarus and Folkman (1984) described a model in which perceived stress depends on *primary appraisal* of a stimulus as irrelevant, positive or stressful. After the primary appraisal, when a person has determined the relevance and consequences of the stimulus for him- or herself, the *secondary appraisal* involves the evaluation of resources. Therefore, skills the person has acquired in previous stressful situations, self-confidence, but also material resources or social support are needed. The fewer resources a person has to cope with a specific stressful situation, the more intense the stress response will be. These two appraisals do not temporally occur in sequence but may overlap and influence each other and are characterized by person's perception. After the appraisal is completed, coping occurs. The focus of coping can be on changing the external situation (*problem-oriented coping*), e.g., through the structuring of daily activities or hygiene and protection measures, or on changing internal states and feelings (*emotion-oriented coping*), e.g., through social contacts, self-care, mindfulness. Since the COVID-19 pandemic could be described as a psychological stressful experience, the individual's cognitive evaluation of the situation (as positive, irrelevant, or stressful) and the resources available to the individual may determine whether coping is necessary at all or the extent to which coping strategies are (or need to be) used.

In the present study, we were interested in how older adults with an increased vulnerability for severe COVID-19 cope with the pandemic-related circumstances over time and how these strategies change over time.

1.1. The aim of the present study

Since very little is known in the literature about how vulnerable populations deal with the COVID-19 pandemic longitudinally, we posed the following research question: *How do older adults cope with the COVID-19 pandemic over time?* To answer our research question, we sent questionnaires to a vulnerable population of older adults at continuous intervals over a period of 2.5 years (for more detailed information, see 2.1 research sample). In these, among many other topics, an open-ended question was asked about what the participants experienced as helpful during the pandemic from May 2020 to November 2022. Our first aim was to categorize the responses to the open-ended question (text fragments) using qualitative data analysis and develop a comprehensive category system. Furthermore, in an exploratory quantitative analysis, we aimed to examine associations between coping (strategies) and demographic variables (age, education level), fear of COVID-19, perceived stress, resilience, depression, loneliness, health-related quality of life, and physical (in) activity, as well as gender differences. This proceeding represents a mixed-methods approach.

2. Methods and materials

2.1. Research sample

The cohort of the present study originates from the prospective longitudinal cohort study "**T**übingen Evaluation of **R**isk Factors for **E**arly Detection of **N**euro**D**egeneration" (TREND), which was initiated in 2009 and is currently in its 5th follow-up (Wave 6). Participants are examined in 2-year intervals. The main purpose of the TREND study is to identify, define, and validate risk factors and prodromal markers for Alzheimer's and Parkinson's disease.[1] For TREND, older adults (aged 50+ years) from the Neckar-Alb and Stuttgart regions (in southern Germany) were recruited, primarily participants with specific prodromal markers for neurodegeneration ("enriched cohort"): lifetime depression, hyposmia, or (probable) REM sleep behavior disorder (RBD). In-depth details about the inclusion and exclusion criteria of TREND can be found in the study protocol (Gaenslen et al., 2014). In addition, participants were included who had previously taken part in another study for early detection of Parkinson's disease which was population-based ("Prospective evaluation of Risk factors for Idiopathic Parkinson's Syndrome," PRIPS; Berg et al., 2010, 2013). A total of 1,201 participants took part in at least one visit of the TREND study. Membership to one or more risk groups (depression, hyposmia, probable RBD) was determined at the first study visit using tests and questionnaires. At the first study visit, 60% of participants had at least one prodromal marker (30% depression, 36% hyposmia, 18% probable REM sleep behavior disorder; for more details see Supplementary Table S1). Furthermore, 14% had first-degree relatives with Parkinson's disease, and 31% with dementia, and participants thus had an increased risk of developing the diseases. The study follows the guidelines for good scientific practice at the University of Tübingen (Germany), the Declaration of Helsinki (1964) and its later amendments and was approved by the local ethics committee of the University Hospital Tübingen (No 90/2009BO2). All participants gave their written informed consent to participate in the study.

Due to the COVID-19 pandemic, lockdown and hygiene recommendations of the regional government and the Robert Koch Institute, the regular TREND data collection had to be paused immediately in March 2020 to minimize our participants' risk of infection with SARS-CoV-2 (Governmental Regulation of the State of 266 Baden-Württemberg from 03/17/2020, CoronaVO). In the following, the research question arose how our cohort with increased vulnerability (older age, increased risk for neurodegenerative diseases) would cope with the pandemic longitudinally, especially the protective measures such as self-isolation and general restrictions. As it is known from the literature, adults who are at increased risk for dementia are also at increased risk for severe COVID-19 progression and accelerated cognitive decline (Chen et al., 2023). To investigate the impact of the COVID-19 pandemic on our cohort, six Corona questionnaires (Coro-Q, in the following referred to as Coro-Q1 to Coro-Q6 in Tables/Figures, e.g., Coro-Q1 means Corona questionnaire No. 1) on general, health- and pandemic-related aspects were sent to the participants via post and later also online. Eight hundred and eighty participants of the TREND cohort were willing to take part in these COVID-19 pandemic related questionnaires at least once (mean age in May 2020: $M = 72.1$, $SD = 6.4$, Range: 58–91 years; 48.3% females, years of education: Mdn = 14, IQR: 12–16 years; for demographics of each questionnaire round see Table 1). The first questionnaire was sent by post in May 2020, followed by five more questionnaires approximately every 6 months (paper or online questionnaires, depending on participants' preference). The response rates for each questionnaire were > 80%. Participants did not reach any financial or other benefit of the participation in the pandemic-related questionnaire study. However, it should be noted that most participants had been taking part in TREND for over 10 years at the onset of the pandemic, and many participants had developed a strong commitment to the study and a bond with the longstanding, consistent study team over time. This may have contributed to the exceptionally high response rates. Table 1 provides an overview of the questionnaire rounds [Coro-Q1 to Coro-Q6, and demographic characteristics of the respondents ($N_{total} = 4{,}561$)]. Of the 880 participants who completed at least one Corona questionnaire (Coro-Q), 56% had at least one prodromal marker for neurodegeneration (29% depression, 31% hyposmia, 17% probable REM sleep behavior disorder); 14% had first degree relatives with Parkinson's disease and 35% with dementia (for exact numbers and percentages for each risk group and combination of prodromal markers see Supplementary Table S1).

As of June 2023, TREND has a total of 77 subjects who have developed a severe neurodegenerative disease (Parkinson's disease, dementia, or other); of these, 27 have completed a Corona questionnaire at least once (14 subjects diagnosed with Parkinson's disease, 11 diagnosed with dementia, one diagnosed with progressive generalized chorea, one with amyotrophic lateral sclerosis), with 13 of these participants receiving their diagnosis during the course of the pandemic (2021 to 2023) (four Parkinson's disease, nine dementia). Overall, the subcohort of TREND that completed at least one Corona questionnaire contains 3% subjects with a severe neurodegenerative disease.

2.2. Questionnaires

From May 2020 to November 2022, more than 800 older adults were surveyed six times (Coro-Q1 to Coro-Q6) at 6-month intervals about their fear of getting COVID-19, depression, perceived stress, loneliness, resilience, health-related quality of life, and level of physical (in)activity. Table 2 shows selected material used in the questionnaire rounds. At the end of each of the abovementioned six Coro-Q questionnaires, there was a question about personal coping with the COVID-19 pandemic in an open-ended response format: *"What was helpful for you to get through the last months despite the COVID-19 pandemic? (E.g., phone calls, going for a walk, or others)."* Because the active subset of the TREND cohort at the beginning of the pandemic still consisted of more than 900 subjects, we were unable to interview each participant in person using semi-structured interviews. For this reason, we had to rely on postal or online questionnaires. In total, we obtained 4,561 records in the six biannual questionnaire rounds. An impressive and unique set of qualitative longitudinal data on the pandemic, health-related and psychosocial factors of older adults' personal coping with the COVID-19 pandemic was collected over a 2.5-year period. Study data were collected and managed using

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TABLE 1 Questionnaire rounds (Coro-Q1 to Coro-Q6) and demographic characteristics of the participants.

Questionnaire round		3-Month Coro-Q1	8-Month Coro-Q2	14-Month Coro-Q3	20-Month Coro-Q4	25-Month Coro-Q5	32-Month Coro-Q6
Response date (median [month/year])		June-20	November-20	May-21	November-21	April-22	November-22
Number of surveys sent	Total (*n*)	932	909	899	880	868	854
	Paper (*n*, %)	932 (100%)	909 (100%)	540 (60%)	519 (59%)	495 (57%)	480 (56%)
	Online (*n*, %)	–	–	359 (40%)	361 (41%)	373 (43%)	374 (44%)
Number of respondents	Total (*n*, %)	774 (83%)	780 (86%)	796 (89%)	759 (86%)	746 (86%)	706 (83%)
	Paper (*n*, %)	774 (83%)	780 (86%)	445 (82%)	412 (79%)	392 (79%)	367 (76%)
	Online (*n*, %)	–	–	351 (98%)	347 (96%)	354 (95%)	339 (91%)
At least one codable text fragment on the coping strategies question[1]	*(n, %)*	667 (86.2%)	694 (89.0%)	709 (89.1%)	653 (86.0%)	635 (85.1%)	610 (86.4%)
Age (yrs)	*M*	72.3	72.5	73.0	73.5	73.8	74.3
	SD	6.3	6.3	6.2	6.3	6.2	6.2
	Range	58–91	59–91	59–92	60–92	60–93	61–93
Females	*n* (%)	367 (47.5%)	377 (48.3%)	380 (47.7%)	364 (48.0%)	354 (47.5%)	333 (47.2%)
Education (yrs)	Median	14.0	14.0	14.0	14.0	14.0	14.0
	IQR	12–16	12–16	12–16	13–16	13–16	13–16
	Range	9–21	9–21	9–21	9–22	9–22	9–22

IQR, interquartile range; M, Mean; SD, standard deviation; yrs, years. [1]Question: "What was helpful for you to get through the last months despite the COVID-19 pandemic? E.g., phone calls, going for a walk, or others."

REDCap electronic data capture tools hosted at the University of Tübingen (Harris et al., 2009).

2.3. Mixed-methods approach

The core of this article is a mixed-methods analysis to answer our research question on how older adults with increased vulnerability for severe COVID-19 (Chen et al., 2023) deal with the pandemic situation longitudinally (*cf.* mixed-methods or hybrid approach, Hussy et al., 2010).

First, a *qualitative* content analysis was conducted on the textual information that participants were asked to provide at the end of the questionnaire by indicating what they found helpful for coping with the pandemic. In response to the open-ended question *"What was helpful for you to get through the last months despite the COVID-19 pandemic? (E.g., phone calls, going for a walk, or others),"* we received answers in text format. These ranged from one-word answers through lists to shorter or longer text fragments (in complete sentences). For organizing and coding the text material, we used the qualitative analysis software MAXQDA (VERBI-Software, 2021). MAXQDA is a computer-assisted qualitative data analysis software (CAQDAS) designed to assist researchers in managing and analyzing qualitative and mixed-methods data, provided in a range of tools to facilitate the organization, coding, analysis, and visualization of data. As method, we used the widely used and established qualitative content analysis according to Mayring (2015, 2020), which enabled us to analyze the text material (summarizing, explicating, structuring), form categories, and combine two approaches: (1) *inductive category development* ("bottom-up approach") and (2) *deductive category application* ("top–down approach"). Accordingly, in a first step, we inductively coded the text material and derived a preliminary category system. In long team and expert discussions, it turned out that the code system so far was insufficient regarding many text passages that described for instance general value beliefs or the evaluation of the pandemic situation and did not directly represent coping strategies (e.g., *"faith in god,"* "*having a garden*"). Due to this problem, some text passages from our participants could not be logically integrated into our category system. At this point, as it is also part of the method according to Mayring, we added the deductive approach and started searching for definitions and classifications of coping and coping strategies (for an overview see Skinner et al., 2003). Thereby, we encountered Lazarus and Folkman's transactional stress model (Lazarus and Folkman, 1984). This model offered a solution for handling text passages about general value beliefs or the evaluation of the pandemic situation. Thus, in a second step, we restructured our category system deductively using the theoretical framework of Lazarus and Folkman by considering the pandemic situation as stress. Overall, after inductive category formation with recourse to the transactional stress model (Lazarus and Folkman, 1984), we were able to deductively classify all text material in the sample into a logical and comprehensive category system.

Once the final category system was defined, we were able to calculate the numbers for each category and each participant for all six questionnaire rounds. In a *quantitative* exploratory analysis, we investigated how our main categories correlate with demographic

TABLE 2 Used material per questionnaire round (May 2020 to November 2022).

Questionnaire	Description
Fear of COVID-19	Fear of COVID-19 was measured on a scale from 0 (*no fear at all*) to 10 (*very much fear*).
Depression	To measure severity of depression, the *Becks Depression Inventory* (BDI) was used as self-report questionnaire. It was developed in the USA in 1961, revised in 1978 (Beck et al., 1961, 1987); the latest German translation and validation for the BDI-I (Hautzinger et al., 1996). Since 1996, there has been a newer version adapted to DSM-IV (BDI-II, Beck et al., 1996) for which the latest German translation and validation used in TREND is from 2009 (Hautzinger et al., 2009). Participants had to choose one of four statements which they mostly described their feelings and behavior in the last 2 weeks. Thereby, 0–13 scores indicate minimal depression, 14–19 mild depression, 20–28 moderate depression, and 29–63 severe depression. Scores ≥14 are referred to as clinically relevant depression.
Perceived Stress	Stress was assessed with 10 items using the *Perceived Stress Scale* (PSS, 58). Participants were asked how often they felt stressed in the last month (example-item: *'In the last month, how often have you been upset because something unexpected happened?'*, answer options: *never, almost never, sometimes, quite often, very often*). The total score ranges from 0 (*no perceived stress*) to 40 points (*very strong perceived stress*).
Resilience	To measure resilience, we used the *Brief Resilience Scale* (BRS, Chmitorz et al., 2018) consisting of 6 items, e.g., *'I tend to recover quickly after difficult times'* with response options on a 5-point-likert scale from *'strongly disagree'* to *'strongly agree'*. Resilience scores range from 1 (*low resilience*) to 5 (*high resilience*).
Loneliness	Since loneliness is associated with depression (Klein et al., 2016), we used a 6-item questionnaire (Gierveld and Tilburg, 2006) to measure overall loneliness. Participants were asked to indicate on a 4-point Likert scale how much they agree with the statements personally (*not at all true* to *true exactly*) in the last 3 months (example-item: *'I miss people who make me feel good'*). Total scores range from 0 (*not lonely at all*) to 6 (*very lonely*).
Health-related quality of life	To measure participants' health-related quality of life, the EQ-5D-5L (Herdman et al., 2011; Feng et al., 2021) visual analog self-report scale was used with endpoints labeled *'The worst health you can imagine'* (0) and *'The best health you can imagine'* (100 scores).
Physical (in)activity	Since there is a strong association between depression and physical (in)activity (Mura and Carta, 2013), we decided to analyze physical (in) activity as ordinal data of *'no activity'*, *'< 1 h (hrs)/week'*, *'1–2 h/week'*, *'2–4 h/week'*, and *'> 4 h of physical activity per week'* with increased heart-rate or sweating using a standardized questionnaire (Thefeld et al., 1999).
Coping strategies	Since we were interested in how participants were coping with the COVID-19 pandemic, we used an open response format to answer the question: *"What was helpful for you to get through the last months despite the COVID-19 pandemic?* E.g., *phone calls, going for a walk, or others."*

variables (age, years of education), depression, perceived stress, resilience, loneliness, health-related quality of life, physical (in)activity, and examined gender differences (Herrera-Añazco et al., 2022; Peyer et al., 2022). Kendall's tau B was used for correlations and Mann–Whitney U tests for group comparisons because of the skewness of the data. Quantitative data analysis was performed using the software SPSS version 29.0 (IBM-Corp, 2021).

3. Results

3.1. Results of the mixed-methods analysis

Through the qualitative content analysis in MAXQDA and deductively using an adapted/extended Lazarus stress model, a total of 20,578 text passages could be coded and 427 categories could be formed which are organized on seven hierarchic levels, with level 1 representing the highest and level 7 the lowest (for details, see Supplementary Table S1). In this article, we use the term "categories" to refer to the related content that has been organized hierarchically. Categories at higher levels represent supercategories and stand for a topic area (e.g., problem-focused strategies) to which further categories are subordinated (e.g., structuring everyday life). The more detailed a topic is represented in the category system, the more levels that topic has. The categories are mutually exclusive and the representation in Supplementary Table S2 is not cumulative, since it was possible that very generally formulated text fragments were sorted directly into a higher level without belonging to one of the subordinate levels. However, the category system can be aggregated at each level by cumulating the numbers of the lower levels and adding them to the numbers of the higher levels.

We obtained six main categories on level 1 (C1–C6): (1) C1: *General Beliefs (concepts/values/convictions)* ($N = 234$), (2) C2: *General Living Conditions (material/financial/social)* ($N = 1{,}252$), (3) C3: *General Evaluation of the Situation (meta-reflection* as positive, irrelevant, or stressful*)* ($N = 863$), (4) C4: *Problem-focused Strategies* ($N = 9{,}925$), (5) C5: *Emotion-focused Strategies* ($N = 8{,}049$), (6) C6: *Cognitive Strategies (reactive)* ($N = 255$). Thereby, C1 and C2 describe the general prerequisites that a person possesses in terms of values and material/financial/social resources, whereas C3 represents the general evaluation of the situation in the form of the primary appraisal as positive, irrelevant, or stressful. This is followed by the secondary appraisal, considering whether sufficient resources are available to deal with the problem. C4–C6 represent the specific coping strategies in dealing with the problem, where either the external situation is to be changed by problem-focused coping (e.g., daily structuring) or the internal attitude with respect to emotions (e.g., by emotion regulation through eating, social contacts) or cognitions (e.g., by distraction, attitude change). A definition of the 6 main categories (and subcategories up to level 3) and examples can be found in Table 3. For details on the distribution of the numbers of the main categories among the 6 questionnaire rounds, see Table 4 (a more detailed table with all 427 categories can be found in the Supplementary Table S1) and for relative frequencies of how often each category was used, see

TABLE 3 A definition of the 6 main categories (subcategories up to level 3) and participants' examples.

Level 1 Level 2 Level 3	Definition	Examples
C1: General Beliefs (concepts/values/convictions)		
Life Attitude and Experience	General values are values/ways of thinking that the person brings with him/her based on life experiences and personality traits.	*"Perhaps also my entire attitude to life."* [2_7367]
Positive Thinking/Optimism		*"Positive thinking"* [1_1220], *"I always see the half-full glass and not the half-empty glass!"* [1_7272]
Self-motivation		*"My will not to give up"* [6_7068], *"have enough initiative"* [6_7145]
Resilience		*"My own adaptability, to put things into perspective and take them as they are"* [2_9068]
Joy of Life		*"Laugh a lot"* [4_7483]
Faith/Spirituality		*"Who counts on God, saves worries"* [1_7028], *"grateful to be connected with Jesus"* [2_1217]
Own Health Status		*"Physical and mental health"* [4_1359], *"the end of my depression in March 2020"* [4_7439]
Introverted/used to Being Alone		*"I can be well alone"* [6_7522], *"Being more of a loner, I had little problem because of the contact restrictions"* [8_7215]
C2: General Living Conditions (material/financial/social)		
Good Health System/Medical Care	General living conditions are understood as the material (housing situation), financial (pension, financially secure) and social (mobility) conditions that a person brings with him/her.	*"happy to live in Germany, and knowing should one become infected the medical care is very good"* [1_1175]
Not Being/Living Alone		*"not living alone in the household"* [6_1453]
Autonomy/Independence/Self-reliance		*"That I can take care of myself without help"* [8_7274], *"I am autonomous, can take care of myself"* [2_7162]
Be Retired		*"As a pensioner, you have almost no restrictions."* [2_1460], *"Since I am a pensioner, I could organize my day as I wanted"* [1_1691]
Financial Security		*"financial independence"* [1_1366], *"No financial worries"* [2_7002]
Housing Situation		*"home environment"* [6_7128], *"my home gives me a feeling of security"* [1_1454]
Good Living Environment		*"optimal residential location"* [1_7015], *"Ideal location of the apartment: quiet, garden, all routes within walking distance"* [2_7015]
Living Atmosphere (apartment, feeling comfortable at home)		*"Feeling good at home within your own "4 walls.""* [6_1250]
Specific Housing Situation/Amenities		*"I have my own house with a large garden, due to which I can withdraw and occupy myself in and around the house"* [8_7350]
Mobility		
Bicycle/Walking Instead of Public Transport		*"Doing the shopping on foot"* [1_1529]
Mobility by Public Transport		*"Use public transportation to get out of the house"* [4_7253]
Mobility by Own Means of Transport		*"own car (=less risk of infection)"* [2_1056], *"Travel with camper"* [6_7056]

(Continued)

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TABLE 3 (Continued)

Level 1 Level 2 Level 3	Definition	Examples
C3: General Evaluation of the Situation (meta-reflection)		
Positive	The general evaluation of the situation describes the meta-reflection of the current situation, which Lazarus and Folkman (1984) defined as primary appraisal as positive, irrelevant or stressful. This evaluation is the precondition for further coping strategies.	
Better/Longer Sleep (Quality)		*"shut down" = "+" for "private"* [1_7633]
Having More Time		*"Due to the rest, better sleep"* [1_7260]
No Boredom		*"more time for own family"* [1_1211]
Freedom from Obligations/Appointments		*"I never get bored, I always find something to keep me busy"* [2_7181]
Less People Outside		*"Exemption from any obligations and deadlines"* [1_7015]
(Intensive) Connection With Others		*"Deserted walking paths almost on the doorstep"* [2_7233]
Irrelevant		*"Engage more intensively with familiar people"* [1_7008]
Pandemic not as Threatening as Before		*"The pandemic was no longer perceived as threatening as it was in 2020 and 2021"* [8_7629]
There were more Important Things than the Pandemic		*"For the last few months, Corona has been less of a concern to me than the heat"* [8_1714]
No Restriction/Change due to Pandemic		*"Just continue to live normal life with the rules"* [1_1423]
Hardly any Restriction/Change due to Pandemic		*"Life goes on"* [2_7190]
No special Support needed during the Pandemic		*"My daily routine has barely changed"* [1_7034]
Do not miss Personal Contacts		*"I do not miss personal contact."* [4_7646]
No Fear (of Corona/Infection)		*"I am not afraid of Corona"*[1_7367]
Joy/Relief about Relaxation of Corona Rules		*"The relaxations of the regulations"* [6_1621]
Stressful		
Damage/Loss		*"What is missing: the training in the gym, the direct contact with friends, acquaintances, also authorities, etc, the free travel, it is easier to describe that than all the positive things that remained"* [1_7283]
Threat		*"Corona is almost not on my mind at the moment, unlike the Ukraine war."*[7_7530]
Challenge		*"biggest nuisance the vaccination chaos!"* [4_1427]

(Continued)

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TABLE 3 (Continued)

Level 1 Level 2 Level 3	Definition	Examples
C4: Problem-focused strategies		
Active engagement with the Corona Pandemic	Problem-focused strategies are used when the primary appraisal requires action in the sense of coping strategies. One possible strategy is to focus on the problem (in this case, the pandemic) by means of active strategies such as structuring the day or actively dealing with the Corona pandemic (e.g., critical questioning, gathering information).	
Information Gathering		*"obtain information"* [7_1056]
Compliant Behavior		*"be at home a lot"* [2_1816]
Caution and Consideration		*"careful contact with the neighbors"* [2_7350]
Talking to others about Corona		*"Talking to my friends about vaccination"* [4_1547]
Critical Questioning of Corona		*"Critical questioning of government corona policies"*[4_1326]
Trust in Government/Politics/Authorities/Measures		*"Professional management of the authorities"* [1_7049]
Active Criticism of and Resistance to Corona Rules		*"Participation in demos against Corona policies"* [7_7684]
Knowledge about the Health Status of Relatives		*"Since my family and I are healthy, I was not very worried"* [1_1314]
No/Less Preoccupation with Pandemic		*"Not watching the news, reading little to no newspapers"* [8_7324]
Structuring Everyday Life		*"Structured day - plan day and take and work on tasks/things"* [1_1674]
Everyday Tasks		*"Various challenges (house, garden, financing, etc.)"* [4_7218]
(Leisure) Activities		*"Cultural participation via TV, radio,* e.g.*, also outdoor cultural offerings"* [1_1154]
Receiving Instrumental Social Support		*"My family and friends supported me, I wanted for nothing"* [4_7547]
Cleaning Help		*"Cleaning help me partly, as far as necessary"* [2_7273]
Care Service		*"Help from care service in caring for my husband with Parkinson's disease"[4_7315]*
Relatives Live in the same House		*"My son's family living in the same house (2 separate apartments, 2 children 4 and 2 years old)"* [2_7543]
Get Help with Errands		*"Food brought by the children and the neighborhood assistance"* [1_7222]
Ask for Help		*"I also learned to ask for help"* [6_1714]
Know about possible Support from Others		*"The knowledge that if necessary someone is there to "help"* [8_1710]

(Continued)

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TABLE 3 (Continued)

Level 1 Level 2 Level 3	Definition	Examples
C5: Emotion-focused strategies		
Maintain/Seek out Social Contacts	Another possibility when the primary appraisal requires action is emotion-focused coping, which allows dealing with the situation by regulating emotions (specifically in the pandemic situation: by staying in contact with other people, self-care, or religion).	*"In general, it was very helpful to have regular contacts with other people"* [1_7416]
Type/Size of Social Contacts		*"Phone calls with the children"* [1_1453]
Social Form of Interaction		*"Conversations, discussions"*[1_1356]
Receiving Emotional Social Support		*"Lovingly concerned and helpful children and grandchildren"* [1_1205]
Self-care		*"Good relationship with myself that carries, regardless of external changes"* [1_7319]
Care for Physical Well-Being		*"Visit to a salt hall for inhalation"* [2_7703]
Mindfulness		*"mindfulness"* [4_9061]
Diary/Journaling		*"I made daily notes about the day, as a corona diary"* [1_9062]
Enjoy Season/Nature		*"Enjoy the nature"*[1_1781]
Religion/Fait Related Activities		*"Worship songs"* [1_1491]
Prayer		*"Turn to God in prayer"*[8_7134]
Church Services		*"Possibility to attend church services"*[2_7348]
Community with other Believers		*"Meetings with other believers"* [4_7491]
Church Engagement		*"church commitment"* [4_7241]
Reading the Bible		*"Read God's Word (Bible) daily"* [2_7077]
Resort to Unhealthy Coping Strategies		*"(too much) chocolate"* [2_9095]
Frustration Eating		*"I have the feeling of living under a glass bell jar with no prospect of improvement. In the meantime, I have become a frustration eater (chocolate)"* [6_1,171]
Unhealthy Diet		*"I bought food that just caught my fancy - it wasn't exactly healthy, but it tasted good to me"* [1_7343]
Drink (too much) Alcohol		*"In the evening I drink a beer with my neighbors (Corona distance)"*[1_7350]

(Continued)

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TABLE 3 (Continued)

Level 1 Level 2 Level 3	Definition	Examples
C6: Cognitive strategies (reactive)		
(Re)assessment of the Situation	Another strategy after the primary appraisal is the cognitive strategies, which include reappraisal of the situation, but also distraction, hope, or planning activities by attention shifting.	*"Many things that were always so important before became increasingly relative"* [2_7272]
Social Comparison/Relativization		*"Compared to other countries, we are doing very well here"* [1_1140]
(Change) Attitude/Basic Mindset		*"No time for musings that do not go far anyway"* [4_7323]
Stay Calm		*"keep calm"* [1_9014]
Focus on the Positive		*"Gratitude for being able to look back on a "rich," colorful life"* [1_7348]
Focus on Others		*"Helping others,* e.g., *listening, comforting* etc.*"* [7_9054]
Distraction		*"All activities that distract one from the topic of pandemic (not only Corona)"* [8_1253]
Hope		*"Hope for a good ending!!!"* [7_1,186]
Give up Hope		*"At the beginning of the pandemic, I found it easier for me to deal with the changes, currently it is somehow more stressful because it is not foreseeable how long this situation will last"* [2_7171]
Anticipation of the Time after the Pandemic		*"Joy of sporting activities allowed again, joy of planned excursions and vacations"* [4_9078]
Hope for Normality soon		*"The hope for normality soon"* [1_1018]
Hope for Vaccine		*"The belief that a vaccine will be found quickly"* [1_7108]
Planning		*"Organize events"* [7_1794]
Plan the Future		*"More time to think about the future"* [2_7040]
Plan a Move		*"To prepare and organize my move from my house to an apartment"* [2_7175]
Plan Vacation/a Trip		*"Travel planning for the time after Covid-19"* [2_7167]

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TABLE 4 Descriptive statistics of the six main categories: an overview of how often participants named each strategy.

	Coro-Q1 Jun-20 *N* = 774			Coro-Q2 Nov-20 *N* = 780			Coro-Q3 May-21 *N* = 796			Coro-Q4 Nov-21 *N* = 759			Coro-Q5 Apr-22 *N* = 746			Coro-Q6 Nov-22 *N* = 706		
	Mean (SD)	Median [IQR]	Range	Mean (SD)	Median [IQR]	Range	Mean (SD)	Median [IQR]	Range	Mean (SD)	Median [IQR]	Range	Mean (SD)	Median [IQR]	Range	Mean (SD)	Median [IQR]	Range
C1: general beliefs	0.1 (±0.2)	0 [0;0]	0–2	0.1 (±0.3)	0 [0;0]	0–3	0.0 (±0.2)	0 [0;0]	0–2	0.1 (±0.3)	0 [0;0]	0–3	0.0 (±0.2)	0 [0;0]	0–2	0.0 (±0.2)	0 [0;0]	0–2
C2: general living conditions	0.4 (±0.8)	0 [0;1]	0–5	0.3 (±0.7)	0 [0;1]	0–7	0.3 (±0.6)	0 [0;0]	0–4	0.2 (±0.5)	0 [0;0]	0–4	0.2 (±0.5)	0 [0;0]	0–3	0.2 (±0.5)	0 [0;0]	0–5
C3: general evaluation of the situation	0.3 (±0.8)	0 [0;0]	0–6	0.2 (±0.6)	0 [0;0]	0–4	0.1 (±0.5)	0 [0;0]	0–4	0.1 (±0.4)	0 [0;0]	0–4	0.2 (±0.5)	0 [0;0]	0–4	0.2 (±0.5)	0 [0;0]	0–4
C3.1: positive	0.1 (±0.4)	0 [0;0]	0–4	0.1 (±0.3)	0 [0;0]	0–4	0.0 (±0.1)	0 [0;0]	0–1	0.0 (±0.1)	0 [0;0]	0–1	0.0 (±0.1)	0 [0;0]	0–2	0.0 (±0.2)	0 [0;0]	0–3
C3.2: irrelevant	0.1 (±0.3)	0 [0;0]	0–2	0.1 (±0.3)	0 [0;0]	0–2	0.0 (±0.2)	0 [0;0]	0–1	0.0 (±0.2)	0 [0;0]	0–2	0.1 (±0.3)	0 [0;0]	0–2	0.1 (±0.3)	0 [0;0]	0–2
C3.3: stressful	0.1 (±0.4)	0 [0;0]	0–4	0.1 (±0.4)	0 [0;0]	0–3	0.1 (±0.4)	0 [0;0]	0–4	0.1 (±0.4)	0 [0;0]	0–4	0.1 (±0.4)	0 [0;0]	0–4	0.0 (±0.2)	0 [0;0]	0–2
C4: problem-focused strategies	2.3 (±2.2)	2 [0;4]	0–13	2.3 (±2.2)	2 [1;4]	0–12	2.3 (±2.1)	2 [1;3]	0–12	2.0 (±1.9)	2 [1;3]	0–15	2.0 (±1.9)	2 [0;3]	0–11	2.1 (±2.1)	2 [0;3]	0–14
C5: emotion-focused strategies	1.8 (±2.1)	1 [0;3]	0–11	1.9 (±2.0)	1 [0;3]	0–9	1.9 (±1.9)	1 [0;3]	0–8	1.8 (±1.9)	1 [0;3]	0–11	1.5 (±1.8)	1 [0;2]	0–12	1.7 (±1.9)	1 [0;3]	0–8
C6: cognitive strategies (reactive)	0.1 (±0.4)	0 [0;0]	0–5	0.1 (±0.3)	0 [0;0]	0–3	0.0 (±0.2)	0 [0;0]	0–2	0.0 (±0.2)	0 [0;0]	0–2	0.0 (±0.3)	0 [0;0]	0–5	0.0 (±0.2)	0 [0;0]	0–2
Total number of categories	5.1 (±4.1)	4 [2;8]	0–20	5.0 (±3.8)	4 [2;7]	0–18	4.7 (±3.5)	4 [2;7]	0–20	4.2 (±3.3)	4 [2;6]	0–19	3.9 (±3.3)	3 [1;6]	0–19	4.2 (±3.4)	4 [2;6]	0–20

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Table 5. On average, across all six questionnaire rounds, participants most frequently used problem-focused coping strategies in dealing with the pandemic {Coro-Q1 (*Median* [IQR]): 2 [0;4]; Coro-Q2: 2 [1;4]; Coro-Q3: 2 [1;3]; Coro-Q4: 2 [1;3]; Coro-Q5: 2 [0;3]; Coro-Q6: 2 [0;3], *cf.* Table 4}. Few participants reported their general value beliefs, general life circumstances, their general evaluation of the pandemic or cognitive strategies (see Tables 4, 5).

In further analyses, we were interested in what was most frequently mentioned by the participants. Therefore, for each round of questionnaires, the 15 most frequently mentioned categories were identified from the 427 categories (Figure 1). In 2020, among the top 15, going for a walk (top 1) and phone calls (top 2), as well as having a garden (top 3), were most frequently mentioned. In addition, many emotion-focused strategies were mentioned, such as contact with a spouse, friends, family, and neighbors. In 2021, going for a walk and phone calls continued to be among the top 3, with more problem-focused strategies added, such as bicycling, gardening, sports activities, or traveling, which was found again in a relatively similar manner in 2022. Across all rounds, emotion-focused strategies (social contact to individuals online or personally) were consistently listed. However, it should be noted that the top 15 are probably skewed by the fact that examples were suggested in the open-ended question. For "general living conditions," two items reached the top 15 at the beginning of the pandemic, namely "having a garden" and "own a house/live in a house." During the pandemic, "having a garden" lost some ranks, but remained consistently among the top 15 mentions. In contrast, general beliefs and evaluation of the situation were mentioned less frequently, so that they do not appear in the top 15 (see Discussion). For a more detailed overview of the top 15, see Figure 1.

3.2. Results of the exploratory analysis

In the exploratory analysis, we were interested in whether there is a relationship between our six main categories (level 1, but for content reasons, C3 "general evaluation of the situation" was also analyzed on level 2) and demographic variables (age, sex, years of education), depression, perceived stress, resilience, loneliness, health-related quality of life and physical inactivity. Resilience was only recorded from the 2nd corona questionnaire (Coro-Q2) onwards. For this reason, no correlations with our main categories are available for the first corona questionnaire (Coro-Q1).

Results are shown for the six main categories for each of the six questionnaire rounds in Supplementary Tables S3–S9. Although most of the correlations were weak ($r < 0.3$), correlations $r > 0.1$ or correlations that showed a pattern over time were reported. Most of the significant correlations were as expected: Rating the situation as *irrelevant* (C3.2) correlated negatively with fear of COVID-19 and perceived stress, while positive correlations were found with resilience (Coro-Q4/Coro-Q5) and health-related quality of life (Coro-Q4). In contrast, if the situation was rated as stressful (C3.3), a positive correlation with perceived stress and a negative correlation with health-related quality of life emerged as an almost continuous pattern. In addition, a weak negative correlation between rating the situation as stressful and resilience was found in the last three questionnaire rounds. Not surprisingly, at several time points, depression and loneliness also correlated positively with the evaluation of the situation as stressful. For problem-focused strategies (C4), which include (leisure) activities and among them sports, a negative correlation with physical inactivity was found as a consistent pattern. At four time points, fear of COVID-19 also correlated positively with the problem-focused strategies, which include pandemic-related activities (e.g., adhering to Corona rules, seeking information). Emotion-focused strategies (C5), which include maintaining social contacts, showed a negative correlation with loneliness in the last two questionnaire rounds, a pattern of negative correlation with age, and a positive correlation with education in the first two questionnaire rounds. Furthermore, it is worth mentioning a negative correlation of general beliefs (C1) with fear of COVID-19 at two time points (Coro-Q2 and Coro-Q4) and a positive correlation of problem-focused strategies (C4) with years of education (Coro-Q2, Coro-Q3). For total number of codes, there was an almost consistent pattern of a positive correlation with fear of COVID-19 and a negative correlation with physical inactivity. There was also a negative correlation between the total number of codes and age and a positive correlation with years of education in the first two rounds of questionnaires. In the last questionnaire rounds, the total number of codes correlated negatively with loneliness and positively with health-related quality of life. No pattern or noteworthy individual correlations were found for general living conditions (C2), evaluation of the situation as positive (C3.1), and cognitive strategies (C6).

Since gender differences are found in many questionnaires on stress management, resilience, depression, anxiety, and physical activity (Herrera-Añazco et al., 2022; Peyer et al., 2022), we were also exploratively interested in whether these differences could also be found in our categories generated by the qualitative analysis. Regarding gender-related group comparisons using Mann–Whitney *U*-Test, women reported more positive aspects when evaluating the situation at the beginning of the pandemic compared to men (Coro-Q1, Coro-Q2). They also reported more strategies overall in all questionnaire rounds, but especially emotion-focused strategies, showing small effect sizes (r between 0.16 and 0.28). In addition, women also reported more problem-focused strategies at four time points. For an overall overview of all correlations and group comparisons, see Supplementary Tables S3–S9.

4. Discussion and implications

In the current article, we were interested in how older adults with increased vulnerability for severe COVID-19 cope with the pandemic situation in the long-term. In order to better classify older adults' coping strategies, a qualitative approach was chosen to identify long-term coping strategies by using a qualitative content analyses according to Mayring (2000, 2015). Contrary to the expectations that older adults might have difficulties withstanding the pandemic situation (Ayalon et al., 2020; Minahan et al., 2021), especially with regard to the psychosocial effects, the results of this article highlight older adults' resilience in terms of their coping and adaptability during the crisis of COVID-19. Our main finding in this study was that the Lazarus and Folkman (1984) "extended" transactional stress model helped to classify the responses from over 800 participants over a period of 2.5 years.

According to text material, we identified six main categories that comprised the coping strategies mentioned by participants. Categories included three types of coping mechanisms (problem-focused, emotion-focused, or cognitive), as well as general beliefs, living conditions, and the specific evaluation of the situation as positive, irrelevant, or stressful. In line with other studies investigating coping strategies in older adults, the

TABLE 5 All participants who ever took part in one of the questionnaires ($N = 880$).

	Coro-Q1	Coro-Q2	Coro-Q3	Coro-Q4	Coro-Q5	Coro-Q6	Total
	$N = 774$	$N = 780$	$N = 796$	$N = 759$	$N = 746$	$N = 705$	
C1: general beliefs	45 (1.2%)	62 (1.6%)	39 (1.0%)	38 (1.2%)	25 (0.9%)	25 (0.9%)	234 (1.1%)
C2: general living conditions	327 (8.4%)	263 (6.8%)	241 (6.4%)	156 (4.8%)	137 (4.8%)	127 (4.3%)	1,251 (6.1%)
C3: general evaluation of the situation	234 (6.0%)	175 (4.5%)	111 (3.0%)	93 (2.9%)	136 (4.7%)	114 (3.9%)	863 (4.2%)
C4: problem-focused strategies	1810 (46.3%)	1827 (47.0%)	1828 (48.8%)	1,526 (47.4%)	1,464 (50.8%)	1,464 (50.1%)	9,919 (48.2%)
C5: emotion-focused strategies	1,425 (36.4%)	1,493 (38.4%)	1,490 (39.8%)	1,382 (42.9%)	1,087 (37.7%)	1,171 (40.0%)	8,048 (39.1%)
C6: cognitive strategies (reactive)	70 (1.8%)	64 (1.6%)	37 (1.0%)	27 (0.8%)	34 (1.2%)	23 (0.8%)	255 (1.2%)
Total	3,911 (100%)	3,884 (100%)	3,746 (100%)	3,222 (100%)	2,883 (100%)	2,924 (100%)	20,570 (100%)

All available records ($N = 4,561$).

FIGURE 1
Overview of the Top 15 mentioned items for coping with the COVID-19 pandemic. Participants had to answer the question *"What was helpful for you to get through the last months despite the COVID-19 pandemic?* E.g., *phone calls, going for a walk, or others"*.

transactional stress model allowed a comprehensive and individual-centered view of the stress-inducing events, such as the pandemic (Minahan et al., 2021; Whitehead and Torossian, 2021). In contrast, the main criticism in this model was the individual-centered view of stress-induced events, without sufficiently considering the situation (e.g., Broda, 1990). The model assumed that an individual experiences stress when he or she perceived an imbalance between him- or herself and the environment, and that this imbalance was classified as a threat.

Especially, for the evaluation of the situation as *irrelevant*, we found that the lower the fear of COVID-19 and the lower the perceived stress, the more text fragments belonging to this category could be coded. We also found a positive correlation between the evaluation of the situation as irrelevant and resilience, which indicated that more resilient individuals were better able to cope with stress and assess situations as stressful less frequently. As expected, the higher the perceived stress and depression and the lower the resilience and health-related quality of life, the more frequently codable text question segments were found to evaluate the situation as *stressful*. In line with our expectations, we found for the problem-focused strategies (C4) including daily structuring, (leisure) activities and sports, that the higher the number in this category, the higher the level of physical activity reported in the standardized questionnaire. Similarly, the correlation with fear of COVID-19 could be explained by the fact that C4 also included a subcategory on "active engagement with the corona pandemic" (e.g., seeking information, following corona rules, taking protective measures, keeping distance). For the emotion-focused strategies, which included the large subcategory of "maintaining and seeking out social contacts," while it was not surprising that loneliness was negatively correlated with the number of codes in this category, it was interesting that the greater the fear of COVID-19 reported, the higher the number of codes in this category. It probably played a large role that contacts could be maintained at a distance that did not carry a risk of infection, e.g., telephone calls (top 2 among all categories), video conferencing, and messengers. A potential explanation for choosing telephone calls, video conferencing, and messengers might be the rise of the internet and social media platforms (34% of older adults use social media platforms, Anderson and Perrin, 2017). Despite the very weak correlations the pattern of fewer emotion-focused strategies being mentioned with increasing age may be because older adults less frequently use modern means of communication or have smaller social networks. In contrast, there seemed to be a correlation of education with emotion-focused strategies, which might also be explained by the fact that education allowed more opportunities to use different means of communication. The fact that the greater the fear of COVID-19, the higher the total number of codes, was probably since people who were less engaged with the pandemic due to low fear also have a lower need to communicate on this topic (in this case, the question of what helped them deal with the pandemic). The quantitative analysis of the data did confirm several (plausible) relationships between coping and psychosocial factors, which support the validity of our qualitative category system. In other studies, gender differences were found in many questionnaires on stress management, resilience, depression, anxiety, and physical activity, in the sense that women reported be more stressed, more depressed and anxious, and were less physically active (Herrera-Añazco et al., 2022; Peyer et al., 2022); this could be confirmed by our data. Regarding the data on coping during the pandemic, we found that women assessed the situation more positively than men at the beginning of the pandemic (early summer and late fall 2020). It is possible that mostly women responded who had suffered little from the effects of the pandemic and were therefore happy to answer this open-ended question. This finding could possibly also be explained by the fact that in our study women wrote more text overall and achieved a higher number of categories than men. It is already known from other studies that women have a higher need to communicate in open response formats (Moreno and Mayer, 1999). Otherwise, the coping strategies mentioned are consistent with other studies (Finlay et al., 2021; Greenwood-Hickman et al., 2021). For instance, Finlay et al. (2021) reported strategies such as exercising, modifying routines, going outdoors, following public health guidelines, staying socially connected. Negative coping strategies such as overeating were rarely mentioned.

There are several strengths of this study, including (a) a large number of qualitative data collected over 2-year period from over 800 subjects, (b) these data belong to a long-term prospective data collection long before the COVID-19 pandemic in a well-characterized cohort of older adults; (c) continuous rounds of questionnaires with specific questions on pandemic-, health- and psychosocial factors, and (d) an open-ended question about individual coping strategies. The question was deliberately chosen in an open-ended format to allow us to capture the unpredictable developments of the pandemic and not limit ourselves to coping strategies mentioned in already established coping questionnaires (e.g., COPE inventory). However, there are also some limitations that should be mentioned: First, there might have been a bias due to the specific wording of the open question about coping strategies, since examples were given in addition to the specific question (e.g., making phone calls, going for a walk, etc.). This might have led participants to think more about problem-solving strategies and therefore these were mentioned more often in our study. Moreover, the wording of the question about coping strategies seemed to suggest to participants that only positive strategies should be mentioned, so dysfunctional strategies for dealing with the pandemic were only mentioned 1–2 times in all questionnaire rounds. However, the aim was to look at the helpful strategies and not at the obstacles.

Another limitation of our study are missing answers to the question on coping strategies. The question may have been intentionally left unanswered or inadvertently overlooked, or that no coping strategies could be mentioned because nothing was experienced as helpful. Another possible explanation for this finding could be that the participants became tired of answering the question over the duration of the pandemic, in the sense of a lack of motivation. Besides, it should be mentioned that the sample of the TREND study might be selective with respect to well-educated and wealthy individuals. For example, many of our participants reported having their own garden or house, which provided them with free space during the pandemic. But the years of education did only show correlations with coping strategies lower than 0.07 (*cf.* Supplementary Tables S2–S7).

Methodologically, it should be noted that the coping strategies were recorded by means of a free-text field and using an open format question, rather than using an already established coping questionnaire. Nevertheless, the results of these surveys are unique, as data on coping strategies were collected at regular intervals over a period of 2.5 years, which extend the data pool of usual qualitative surveys (in our study, a total of 20,578 text segments in 4561 records, originating from more than 800 participants and collected at six time points over a 2.5-year period, were coded). The response rates over 2.5 years stayed between 83 and 90% and were exceptionally high for surveys. These constantly high rates prevent a severe bias towards healthy and resilient subjects, which is underlined by the fact that similar patterns of coping strategies emerged, even when all respondents were included, and analyses were not limited to subjects who participated in each of the six

questionnaires. Society should be aware of helpful strategies, share them with older individuals and support and facilitate such strategies and activities, as the next pandemic and lockdowns might come.

In conclusion, the present findings provide novel insights into the longitudinal coping strategies of older adults during the COVID-19 pandemic. Throughout the COVID-19 pandemic, emotional-focused as well as problem-focused strategies were the main coping strategies, whereas general beliefs, general living conditions and the evaluation were mentioned less frequently. However, the current results so far do not allow a conclusion on how stable these strategies were for the individual.

Data availability statement

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

Ethics statement

The TREND study and all its amendments, including the questionnaires during the COVID-19 pandemic, were approved by the ethics committee at the Medical Faculty of the Eberhard Karls University and at the University Hospital of Tübingen (No. 90/2009BO2). The study was conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

SH, DB, WM, KB, US, A-KT, TD, GE, and AT developed the research question, and contributed to the conception and study design. LK, CM, US, A-KT, SH, GE, and AT implemented the questionnaires. US programmed the database and online questionnaires. A-KT, US, and LK entered the data. US, LK, GE, and AT categorized the data in MAXQDA. LK and US contributed to drafting the text, designed the figures and tables, and performed the statistical analyses. All authors provided critical feedback and helped in every stage of the research, analysis, and 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.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1209021/full#supplementary-material

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The impacts of the COVID-19 pandemic on indirect costs of mental illness and behavioral disorders in Poland

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Introduction: In various research, the estimation of the disease's economic burden has been taken into consideration. But given the fact that different settings will have distinguished consequences, determining the economic burden of COVID-19 in the studied environment is of great importance. As a result, this study aimed to show the change in indirect costs of mental health problems due to the COVID-19 pandemic in Poland.

Methods and Results: Indirect costs related to mental health problems were analyzed from the perspective of the Social Insurance Institution in Poland. In 2021, they amounted to about 285.8 billion PLN (Polish currency) [61.1 billion EUR (European currency)], up 6% from the previous year. A large increase in spending on disability benefits was observed for 2019–2021 (+14.7%). Disease groups generating the highest expenditures in the structure of total expenditures on incapacity benefits in 2021 in Poland were mental health problems (16.7% of total expenditures). Expenditures on disability benefits related to mental health problems incurred by Social Security in 2021 amounted to about 7.42 billion PLN [1.6 billion EUR] and were 19.4% higher than in 2019 (before the pandemic). In the 2012–2019 period, there was a significant decrease in expenses related to inpatient rehabilitation (41.3%), while in 2020–2021, these expenses decreased several times as the epidemiological situation related to the COVID pandemic reduced access to such services.

Discussion: This is the first study on the economic burden of COVID-19 indirect costs in Poland. Calculating the economic impact is crucial, particularly when there is a large disease outbreak and countries are severely constrained by financial resources. Doing so could aid in the development of effective social security policies. As shown in this study, the indirect costs of absenteeism expenses due to mental health problems increased significantly during the COVID-19 pandemic. It is necessary to take all possible measures, both in the field of primary and secondary prevention, to prevent disability and exclusion from the labor market of people affected by mental health problems, which is justified by epidemiological data and financial data on the expenses incurred by Social Security for social insurance benefits.

KEYWORDS

indirect costs, mental illness, behavioral disorders, absenteeism, COVID-19

1. Introduction

Globally, there have already been a very large number of cases of the new coronavirus disease (COVID-19), which is caused by the SARS-CoV-2 virus. By April 6, 2023, this fatal disease has infected more than 762201169 million people and nearly 6893190 million have died

as a result of the disease (1). Global health systems are facing significant difficulties in avoiding infections, recognizing and managing COVID-19 cases, and providing efficient public health protection measures as a result of COVID-19's rapid spread (2, 3). Although these difficulties largely result from an infectious condition with implications for physical health, they may also have a significant negative impact on mental health and well-being (4, 5). People all around the world struggle with anxiety and dread about their safety, the lack of a viable vaccine or cure, and negative socioeconomic effects including unemployment and restricted access to necessities as a result of lockdown and quarantine measures in various situations (6–9). Researchers and practitioners in global health must pay attention to these challenges because they may have various effects on mental health across populations. Previous research indicates that significant economic crises or natural disasters are frequently followed by depression, anxiety disorders, substance addiction, increased suicidal thoughts, and PTSD (10–12). It is stressed that the COVID-19 pandemic has had a huge impact on the mental health of the general public, and workers in particular, and in this context the transition to remote work has had the greatest impact (13–15).

Another issue with global health is the effect COVID-19 has on those who test positive psychologically (16). This vulnerable demographic is affected by several issues, including social isolation following a diagnosis of the illness, stigma and prejudice, lengthy hospitalization, and a lack of social support (7, 17, 18). These difficulties could become more common in COVID-19 along with psychological pressures that affect people generally. In addition, individuals with preexisting diseases or those with poor access to healthcare are more likely to experience psychological stress during this epidemic (19, 20). Furthermore, individuals and populations may have experienced several mental health issues before the start of the pandemic, which could make them more vulnerable to negative mental health outcomes after receiving a COVID-19 diagnosis (21, 22). More and more studies and reports indicate that COVID-19 individuals may experience depression, anxiety disorders, psychological discomfort, and suicidal conduct, which calls for a thorough study of the pandemic's mental health epidemiology (18, 23, 24).

Diseases, such as COVID-19, bring not only direct medical costs such as hospitalization, medicine, and doctor consultations but also indirect costs that are not as easily quantifiable. These indirect costs can have a lasting impact on individuals, families, communities, and society as a whole. One of the major indirect costs of diseases is loss of productivity (25). When someone falls ill, they may miss work and lose income or be less productive at work due to reduced energy levels and concentration. This not only affects the individual but also their family who may have to make sacrifices to make up for the loss of income (26).

Another indirect cost of diseases is the burden placed on caregivers. Family members or friends may have to take time off work to care for the sick person, and in some cases, may have to give up their careers to become full-time caregivers. This can lead to financial strain and emotional stress on the caregivers as well as the patient. Diseases can also have a ripple effect on the economy (27). When a large number of people fall ill, it can lead to reduced economic activity and lower GDP (28). The cost of healthcare also rises, which puts a strain on government budgets and can lead to cuts in other areas such as education and infrastructure. Furthermore, diseases can also have long-term effects on people's lives such as disabilities, reduced quality of life, and premature death. These consequences can lead to a loss of potential economic productivity and put an additional burden on social welfare programs (15, 29).

In various research, the estimation of the disease's economic burden has been taken into consideration (26, 30, 31). But given the fact that different settings will have distinguished consequences, determining the economic burden of COVID-19 in the studied environment is of great importance. As a result, this study aimed to show the change in indirect costs of mental illness and behavioral disorders due to the COVID-19 pandemic.

2. Materials and methods

2.1. Study design and settings

The study is a cost analysis. Indirect costs related to mental illness and behavioral disorders were analyzed from the perspective of the Social Insurance Institution in Poland. All cost values were presented in PLN (Polish currency). According to the National Bank of Poland, the euro exchange rate on 11/04/2023 was PLN 4.68. For ease of reference, conversions to EUR (European currency) are shown in parentheses.

2.2. Data collection

Disability cost data were extracted based on the International Statistical Classification of Diseases and Health Problems – Tenth Revision (ICD-10) codes: F00-F99 "Mental and behavioral disorders." The analysis of indirect costs was based on a retrospective evaluation of Social Insurance Institution data for 2012–2021, which was provided by this public finance sector institution.

In the Classification of Mental Disorders (DSM-5), behavioral disorders are defined as those that do not fit into accepted social norms and standards set by law, e.g., refusal to go to school, aggression toward others, and destruction of objects.[1]

The study did not require the approval of a bioethics committee under current Polish legislation.

The research was conducted using Statistica 13.0 software. Mann–Whitney U and Kruskal-Wallis statistical tests were used in the statistical processing of the data. The probability level was set at $p = 0.05$.

1 Mental disorders refer to a wide range of mental problems that can affect a person's thinking, emotions and behavior. Examples include depression, anxiety, schizophrenia, bipolar affective disorder, PTSD and many others. These disorders are often caused by a combination of genetic, biological, environmental and psychological factors. Behavioral disorders are a type of mental disorder that affects a person's behavior. They can be defined as patterns of behavior that are socially unacceptable, interfere with a person's daily functioning, or both. Examples include ADHD, oppositional defiant disorder, chronic disorders, impulsivity, aggression and others. These disorders often begin in childhood or early adolescence, but can also occur in adults.

3. Results

3.1. Expenditure on social security benefits related to incapacity due to mental illness and behavioral disorders

The amount of expenditures on cash benefits realized by the Social Insurance Institution has shown an upward trend over the past decade. In 2021, they amounted to about 285.8 billion PLN [61.1 billion EUR] up 6% from the previous year. Since 2016, the main item of expenditures on incapacity benefits has been sickness absence and disability benefits – in 2021 this was 52.2 and 28% of total expenditures, respectively. The structure of the discussed group of expenditures in 2021 also included expenditures on social pensions (8.4%), rehabilitation benefits (5.2%), and therapeutic rehabilitation under Social Security disability prevention (0.2%) (32).

Total Social Security disability benefit expenditures incurred by the Social Insurance Institution in 2021 amounted to more than 44.4 billion PLN [9.5 billion EUR], increasing by 14.8 billion PLN [3.2 billion EUR], compared to 2011. The amount of these expenditures in the year under review accounted for 1.7% of GDP, and this share decreased by 0.1 percentage points compared to the previous year. The observed large increase in spending on disability benefit expenditures in 2019–2021 (+14.7%) is due to the occurrence of the COVID-19 pandemic. The detailed data is illustrated using Figure 1.

Disease groups generating the highest expenditures in the structure of total expenditures on incapacity benefits in 2021 in Poland were mental disorders and behavioral disorders (16.7% of total expenditures), diseases of the osteoarticular, muscular, and connective tissue systems (14.5%), diseases related to pregnancy, childbirth and the postpartum period (12.5%), injuries, poisoning and other specified effects of external agents (12.2%), diseases of the respiratory system (8.2%), the circulatory system (8%) and the nervous system (7.7%). All of the aforementioned disease groups accounted for about 80% of incapacity expenses (32).

Expenditures on disability benefits related to mental and behavioral disorders incurred by Social Security in 2021 amounted to about 7.42 billion PLN [1.6 billion EUR] and were 19.4% higher than in 2019 (before the pandemic) and 41.2% higher than in 2012. For men, these expenditures have increased by 33.3% over the past 10 years, (from 2.7 billion PLN to 3.6 billion PLN [from 0.6 billion EUR to 0.8 billion EUR]) for women – by 50% (from 2.4 billion PLN to 3.6 billion PLN [from 0.5 billion EUR to 0.8 billion EUR]). It is also noteworthy that while in the case of men the share of expenditures related to incapacity due to mental and behavioral disorders in the structure of total expenditures increased by 1 percentage point, a decreasing trend was observed for women (a decrease of 0.7 percent points). Detailed data are shown in Table 1.

In assessing the level of spending on incapacity-related benefits, the rate of spending per person covered by health insurance is also important. Mental and behavioral disorders, unchanged for the past 10 years, rank first in the ranking of disease groups generating the highest average spending per person (about 295 PLN in 2020 [63 EUR]). These expenses were 15.6% higher than in 2019 (about 256 PLN [54.7 EUR]) and 33.8% higher than in 2012 (about 222 PLN [47.4 EUR]) (33). The fact that mental and behavioral disorders are a significant burden on the social security system is also evidenced by the fact that among the 20 disease entities generating the highest expenditures on incapacity benefits in 2021 were as many as six from the group in question. These are schizophrenia, stress reaction and adaptive disorders, moderate intellectual disability, depressive episode, anxiety disorders other than a phobia, and recurrent depressive disorder, generating a total of 11.5% of total expenditures on incapacity benefits (32).

The difference between the periods depends on the number of patients admitted to the wards due to the prevailing COVID-19 pandemic, especially in its first phases (the year 2020) ($p < 0.05$).

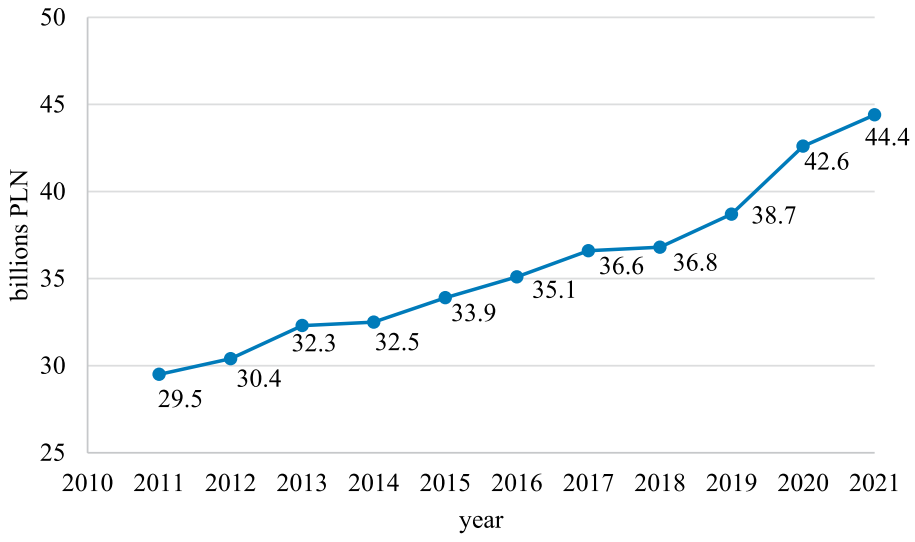

FIGURE 1
Total Social Security disability benefit expenditures incurred by the Social Insurance Institution in 2011–2020 (in billion zlotys). Own compilation based on: Social Insurance Institution, Expenses for social insurance benefits related to inability to work in 2011–2021.

TABLE 1 Expenditures for benefits related to incapacity due to mental and behavioral disorders incurred by the Social Insurance Institution from 2012 to 2021 by gender in billion zlotys and as a % of the total in the structure of expenditures.

Gender	Total		Men		Women	
Year	Billions PLN [EUR]	%	Billions PLN [EUR]	%	Billions PLN [EUR]	%
2012	5.1 [1.1]	16.7	2.7 [0.6]	15.8	2.4 [0.5]	17.7
2013	5.4 [1.2]	16.8	2.9 [0.6]	16.0	2.5 [0.5]	17.7
2014	5.6 [1.2]	17.3	3.0 [0.6]	16.9	2.6 [0.6]	17.9
2015	5.9 [1.3]	17.4	3.1 [0.7]	17.2	2.8 [0.6]	17.7
2016	5.6 [1.2]	16.0	2.9 [0.6]	15.6	2.7 [0.6]	16.5
2017	5.8 [1.2]	15.9	3.0 [0.6]	15.7	2.8 [0.6]	16.1
2018	5.8 [1.2]	15.8	3.0 [0.6]	15.8	2.8 [0.6]	15.8
2019	6.2 [1.3]	16.2	3.2 [0.7]	16.3	3.0 [0.6]	16.1
2020	7.2 [1.5]	17.1	3.6 [0.8]	16.8	3.6 [0.8]	17.3
2021	7.4 [1.6]	16.7	3.7 [0.8]	16.5	3.7 [0.8]	17.0

Own compilation based on: Social Security, Expenditures on social insurance benefits related to inability to work in 2012–2021.

3.2. Costs of short-term absenteeism due to mental and behavioral disorders

In 2021, a total of 23.1 million medical certificates for 252 million days were issued to people insured with Social Security. Of this number, 20.5 million certificates were certificates issued for self-inflicted illness. The number of days of sickness absence from these certificates was 239.9 million days (57.2% were for women, 42.8% for men), and the average length of the certificate was 11.73 days. Mental and behavioral disorders ranked fifth among the most common causes of sickness absence, accounting for 25.2 million days of absence from work (10.5% of the total) (34).

Mental and behavioral disorders, as already mentioned, occupy the first place in the structure of expenses incurred by Social Security for the payment of benefits related to the inability to work in total (16.7% in 2021). Restricting the analysis of the data solely to expenses incurred for sickness absence – they occupy the 3rd place (11.4%), after diseases of pregnancy, childbirth, and the puerperium (22.6%) and diseases of the osteoarticular, muscular, and connective tissue systems (13.7%). Noteworthy is the fact that limiting the analysis of expenditures only to those incurred in connection with sickness absence for men puts diagnoses in the group of mental and behavioral disorders in fourth place (11.3% of the total in 2020). For women, it ranks second (11.5% of the total in 2021), after diseases caused by pregnancy, childbirth, and puerperium (36.9%). As for rehabilitation benefits, mental disorders and behavioral disorders rank second among the disease groups generating the highest costs associated with their payment (17.9% of the total in 2021), after diseases of the osteoarticular, muscular, and connective tissue systems (31.2%) (32).

Under Social Security disability prevention, dysfunctions resulting from diseases of the musculoskeletal system, cardiovascular system, respiratory system, psychosomatic diseases, vocal system, and oncological diseases are subject to medical rehabilitation. Expenses related to conditions occurring in the group of mental and behavioral disorders, do not dominate the structure of expenses for inpatient rehabilitation (3.3% of the total in 2021). Much higher costs are generated in this case by diseases of the musculoskeletal system (58.9%), injuries and poisonings (10.7%), diseases of the nervous system (10%), the cardiovascular system (6.5%), or the respiratory system (5.9%) (32). Between 2012 and 2021, there was a significant increase in expenses incurred by Social Security for short-term absenteeism for sickness benefits and rehabilitation benefits. In the 2012–2019 period, there was a significant decrease in expenses related to inpatient rehabilitation (41.3%), while in 2020–2021, these expenses decreased several times as the epidemiological situation related to the COVID pandemic reduced access to such services (33). Expenditures related to sickness absence in 2021 increased by about 41.8%, compared to 2019 (before the pandemic). For rehabilitation benefits, this was an increase of 53.5% over the same period. Detailed data on Social Security's expenditures on benefits related to incapacity for work due to mental and behavioral disorders in 2012–2021 due to short-term absenteeism are presented in Table 2.

Based on the analysis, the cost of mental disorders since the COVID-19 pandemic has increased compared to previous years ($T = 10.654$; $r = 0.531$; $p = 0.001$).

3.3. Costs of long-term absenteeism due to mental and behavioral disorders

For incapacity pensions, the highest expenses in 2021 were for injuries and poisoning (17.1%), cardiovascular diseases (16.6%), osteoarticular diseases (16.3%), and mental and behavioral disorders (15%). The highest share of expenditures, in the case of mental and behavioral disorders, is recorded for partial disability pensions (46.1% of pension expenditures in this disease group) and total disability pensions (37.6%); the remainder is for total disability and independent living pensions (16.3%) (32). From 2012 to 2021, there was a significant decrease in the expenses incurred by Social Security for disability pensions due to mental and behavioral disorders (29.5%) (33). The 2019–2021 period also saw a slight decrease in this area of spending (about 4%). Detailed data on Social Security's expenditures on disability benefits due to mental and behavioral disorders in 2012–2021 in connection with long-term absenteeism are presented in Table 3.

Based on the analysis, the cost of mental disorders since the COVID-19 pandemic has increased compared to previous years ($T = 11.965$; $r = 0.674$; $p = 0.002$).

4. Discussion

This is the first study on the economic burden of COVID-19 indirect costs in Poland. Calculating the economic impact is crucial, particularly when there is a large disease outbreak and countries are severely constrained by financial resources. Doing so could aid in the development of effective social security policies.

The social cost of COVID-19 far transcends the medical costs. Marziyeh et al. study on COVID-19 costs showed that only productivity losses due to premature death per patient were $83410.82 that in comparison with average direct medical costs is 58 times (25). The average indirect cost of premature death is very similar to the amount determined in another Iranian study (31). When the

TABLE 2 Expenditures on benefits related to incapacity for work due to mental and behavioral disorders incurred by Social Security from 2012 to 2020 in connection with short-term absenteeism in millions of zlotys and as a % of the total in the structure of expenditures.

Benefit	Sickness absence		Rehabilitation benefits		Disability prevention	
Year	Billions PLN [EUR]	%	Billions PLN [EUR]	%	Billions PLN [EUR]	%
2012	907.3 [193.9]	7.4	136.2 [29.1]	12.2	12.1 [2.6]	7.4
2013	1070.4 [228.7]	8.0	169.8 [36.3]	13.8	12.1 [2.6]	7.2
2014	1139.6 [243.5]	8.4	180.7 [38.6]	14.1	13.5 [2.9]	8.0
2015	1359.8 [290.6]	9.0	221.5 [47.3]	16.2	14.1 [3.0]	8.3
2016	1535.9 [328.2]	9.4	241.7 [51.6]	15.8	11.9 [2.5]	6.8
2017	1662.5 [355.2]	9.4	256.0 [54.7]	15.4	11.1 [2.4]	6.1
2018	1734.9 [370.7]	9.4	264.5 [51.6]	15.5	7.8 [1.7]	4.1
2019	1977.2 [422.5]	10.0	269.7 [54.7]	14.5	7.1 [1.5]	3.5
2020	2680.8 [572.8]	11.7	383.8 [56.5]	17.0	2.4 [0.5]	3.8
2021	2803.5 [599.0]	11.4	414.1 [57.6]	17.9	3.1 [0.7]	3.3

Own compilation based on: Social Insurance Institution, Expenditures on social insurance benefits related to inability to work in 2012–2021.

TABLE 3 Expenditures for disability benefits related to mental and behavioral disorders, incurred by Social Security from 2012 to 2021 in connection with long-term absenteeism in millions of zlotys and as a % of the total in the structure of expenditures.

Benefit	Disability pensions	
Year	Billions PLN [EUR]	%
2012	2922.8 [624.5]	19.4
2013	2998.5 [640.7]	19.2
2014	3118.9 [666.4]	20.0
2015	3207.5 [685.4]	20.9
2016	2591.4 [553.7]	17.3
2017	2417.4 [516.5]	16.5
2018	2201.9 [470.5]	16.1
2019	2142.6 [457.8]	15.8
2020	2135.6 [456.3]	15.6
2021	2059.6 [440.1]	15.0

Own compilation based on: Social Insurance Institution, Expenditures on social insurance benefits related to inability to work in 2012–2021.

productivity lost as a result of hospitalization and the subsequent healing process is taken into account, the societal costs in Marziyeh et al. (25) study will exceed this sum. According to the findings of this study, the economic burden of COVID-19 in Bushehr province in Iran is estimated to be $43.97 million ($39.47 and $205.20 million) and 32% of this constitutes direct medical costs. In other words, the share of societal or indirect costs is more than twofold.

A large share of indirect costs in the economic burden of COVID-19 is seen among medical personnel. Healthcare workers (HCP) have been identified as a high-risk group for SARS-CoV-2 infection from the very beginning of the epidemic, and elevated absence rates and shortages of HCP have been observed (35–40). A recent systemic review of 594 sources found a total of 152,888 reported infections and 1413 deaths among HCP during the first pandemic wave worldwide (36). In addition to the safety issues with HCP, exposure and infection of front-line HCP necessitate the allocation of financial resources for their monitoring and care, which worsens the scarcity of HCP due to elevated absenteeism rates (38). In Maltezou et al. (30) study, absenteeism was the primary factor in both categories of HCPs' overall expenditures. The significant negative effects of absence are in part attributable to its protracted duration, whether it be for isolation needs (healthy absenteeism) in compliance with Greek national guidelines (35) or in the setting of symptomatic disease (COVID-19). For a mean period of 7.5 days, absenteeism was recorded in 40% of exposed HCP, and for a mean period of 25.8 days in 99% of HCP with COVID-19. Results from Maltezou et al. (30) were consistent with a study from Spain where 65 symptomatic workers (24.6%) at a long-term care facility missed a mean of 19.2 days of work during an epidemic of COVID-19 (41).

The consequences of mental illnesses and behavioral disorders, especially those of a chronic nature, significantly affect the reduction of the psycho-physical performance of individuals, including the ability to engage in employment and limitations in the performance of activities of daily living. The phenomenon of sickness absence, both short-term and long-term, affects many aspects of society's functioning, is a measure of the population's health situation, and is an important indirect cost of illness. The scale of absenteeism indicates, among other things, the effectiveness of the healthcare system and the labor market situation (42). As indicated in the publication, mental illnesses and behavioral disorders rank first in the ranking of conditions that generate the highest costs of lost productivity borne by the social security system. They also rank first in the ranking of disease groups generating the highest average expenditures per insured person. Significantly, the last decade has seen a significant increase in all expenses incurred by Social Security for short-term absenteeism due to the group of conditions in question.

5. Strengths and limitations

An important achievement of the study is the collection in one place of all the necessary data on the cost of mental disorders, taking into account the predictive factor that was the COVID-19 pandemic. The conclusions of the study can be used in the wide-ranging health promotion and prevention and future psychoeducation of the public. Being guided by the results of the study can help in designing such

undertakings as health policy programs or national health strategies. In addition, the study is not free of limitations. First of all, the data is based on reports that are available electronically, and it is worthwhile to include in future research the raw data collected by individual centers. It should also be emphasized that the results cannot be generalized and show only the national state.

6. Conclusion

As shown in this study, the indirect costs of absenteeism expenses due to mental illness and behavioral disorders increased significantly during the COVID-19 pandemic. The COVID-19 epidemic drastically changed how people behave, work, and interact with one another in a very short amount of time. Never before has society depended so heavily on modern technology and the internet for communication and production, and many of these changes are likely to persist far beyond the current public health crisis. Additionally, the pandemic has provided us with two crucial but extremely tough lessons regarding mental health. The first is that those with mental illnesses are disproportionately affected by such events. The additional travel limitations, social isolation, and house confinement — all necessary measures to contain the epidemic — make them vulnerable in addition to going against what is often utilized in cognitive and behavioral therapy to effectively treat these problems. The majority of therapeutic advancement must be made by patients when they are not with their doctor, according to a second lesson. Patients need to keep in mind to remember to take their prescriptions, avoid risk factors, and engage in adaptive behaviors or exercises during those times, which are frequently spent at home and alone. During confinement, many people with mental illnesses were unprepared for such autonomy and self-help, and society was unprepared to assist them. For these reasons, the viral pandemic that is COVID-19 has also highlighted the existence of a chronic and major mental health crisis (43).

It is necessary to take all possible measures, both in the field of primary and secondary prevention, to prevent disability and exclusion from the labor market of people affected by mental and behavioral disorders, which is justified by epidemiological data and financial data on the expenses incurred by Social Security for social insurance benefits. A reliable assessment of the number of public funds allocated to finance the indirect costs of diseases should be an integral part of prioritizing investments in specific areas of health. These decisions should also take into account epidemiological data and projections on morbidity and prevalence. Only properly made decisions that improve the economic efficiency and clinical effectiveness of health care will lead to improvements in the health of individuals and society as a whole.

Data availability statement

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

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the patients/participants or patients/participants' legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

KS and TH: conceptualization, writing—original draft preparation, writing—review, and editing. KS: methodology, resources, and supervision. KS and AR: formal analysis. AR: investigation. All authors contributed to the article and approved the submitted version.

Conflict of interest

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

Publisher's note

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Helper Syndrome and Pathological Altruism in nurses – a study in times of the COVID-19 pandemic

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Background: Pathological Altruism and the concept of Helper Syndrome are comparable. We focused on Schmidbauer's description because it provides a comprehensive and testable definition. Nevertheless, this concept of Helper Syndrome has not yet been empirically investigated in a sample of helping professionals.

Aim: To investigate whether nurses working with covid-19 patients are more likely to have Helper Syndrome compared with individuals from non-helper professions.

Methods: The online survey took place between April 2021 and February 2022, in urban and rural regions of Salzburg, during the time of the COVID-19 pandemic. Nurses ($n = 447$) and controls ($n = 295$) were compared regarding Helper Syndrome characteristics. To measure characteristics of Helper Syndrome the following questionnaires were used: WHO-Five (WHO-5), selected scales of the Personality, Style and Disorder Inventory (PSSI) and the Freiburg Personality Inventory-Revised (FPI-R), the Alcohol Use Disorders Identification Test (AUDIT). Insecure gender identity and self-assessment of having a Helper Syndrome was measured by a Likert scale.

Results: In both groups, Helper Syndrome was detected (nurses 29.5%, controls 30.5%). Participants with Helper Syndrome showed significant differences in personality styles and traits, namely significantly higher scores for *Foreboding-Schizotypical Personality Style*, *Spontaneous-Borderline Personality Style*, *Amiable-Histrionic Personality Style*, *Ambitious-Narcissistic Personality Style*, *Loyal-Dependent Personality Style*, *Helpful-Selfless Personality Style*, *Carefully-Obsessive Personality Style*, *Optimistic-Rhapsodic Personality Style*, *Social Orientation*, *Strain*, *Emotionality* and lower well-being. The only difference between nurses and controls was that nurses were significantly less open aggressive.

Conclusion: For the first time, we were able to demonstrate Schmidbauer's concept of Helper Syndrome. According to our data, we found a subgroup of individuals similar to Schmidbauer's description of Helper Syndrome, but this sample was independent of helping or non-helping profession. These individuals seem to be at higher risk for psychiatric disorders.

KEYWORDS

Pathological Altruism, COVID - 19, health care professionals, Helper Syndrome, nurses, well-being, personality

Background

Definition: Pathological Altruism and Helper Syndrome

This study deals with Pathological Altruism, more precisely with Helper Syndrome, which was introduced in 1977 by the German psychoanalyst Schmidbauer (2018). The concept of Schmidbauer is similar to Pathological Altruism, but it is more comprehensive. By definition, Pathological Altruism is a tendency to promote the welfare of another person, but with negative consequences for the other person or even for oneself (Oakley et al., 2012; Oakley, 2013; Kaufman and Jauk, 2020). Pathological Altruism is also defined by a compulsion to heal, save, and help others (Wong, 2020). Schmidbauer (2018) likewise describes Helper Syndrome also by an increased willingness to help other people and denying one's own limits. Helper Syndrome (Schmidbauer, 2018) and Pathological Altruism (Kaufman and Jauk, 2020; Wong, 2020) are related to narcissism. According to Schmidbauer, gratitude from the client/patient leads to narcissistic gain and self-esteem is stabilized by sacrificing energy and time for others in need (Schmidbauer, 2018). In addition, helpers with Helper Syndrome find it difficult to express negative feelings such as anger (Schmidbauer, 2018). They show inhibition of direct aggressive behavior. In addition, both Helper Syndrome and Pathological Altruism include dependent behavior toward others (Oakley et al., 2012; Schmidbauer, 2018). Thus, Helper Syndrome describes people who are attracted to helping professions because of a certain personality structure and who perform this profession in a way that leads to symptoms, namely depressive symptoms and pathological alcohol consumption (Schmidbauer, 2018). Also Pathological Altruism cause depressive symptoms (Kaufman and Jauk, 2020).

Figure 1 provides a detailed overview of the specific symptoms, personality traits and styles that define Helper Syndrome.

Helper Syndrome, mental health problems, nursing staff

In addition to Schmidbauer, other studies between 1977 and the present also addressed the mental health of healthcare workers, particularly nurses: One study found that a significant proportion of nurses suffered from symptoms of post-traumatic stress disorder (Cavanaugh et al., 2014). Another study showed that 81 of 561 nurses were in an incipient or advanced burnout process (Schramm, 2016). Other studies have shown an increased risk of burnout among nurses (Cañadas-De la Fuente et al., 2015) and a higher percentage of risky alcohol use among healthcare workers compared to the average population (Romero-Rodríguez et al., 2019). Study results have also shown that a significant proportion of healthcare workers who were responsible for patients with COVID-19 and SARS reported mental health problems, depression, anxiety, and insomnia (Maunder et al., 2006; Lancee et al., 2008; Lai et al., 2020; Muller et al., 2020; Chen et al., 2022). While working conditions undoubtedly affect mental health care professionals (Lancee et al., 2008), mental health problems of health care workers have also been associated with specific personality traits (Pérez-Fuentes et al., 2019). We assumed that during the COVID-19 pandemic, Helper Syndrome would be an additional risk factor for mental health. According to Schmidbauer, Helper Syndrome is more common among health care professionals, triggering depressive symptoms and pathological alcohol consumption.

Hypotheses and aim of the study

The central question of the study was whether there was a significant difference between nurses and control subjects in terms of certain personality styles and traits as well as symptoms (pathological alcohol consumption, low well-being, insecure gender identity). It is important to emphasize that Schmidbauer first described Helper Syndrome in 1977, and since then more than twenty editions of his book *Helpless Helpers* have been published in German (Schmidbauer, 2018), indicating that many people are interested in this concept. We hypothesized that there are significant differences in Helper Syndrome characteristics between nurses and controls. In his work *Helper Syndrome and Burnout Danger*, published in 2002, Schmidbauer focuses primarily on nursing staff as a typical helping profession, which is why we have chosen the nursing profession as the main group (Schmidbauer, 2002).

Methods

Data collection

The survey was conducted using LimeSurvey (2020) and took place between April 2021 and February 2022, in and around Salzburg, during the time of the COVID-19 pandemic. This study was approved by the local ethics committee. Participants received an online link and completed the questionnaires after they had provided written informed consent.

Participant characteristics

The health care professionals sample ($n = 447$) consisted of graduate frontline nurses with COVID-19 patient contact aged between 20 and 62. The mean age was 39.49 (*SD* 10.89). Managers or nursing staff who were exclusively in teaching positions were excluded. The control group ($n = 295$) consisted of people from other professions (e.g., architects, craftsmen, hairdressers, salesmen, IT, cook, service/waiters and others), aged between 20 and 64 years, without COVID-19 patient contact. The mean age was 39.91 (*SD* 10.94). From this group other "helping professions," namely teachers, psychotherapists, psychologists, doctors, priests, nuns, educators, secretaries, speech therapists, journalists, and nursing staff were excluded. People in training or retired people were excluded from both groups. The mean age of the health care professionals group and control group did not differ significantly ($p = 0.61$). The following participants were excluded from the sample: 40 participants who did not fit into a category, 42 nursing assistants, 14 nursing staff who did not work with patients, 8 participants who were either too old or too young, 3 nurses who were in training, and 70 participants who worked in other helping-professions. Since we were looking at occupational groups, it was important to us that all participants in the study were employed. No psychiatric disorders were recorded or whether anyone was receiving

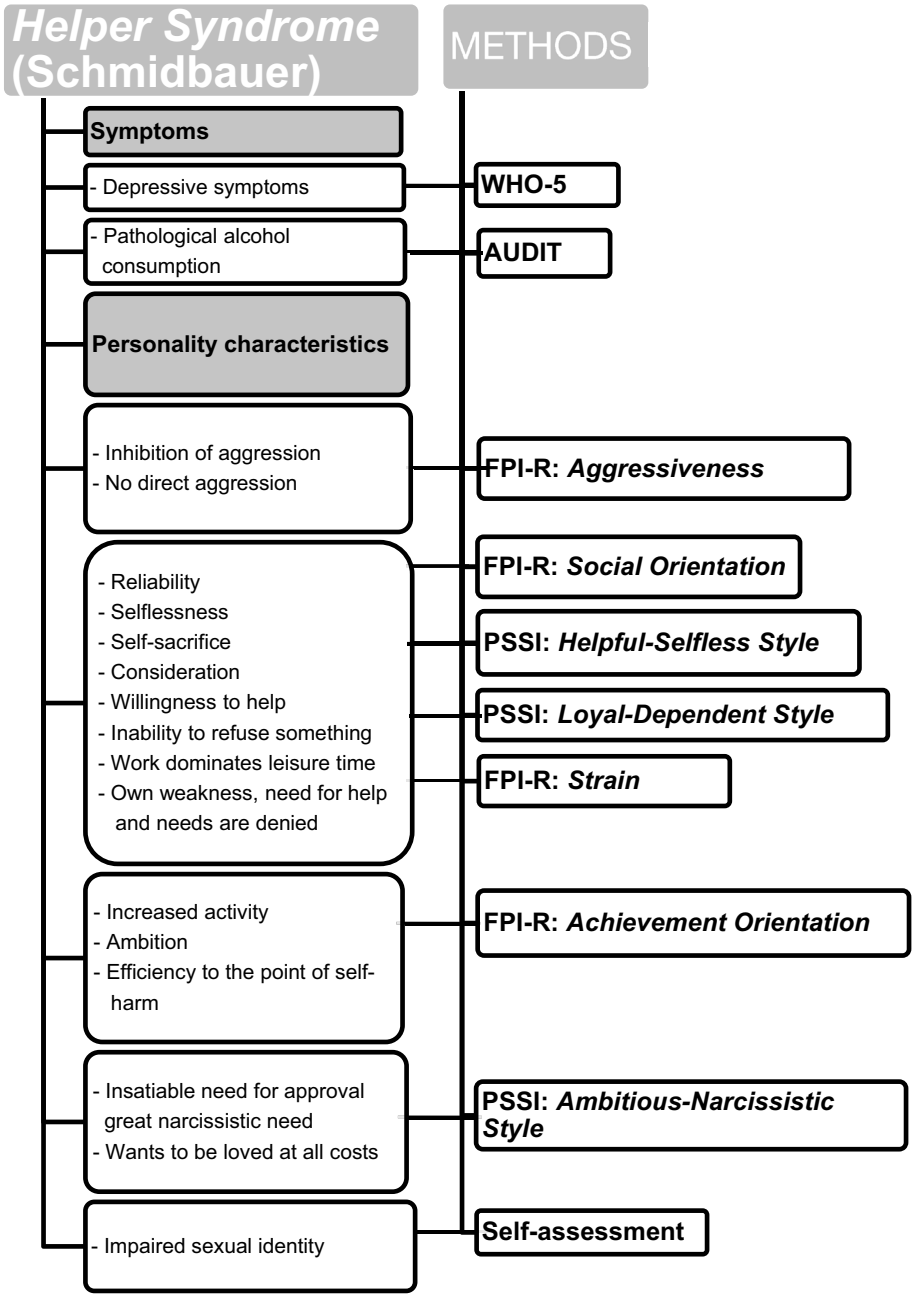

FIGURE 1
The appearance of *Helper Syndrome* – described by Schmidbauer (2018) – and the survey methods [PSSI, Personality Styles and Disorder Inventory; FPI-R, Freiburg Personality Inventory; AUDIT, Alcohol Use Disorders Identification Test; WHO-5, The World Health Organization – Five Well-Being Index (WHO-5)].

psychiatric treatment. In total, 742 participants were investigated. The participants did not receive any compensation. It took approximately 25 min to complete the survey.

Table 1 shows sociodemographic characteristics of participants. The Federal Ministry of Social Affairs, Health, Care and Consumer Protection of Austria stated in 2021 that 84% of nursing staff are female (Bundesministerium für Soziales, Gesundheit, Pflege und Konsumentenschutz [The Federal Ministry of Social Affairs, Health, Care and Consumer Protection of Austria states], 2021). With 79% of our sample being female nurses, the gender distribution is representative.

Measures

Figure 1 shows which psychological methods and scales were used to measure symptoms and personality of Helper Syndrome.

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TABLE 1 Sociodemographic characteristic of participants.

	Nurses (n = 447)		Controls (n = 295)	
	n	%	n	%
sex				
Women (n = 529)	355	79	174	59
Men (n = 213)	92	21	121	41
Relationship status				
In relationship	340	76	232	78
Not in relationship	107	24	63	22
Extent of employment				
no indication	2	0	0	0
Part-time	184	42	94	32
Full time	261	58	201	68

Sample size, n.

Results of two groups (nurses and controls) were compared using the following psychological tests:

Selected scales of the *Personality, Style and Disorder Inventory* (*PSSI*) and the *Freiburg Personality Inventory, Revised* (*FPI-R*) were used to measure the specific personality structure of Helper Syndrome. The *PSSI* is a self-assessment instrument which measures personality styles. The *PSSI* comprises 140 items assigned to 14 scales (Kuhl and Kazén, 2009). Three personality styles (*Helpful-Selfless Style, Loyal-Dependent Style, Ambitious-Narcissistic Style*) were assigned to Helper Syndrome. The *FPI-R* measures traits of personality. It comprises 138 items and consists of 12 scales (Fahrenberg et al., 2010). Four scales (*Aggressiveness, Social Orientation, Strain, Achievement Orientation*) were used to assess Helper Syndrome. The internal consistency (Cronbach's alpha) of the scales of the *FPI-R* ranges from $\alpha = 0.73$ to $\alpha = 0.83$. The consistency coefficients (Cronbach's alpha) of the *PSSI* scales vary from $\alpha = 0.73$ to 0.85. Table 2 shows the descriptions of styles and traits that were important for measuring Helper Syndrome.

The *WHO-Five Well-Being Index* (*WHO-5*) is a screening questionnaire used to assess psychological well-being. Advantages of the *WHO-5* are its brevity and validity as a screening tool for depression (Topp et al., 2015). Brähler et al. (2007) demonstrated that the German version of the *WHO-5* index has a very good psychometric accuracy. Scores range from 0 to 25, with 0 denoting the lowest well-being and 25 denoting the highest well-being. A score below 13 indicates depression (World Health Organisation-5, 2022).

The *Alcohol Use Disorders Identification Test* (*AUDIT*) is a screening questionnaire to measure unhealthy alcohol consumption. It consists of 10 items (World Health Organisation, 2020). The *AUDIT* is a reliable and valid screening tool for the identification of pathological alcohol consumption (Dybek et al., 2006). Alcohol-related disorder is diagnosed at scores above 7 (Suchtforschungsverbund Baden Württemberg, UKL Freiburg, 2022).

Participants were also asked to assess their gender identity on an adapted *Likert* scale from zero to five (*How masculine do you feel/How feminine do you feel?*)

A second self-assessment on an adapted Likert Scale addressed Helper Syndrome itself ("*I have Helper syndrome. On a scale of 0–5, answer how much this statement applies to you*"). This self-assessment was included to capture how strongly someone assesses themselves as having a Helper Syndrome. This self-assessment does not necessarily have to agree with Schmidbauer's definition of Helper Syndrome. We were primarily interested in the self-description of the participants.

TABLE 2 Description of styles and traits that were important to measure Helper Syndrome.

	Description of scale
Helpful-Selfless Style	wants to care for someone, good-natured, wants to relieve the suffering of others, has difficulty saying no, focuses more on the needs of others than on their own
Loyal-Dependent Style	feels helpless on his own, needs a strong person around, needs a lot of proof of being loved, wants to be cared for, is clingy
Ambitious-Narcissistic Style	wants to be special, others should respond to her/his wishes, dreams of great success, wants to be the center of attention, wants to be accepted unconditionally
Aggressiveness	Low scores: low-aggressive, reserved, passive-aggressive, inhibited-aggressive, is able to control anger
Social Orientation	High scores: feels responsible for other people, is helpful, is motivated to help
Strain	High scores: quickly feels overwhelmed by many tasks. Possibly nervousness, exhaustion, exhaustion, stress
Achievement Orientation	High scores: Performance orientation, is motivated to perform, efficient, likes to compete

Statistical analysis

All analyses were conducted using SPSS v.27 (IBM Corp, 2021). In order to reassess the claims of Schmidbauer, a t-test for independent samples was calculated. For the t-test (two-sided significance) the *Levene test of equal variance* was used to check for homogeneity of variance. In total, of 31 variables were tested: all personality styles, all personality traits, alcohol consumption, well-being, self-assessments (12 scales of the FPI-R, 14 scales of the PSSI scales, 1 scale of the Audit, 1 scale of the WHO-5, 3 self-assessment scales). Hence, the level of statistical significance was adjusted to $p = 0.002$ (0.05/31) using the Bonferroni correction for multiple hypothesis testing (Bühner and Ziegler, 2009). In order to not ignore the two potential influencing factors of age and sex, a *multiple linear regression* was carried out. Two artificial groups were created: participants of "Helper Syndrome group" rated 4 or 5 on the self-designed scale "I have Helper Syndrome." The participants of the "Non-Helper Syndrome group" rated 0, 1, 2 or 3. Group differences between "Helper Syndrome group" and "Non-Helper Syndrome group" regarding personality styles, personality traits, femininity, masculinity, well-being, alcohol consumption were also investigated by calculating t-tests (for independent samples).

Results

Self-assessment "I have Helper Syndrome" of nurses and controls

Nurses ($M = 2.57$, SD = 1.49, 95% CI [2.43, 2.71]) and controls ($M = 2.69$, SD = 1.47, 95% CI [2.53, 2.86]) did not differ in their assessment of "I have Helper Syndrome" [t(740) = 1.1, $p = 0.272$]. 29.5% of nurses and 30.5% of controls stated that they have Helper Syndrome.

Group differences "Helper Syndrome group" and "Non-Helper Syndrome group"

There were no differences in demographic characteristics (gender, occupation, relationship status, extent of employment), except for age (see Table 3). The age of the groups differed significantly (t(740) = 3.44, $p = 0.001$). "Helper Syndrome group" ($M = 37.57$, SD = 11.15, 95% CI [36.09, 39.04]) had a significantly lower mean age than "Non-Helper Syndrome group" ($M = 40.55$, SD = 10.68, 95% CI [39.63, 41.47]).

As seen in Table 4, "Helper Syndrome group" ($M = 13.18$, SD = 5.46, 95% CI [12.45, 13.90]) had a significantly ($p < 0.001$) lower mean score in well-being than "Non-Helper Syndrome group" ($M = 14.93$, SD = 5.21, 95% CI [14.48, 15.38]). 43% ($n = 95$, 74 women, 21 men) of participants of "Helper Syndrome group" were under the critical value of 13. In contrast, 27% ($n = 145$, 103 women, 42 men) of "Non-Helper Syndrome group" were under the critical value of 13. As also seen in Table 4, "Helper Syndrome group" ($M = 4.53$, SD = 4.06, 95% CI [3.99, 5.07]) and "Non-Helper Syndrome group" ($M = 3.72$, SD = 3.36, 95% CI [3.43, 4.01]), did not differ significantly in their alcohol consumption (t(740) = 2.819, $p = 0.005$). In these two groups, there were no significant differences in self-assessed masculinity (t(740) = −0.569, $p = 0.57$) and self-assessed femininity (t(740) = 1.752, $p = 0.08$). Group differences between "Helper Syndrome group" and "Non-Helper Syndrome group" regarding personality styles and traits are shown in Table 5.

TABLE 3 Sociodemographic characteristics of "Helper Syndrome group" and "Non-Helper Syndrome group."

	"Helper Syndrome group" ($n = 222$)		"Non-Helper Syndrome group" ($n = 520$)	
	n	%*	*n*	%
Sex				
Women ($n = 529$)	164	74	365	70
Man ($n = 213$)	58	26	155	30
occupation				
Nurses ($n = 447$)	132	59	315	61
Other professions ($n = 295$)	90	41	205	39
Relationship status				
In relationship	170	77	402	77
Not in relationship	52	23	118	23
Extent of employment				
No indication	0	0	2	0
Part-time	81	36	197	38
Full time	141	64	321	62

Sample size, n.

Personality styles and traits of Helper Syndrome by Schmidbauer

With exception of *Aggressiveness (see below)*, there was no significant difference in Helper Syndrome characteristics between nursing staff and controls. Table 6 shows the group differences between nurses and controls regarding personality characteristics of Helper Syndrome.

Aggressiveness

The two groups, nursing staff ($M = 3.0$, $SD = 2.2$, 95% CI [2.82, 3.23]) and controls ($M = 3.5$, $SD = 2.3$, 95% CI [3.30, 3.83]), differed significantly in *Aggressiveness* ($t(740) = 3.184$, $p = 0.002$). The mean value of *Aggressiveness* was significantly higher for controls ($d = 0{,}242$). In a multiple linear regression, the predictors age and *helper/non-helper* were able to predict *Aggressiveness* significantly: $F(2.739) = 10.711$, $p < 0.001$. The predictor sex was excluded due to insufficient statistical significance ($p = 0.008$). The coefficients *helper/non-helper* ($\beta = -0.548$; $p = 0.001$) and age ($\beta = -0.024$; p = 0.001) were significant. There was no multi-collinearity and the residuals were

TABLE 4 Group differences between "Helper Syndrome group" and "Non-Helper Syndrome group" regarding well-being and alcohol consumption.

	M	*SD*	95% CI	*p**	*d*
Well-being				**<0.001****	**0.332**
Helper Syndrome group ($n = 222$)	13.18	5.46	[12.45,13.90]		
Non-Helper Syndrome group ($n = 520$)	14.93	5.21	[14.48,15.38]		
Alcohol consumption				**0.005**	−0.226
Helper Syndrome group ($n = 222$)	4.53	4.06	[3.99,5.07]		
Non-Helper Syndrome group ($n = 520$)	3.72	3.36	[3.43,4.01]		

*Statistical significance level of $p = 0.002$. The values with ** are significant values and because of this it is important that they are in bold. *d*, Cohen's d (effect size); *n*, Sample size; *M*, Mean; *SD*, Standard deviation.

TABLE 5 Group differences between "Helper Syndrome group" and "Non-Helper Syndrome group" regarding personality styles and traits.

	M	*SD*	95% CI	*p**	*d*
Willful-Paranoid PS				**0.078**	**−0.142**
Helper Syndrome group (*n* = 222)	13.13	4.64	[12.51,13.74]		
Non-Helper Syndrome group (*n* = 520)	12.44	4.93	[12.02,12.87]		
Reserved-Schizoid PS				**0.135**	**0.120**
Helper Syndrome group	9.58	4.55	[9.74,10.54]		
Non-Helper Syndrome group	10.14	4.66	[8.98,10.18]		
Foreboding-Schizotypical PS				**<0.001****	**−0.381**
Helper Syndrome group	12.28	5.45	[11.56,13.00]		
Non-Helper Syndrome group	10.09	5.87	[9.58,10.59]		
Spontaneous-Borderline PS				**<0.001****	**−0.355**
Helper Syndrome group	*7.62*	*6.07*	[6.81,8.42]		
Non-Helper Syndrome group	*5.69*	*5.14*	[5.24,6.13]		
Amiable-Histrionic PS				**<0.001****	**−0.383**
Helper Syndrome group	15.66	5.52	[14.93,16.39]		
Non-Helper Syndrome group	13.61	5.29	[13.15,14.07]		
Ambitious-Narcissistic PS				**<0.001****	**−0.307**
Helper Syndrome group	10.96	4.72	[10.34,11.59]		
Non-Helper Syndrome group	9.62	4.23	[9.25,9.98]		
Self-Critical-Self-Insecure PS				**0.008**	**−0.215**
Helper Syndrome group	*11.77*	*5.30*	[11.06,12.47]		
Non-Helper Syndrome group	*10.61*	*5.39*	[10.15,11.08]		
Loyal-Dependent PS				**<0.001****	**−0.429**
Helper Syndrome group	12.99	5.44	[12.27,13,71]		
Non-Helper Syndrome group	10.77	5.06	[10.34,11.21]		
Carefully-Obsessive-Compulsive PS				**<0.001****	**−0.371**
Helper Syndrome group	19.16	4.77	[18.53,19.79]		
Non-Helper Syndrome group	17.38	4.79	[16.97,17.80]		
Critical-negativistic Personality Style				**0.004**	**−0.233**
Helper Syndrome group	*8.10*	*4.40*	[7.52,8.68]		
Non-Helper Syndrome group	*7.057*	*4.56*	[6.65,7.44]		
Silent-Depressive Personality Style				**0.012**	**−0.202**
Helper Syndrome group	*10.19*	*5.31*	[9.49,10.90]		
Non-Helper Syndrome group	*9.16*	*5.02*	[8.73,9.60]		
Helpful-Selfless PS				**<0.001****	**−1.100**
Helper Syndrome group	17.69	4.34	[17.12,18.26]		
Non-Helper Syndrome group	12.96	4.28	[12.60,13.33]		
Optimistic-Rhapsodic PS				**<0.001****	**−0.301**
Helper Syndrome group	17.41	5.38	[16.70,18.13]		
Non-Helper Syndrome group	15.82	5.27	[15.36,16.27]		
Assertive-Antisocial PS				**0.829**	**−0.017**
Helper Syndrome group	*7.34*	*5.06*	[6.67,8.01]		
Non-Helper Syndrome group	*7.25*	*4.77*	[6.84,7.66]		
Life satisfaction				**0.295**	**0.084**

(Continued)

TABLE 5 (Continued)

	M	*SD*	95% CI	*p**	*d*
Helper Syndrome group	7.67	2.88	[7.29,8.05]		
Non-Helper Syndrome group	7.92	2.99	[7.66,8.17]		
Social Orientation				**<0.001****	**−0.468**
Helper Syndrome group	8.27	2.17	[7.98,8.55]		
Non-Helper Syndrome group	7.20	2.32	[7.00,7.40]		
Achievement Orientation				**0.124**	**−0.123**
Helper Syndrome group	*7.21*	*2.63*	[6.86,7.56]		
Non-Helper Syndrome group	*6.89*	*2.54*	[6.67,7.11]		
Inhibitedness				**0.369**	**−0.072**
Helper Syndrome group	*5.69*	*3.20*	[5.27,6.11]		
Non-Helper Syndrome group	*5.46*	*3.14*	[5.19,5.73]		
Impulsiveness				**0.002****	**−0.247**
Helper Syndrome group	5.84	3.20	[5.42,6.27]		
Non-Helper Syndrome group	5.07	3.13	[4.80,5.33]		
Aggressiveness				**0.091**	**−0.135**
Helper Syndrome group	3.45	2.25	[3.15,3.75]		
Non-Helper Syndrome group	3.15	2.22	[2.96,3.34]		
Strain				**<0.001****	**−0.456**
Helper Syndrome group	*7.56*	*3.23*	[7.13,7.99]		
Non-Helper Syndrome group	*6.06*	*3.32*	[5.77,6.34]		
Somatic Complaints				**<0.001****	**−0.350**
Helper Syndrome group	4.13	2.74	[3.76,4.49]		
Non-Helper Syndrome group	3.21	2.55	[2.99,3.43]		
Health Concern				**0.509**	**0.053**
Helper Syndrome group	4.86	2.64	[4.52,5.21]		
Non-Helper Syndrome group	*5.00*	*2.62*	[4.78,5.23]		
Frankness				**0.583**	**−0.044**
Helper Syndrome group	*6.75*	*2.45*	[6.43,7.08]		
Non-Helper Syndrome group	*6.64*	*2.64*	[6.41,6.87]		
Extraversion				**0.006**	**−0.221**
Helper Syndrome group	*7.21*	*3.19*	[6.79,7.63]		
Non-Helper Syndrome group	*6.50*	*3.18*	[6.23,6.78]		
Emotionality				**<0.001****	**−0.294**
Helper Syndrome group	6.47	3.87	[5.96,6.99]		
Non-Helper Syndrome group	5.35	3.79	[5.02,5.68]		

*Statistical significance level of $p = 0.002$. The values with ** are significant values and because of this it is important that they are in bold. *d*, Cohen's d (effect size); *n*, Sample size; *M*, Mean; *SD*, Standard deviation.

independent. No extreme cases were found among potential outliers. Normally distributed residuals were assumed based on a P–P plot. However, with a multiple determination coefficient (R2) of 0.028 (corrected R2 of 0.026), our model has only a weak explanation of variance.

Assertive-Antisocial Personality Style

In contrast to the hypotheses, nurses ($M = 6.77$, $SD = 4.7$, 95% CI [6.34, 7.21]) and controls ($M = 7.97$, $SD = 5.0$, 95% CI [7.46, 8.62]) differed significantly in *Assertive-Antisocial Personality Style* ($t(740) = 3.513$, $p < 0.001$). The mean value of *Assertive-Antisocial Personality Style* was significantly higher in controls than in nurses. However, only a small effect was found ($d = 0{,}264$) (Cohen, 1988). Within the framework of a multiple linear regression, the predictors sex, age and *helper/non-helper* were able to predict *Assertive-Antisocial Personality Style* ($F(3.738) = 17.7$, $p < 0.001$). There was no multi-collinearity and the residuals were independent. No extreme cases were found among potential outliers. Normally distributed

TABLE 6 Group differences between nurses and controls regarding personality characteristics of Helper Syndrome (*t*-test for independent samples).

	M	*SD*	*p**
Ambitious-Narcissistic Personality Style			0.064
Nursing staff ($n = 447$)	9.78	4.463	
Controls ($n = 295$)	10.39	4.346	
Loyal-Dependent Personality Style			0.256
Nursing staff	11.62	5.467	
Controls	11.17	4.950	
Helpful-Selfless Personality Style			0.087
Nursing staff	14.13	4.813	
Controls	14.75	4.781	
Social Orientation			0.055
Nursing staff	7.65	2.278	
Controls	7.32	2.385	
Achievement Orientation			0.009
Nursing staff	6.78	4.467	
Controls	7.29	2.690	
Aggressiveness			**0.002****
Nursing staff	3.02	2.157	
Controls	3.56	2.314	
Strain			0.798
Nursing staff	6.48	3.325	
Controls	6.55	3.426	

*Statistical significance level of $p = 0.002$. The values with ** are significant values and because of this it is important that they are in bold. *d*, Cohen's d (effect size); *n*, Sample size; *M*, Mean; *SD*, Standard deviation.

residuals were assumed based on a P–P plot. The coefficients sex ($\beta = 2.096$; $p < 0.001$) and age ($\beta = -0.057$; $p < 0.001$) were significant whereas the coefficient *helper/non-helper* was not ($\beta = -8.66$; $p = 0.017$). With a multiple determination coefficient (R2) of 0.038 (corrected R2 of 0.034), the model had only a weak explanation of variance. The result of the *multiple regression analysis* indicates that sex is particularly responsible for the result (*t*-test) that nurses differ from controls with regard to this personality style.

Symptoms of Helper Syndrome by Schmidbauer

Nurses ($M = 14.32$, $SD = 5.28$) and controls ($M = 14.53$, $SD = 5.39$) did not differ significantly regarding well-being/depressive symptoms ($p = 0.610$). Moreover, nurses ($M = 3.83$, $SD = 3.30$) and controls ($M = 4.17$, $SD = 4.01$) did not differ significantly regarding alcohol consumption ($p = 0.232$). Regarding female groups, there were no significant differences in femininity ($p = 0.658$) and masculinity ($p = 0.101$). Also no significant differences in femininity ($p = 0.776$) or masculinity ($p = 0.398$) regarding male groups were found.

Conclusion

Some of the personality styles and traits defined as characteristic for Helper Syndrome were significantly more expressed in individuals who described themselves as having Helper Syndrome. Especially *Ambitious-Narcissistic Personality Style, Loyal-Dependent Personality Style, Helpful-Selfless Personality Style, Social Orientation, and Strain* were prominent. Furthermore, participants who believe they have Helper Syndrome showed a significant lower well-being, possibly because of their combination of personality styles and traits. Nearly twice as many participants in "Helper Syndrome group" scored lower than the critical score of 13 for well-being, indicating depression in individuals who believe they have Helper Syndrome.

Our results indicate that the helper syndrome theory has flaws. First there was no significant difference in prevalence of Helper Syndrome in nurses and controls. Furthermore, nurses did not show lower well-being and did not consume more alcohol than control subjects. Similarly, there was no evidence of insecure gender identity among nurses of either sex. However, the nurses showed a significantly lower score for Aggressiveness, which is consistent with Schmidbauer (2018). This is confirmed by the finding that nurses suppress the open, direct expression of anger and instead choose forms of passive aggression, such as procrastination, apathy, unresponsiveness, forgetfulness, lack of understanding, or intellectualization (Carol, 1975). Thus, passive aggression is a potential characteristic of nurses, but not people who self-assessed them as having Helper Syndrome. However, we found that individuals who self-assessed themselves as having Helper Syndrome do not have a significantly lower aggression score.

For the first time, we were able to evaluate Schmidbauer's concept of Helper Syndrome. In synopsis of the studies and the concept of Schmidbauer and the concept of Pathological Altruism, a new clear definition can be derived. According to this, the "new" Helper Syndrome is an occupation-independent personality structure that is narcissistic, schizotypical, Borderline-like, histrionic, carefully-obsessive, rhapsodic, impulsive, somatizing, neurotic, dependent, selfless, socially oriented, and prone to stress and depression. In comparison to the concept of Pathological Altruism, which is defined as behavioral tendency to promote welfare of others with negative consequences for oneself and the other person, our new definition is superior because of its clear correlation to specific personality traits. Future studies should not focus certain profession but on personality traits and styles as potential predictors of mental health problems.

More empirical research is needed to verify these preliminary data.

Limitations

The voluntary participation of the participants, the one-time testing, the inhomogeneity of the control group, the gender-specific

distribution in the samples, and the fact that education was not recorded.

Ethics statement

The studies involving humans were approved by Ethikkommission Land Salzburg, Austria. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

VM, MS, and WA: conception or design of the work. VM: data collection. AK and VM: data analysis and interpretation. VM, MS, AK, and WA: drafting the article. WA, MS, and AK: critical revision of the article. VM, WA, MS, and AK: final approval of the version to be published.

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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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Challenges to dialysis treatment during the COVID-19 pandemic: a qualitative study of patients' and experts' perspectives

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Background: The global COVID-19 pandemic transformed healthcare services in ways that have impacted individual physical and psychological health. The substantial health challenges routinely faced by dialysis-dependent patients with advanced kidney disease have increased considerably during the ongoing COVID-19 pandemic but remain inadequately investigated. We therefore decided to analyze and compare the perspectives of dialysis patients on their own needs and challenges during the COVID-19 pandemic with those of their professional healthcare providers through interviews with both groups.

Methods: Qualitative study of seven in-center hemodialysis patients, seven peritoneal dialysis patients, seven dialysis nurses, and seven physicians at the Medical University of Vienna between March 2020 and February 2021, involving content analysis of semi-structured interviews supported by a natural language processing technique.

Results: Among the main themes emerging from interviews with patients were: (1) concerns about being a 'high-risk patient'; (2) little fear of COVID-19 as a patient on hemodialysis; (3) questions about home dialysis as a better choice than in-center dialysis. Among the main themes brought up by physicians and nurses were: (1) anxiety, sadness, and loneliness of peritoneal dialysis patients; (2) negative impact of changes in clinical routine on patients' well-being; (3) telehealth as a new modality of care.

Conclusion: Preventive measures against COVID-19 (e.g., use of facemasks, distancing, isolation), the introduction of telemedicine, and an increase in home dialysis have led to communication barriers and reduced face-to-face and direct physical contact between healthcare providers and patients. Physicians did not perceive the full extent of patients' psychological burdens. Selection/modification of dialysis modality should include analysis of the patient's support network and proactive discussion between dialysis patients and their healthcare providers about implications of the ongoing COVID-19 epidemic. Modification of clinical routine care to increase frequency of psychological evaluation should be considered in anticipation of future surges of COVID-19 or currently unforeseen pandemics.

KEYWORDS

anxiety, COVID-19, dialysis experts, hemodialysis, isolation, peritoneal dialysis, qualitative study

Introduction

SARS-CoV-2 (World Health Organization, 2020) has transformed healthcare delivery in many countries. The impact of coronavirus disease (COVID-19) strained healthcare infrastructure, resources, and personnel in various ways. Disruption in healthcare, delayed diagnoses, postponed surgical procedures, temporary suspension of transplantation programs, and barriers to accessing healthcare services affected patients with chronic underlying conditions.

Patients with advanced chronic kidney disease (CKD) constitute a particularly vulnerable group. For those who require dialysis as life-sustaining therapy, missing treatment sessions or interruption of treatment could lead to serious health consequences. Many of the patients waitlisted for kidney transplantation must undergo dialysis. Dialysis patients experience multiple comorbidities and are often immunocompromised. They require regular medical appointments for dialysis sessions, laboratory tests, and other healthcare needs. Frequent exposure to healthcare settings could increase the risk of exposure to the SARS-CoV-2 virus. These conditions increase the risk of a COVID-19 infection associated with higher mortality in these patients (Wang et al., 2020; Centers for Disease Control and Prevention (CDC), 2020; Huang et al., 2020).

The choice between dialysis modalities depends on the patient's overall health, comorbid conditions, lifestyle, preference, and other medical considerations. Peritoneal dialysis (PD) is a kidney replacement therapy that requires instillation of glucose-containing fluids into the peritoneal cavity via an abdominal catheter that comes in contact with the peritoneal membrane. Excess fluid is eliminated by osmotic ultrafiltration (via the osmotic gradient between blood and PD fluid), while uremic toxins are removed by diffusion from the peritoneal wall capillaries (a natural filter) into the peritoneal cavity. PD fluid is manually drained from the peritoneal cavity after several hours and replaced by fresh solution (e.g., four times/day). Alternatively, patients may undergo treatment with a machine (a "cycler") that automates peritoneal fluid exchanges through the night, bypassing the need for daytime manual fluid exchanges. After training, patients perform PD at home. PD requires regular delivery of supplies such as PD solutions or hand disinfectants at home. As home therapy, PD offers more autonomy and independence to patients and requires follow-ups at the outpatient clinic approximately every six weeks. However, this type of treatment requiring high degrees of responsibility for oneself and adherence to medical protocol is not suited to all patients dependent on dialysis for renal replacement therapy.

Hemodialysis (HD) can also be provided at home. However, in most countries, patients are treated in the hospital or dialysis center on an outpatient basis (in-center HD). HD patients require a vascular access (fistula or central venous catheter). Via this access, blood is removed from the patient's bloodstream to flow through and be filtered by the hemodialysis machine, for subsequent reinfusion into the patient's bloodstream. Uremic toxins and excess fluids are removed from the patient's bloodstream by diffusion and hydrostatic ultrafiltration. In-center HD patients have three times weekly dialysis schedules at the dialysis center. Each session lasts three to five hours. Since in-center HD is delivered by nurses, patients are often passive recipients of treatment in a clinical setting, with less direct involvement in the dialysis process itself. The environment at the dialysis unit involves close contact with healthcare staff and other patients. For patients living alone, in-center HD sometimes provides a social network.

During the pandemic, dialysis patients have been subjected to stricter regulations at healthcare institutions, such that face-to-face contact has been partially replaced by remote monitoring and telemedicine to reduce virus transmission (Weiner and Watnick, 2020; Antoun et al., 2021). Guidelines and recommendations since the COVID-19 pandemic have promoted the transition to home dialysis (either PD or home HD) to reduce patients' exposure to COVID-19 infection [Brown et al., 2020; Cozzolino and ERA-EDTA Council, 2020; National Institute for Health and Care Excellence (NICE), 2020; The UK Kidney Association, 2020; Cozzolino et al., 2021]. Social distancing measures aimed at reducing spread of the virus resulted in increased social isolation, which could impact the mental and emotional well-being of patients with chronic diseases. The association between chronic kidney disease and clinical severity of COVID-19 infection and the lack of information related to changes in healthcare delivery has imposed on dialysis patients significant burdens of anxiety and fear (Henry and Lippi, 2020; Xia et al., 2021). Increased communication and information from healthcare providers remain essential for optimal patient management.

One previous study has examined patient and clinician perspectives on the transition to dialysis in patients >70 years of age with CKD stages 4 or 5 (Porteny et al., 2022). Other reports have studied kidney transplant candidates (Guha et al., 2020), in-center HD patients (Sousa et al., 2021; Malo et al., 2022), or their caregivers (Sousa et al., 2022). However, no study to date has applied a qualitative analytic approach to compare perspectives of HD and PD patients with those of their healthcare providers during the COVID-19 pandemic. We therefore conducted this qualitative interview study to explore the needs and challenges faced during the COVID-19 pandemic by PD and in-center HD patients. We also solicited the opinions of dialysis nurses and physicians on the challenges faced by their patients.

Methods

Study design, setting, and participants

This qualitative study included 28 participants interviewed during the COVID-19 pandemic between March 2020 and February 2021 at the Division of Nephrology and Dialysis, Medical University of Vienna, Austria. We recruited fourteen patients in maintenance dialysis, seven treated with in-center HD and seven treated with PD. Patients were selected using convenience sampling, including a broad spectrum of age, years of dialysis treatment, and comorbidities. Patients with severe cognitive impairment were excluded. Also included were seven nephrologists or nephrology trainees and seven nurses with experience in both dialysis modalities, with a wide range of seniority and experience. Patients were informed about the study and invited to participate by phone or during a routine hospital visit. A single one-on-one interview by appointment at the participant's choice was conducted at our center. All participants provided written informed consent. The study was performed according to the principles of the Declaration of Helsinki. Approval was granted by the intra-university Data Protection Committee and the Local Ethics

Committee of the Medical University of Vienna (study protocol EK 1725/2020).

Interview guides and data collection

Qualitative content analysis is suitable for our exploratory approach to understanding behaviors associated with a human condition in different contexts and perceived situations (Kvale, 1996; Ritschl and Stamm, 2016). Based on an anonymous questionnaire developed to improve routine care of dialysis patients at the outbreak of the COVID-19 pandemic, we created topic guides that covered aspects related to sources of information, preventive measures against COVID-19, problems with consumables (e.g., hand disinfectants, PD solutions), patients' experience at the dialysis unit, and psychological aspects (Supplementary Tables S1, S2). An experienced qualitative researcher (T.S.) reviewed and adapted the interview guides. Interviews started with an open question as an ice-breaker to motivate participants to talk (for example: *"What is the most challenging as a patient to deal with during COVID-19?"*). We formulated questions in a neutral form, trying to explore not only negative but also positive aspects related to the COVID-19 pandemic (for example: *"Is there something you liked (or disliked) about the patient healthcare/during the lockdown period?"*). To minimize reporting bias, all interviews were performed by K.O.F (female, MD, MSc, and candidate for the Ph.D. degree), who was uninvolved in the patients' care and otherwise unrelated to the patients. Semi-structured interviews conducted at the center were audio-recorded and transcribed verbatim. Demographic characteristics were taken from patient clinical records with written consent of the patients. We reported the study following the Consolidated Criteria for Reporting Qualitative Health Research (COREQ) Guidelines (Tong et al., 2007) (Supplementary Table S3).

Analyses

Descriptive statistics were used to summarize participants' characteristics using GraphPad Prism Software, version 9.0.1. Results were expressed as relative frequencies for categorical variables, as means with standard deviations (SD) for continuous variables, and as medians with interquartile ranges (IQR) for skewed distributions. Fisher's exact test was used to compare categorical variables. Continuous variables were analyzed by Mann–Whitney U-test. Two-tailed tests were used for all comparisons. We conducted an inductive thematic analysis of qualitative data to discover topics describing patients' experiences and perceptions of their dialysis during the COVID-19 pandemic, followed by a modified meaning condensation form (Stamm et al., 2011; Bengtsson, 2016). All transcripts were carefully read and checked for accuracy. Coding was performed independently by K.O.F. and A.V. Data were divided into meaning units (defined as specific text parts, either a few words or sentences with a common meaning) summarized in one or more concepts. Associated concepts were grouped, and a scheme of lower- and higher-level concepts was developed. Lower-level concepts share the attributes of the higher-level concepts but are more specific. An additional researcher (V.R.) with extensive experience in qualitative research reviewed the results. Extensive discussion among V.R., A.V., and K.O.F. resolved disagreements to reach a consensus through the triangulation technique.

We used Atlas.ti version 8 [ATLAS.ti Scientific Software Development GmbH, 2018] for analysis and coding. Additionally, we used a natural language processing technique called Latent Dirichlet Allocation (LDA) to triangulate the thematic analysis and uncover potential additional topics (Gefen et al., 2017; Ruiz et al., 2020). LDA is an unsupervised, generative, probabilistic topic modeling technique that extracts meanings from a pre-defined number of topics/concepts. The number of concepts resulted from the most evident differentiation in the representation of heat maps and the examination of words (topic coherence). As an unsupervised machine learning technique, LDA's primary advantage is its independence from prior knowledge or predefined categories. For this purpose, we created a semantic space by stemming the words, removing stop words (such as 'and', 'the', 'a', and similar), and converting all text to lowercase. In addition, punctuation marks, names, and personal words were removed from the text. LDA analyzes texts by considering word frequency in combination with the co-occurrence of words. LDA characterizes concepts based on word frequency and the words that best distinguish one concept. We conducted separate analyses for physicians, nurses, HD patients, and PD patients, assuming these four groups had different experiences during the two COVID-19 waves. R software (R Development Core Team, 2008) was used to conduct the LDA.

Results

The median age of HD patients was 54 years (IQR 43) and that for PD patients was 56 years (IQR 15) ($p > 0.99$). Other baseline data revealed statistically significant differences between groups only for hypertension (PD versus HD patients, $p = 0.02$). The median age of nurses was 51 years (IQR 5), and of physicians, 35 years (IQR 12) ($p < 0.001$). Most healthcare providers (71%) had more than five years of work experience in dialysis units. All patients were Caucasian. Other participant characteristics are shown in Table 1. The average interview length was 66 min (with a range of 46 to 106 min).

Key themes raised by HD and PD patients

Five main themes and subthemes characterized PD and HD patients' experiences: (1) concerns about 'high-risk patient' status (lack of information about implications of COVID-19 infection in high-risk patients); (2) little fear of COVID-19 as a patient on HD (more significant concern about personal difficulties related to COVID-19 or kidney disease); (3) questions about home dialysis as a better choice during COVID-19 (home therapy kept patients away from contact with hospital, increasing anxiety; is the autonomy of PD treatment an advantage?); (4) changes in clinical routine (limitations and changes during dialysis routine upset patients and their family); (5) positive psychological elements to overcome the crisis (alternative routines to promote well-being, cultivating positive emotions to transform suffering, seeing the glass half full, vaccination as hopeful for patients at risk). All topics are presented in a thematic coding tree (Figure 1), and exemplary quotes are included in Table 2.

TABLE 1 Participants' characteristics.

Characteristic	HD patients (*n* = 7)	PD patients (*n* = 7)	Nurses (*n* = 7)	Physicians (*n* = 7)
Age in years, median (IQR)	54 (43)	56 (15)	**51 (5)**	**35 (12)**
Sex, *n* (%)				
Female	3 (42.8)	4 (57.2)	5 (71.4)	4 (57.2)
Male	4 (57.2)	3 (42.8)	2 (28.6)	3 (42.8)
Marital status, *n* (%)			N/A	N/A
Married/Partnered	6 (85.7)	7 (100)		
Single	1 (14.3)	0		
Employment status, *n* (%)			N/A	N/A
Employed	2 (28.6)	3 (42.8)		
Not employed	0	1 (14.3)		
Retired	5 (71.4)	3 (42.8)		
Living alone			N/A	N/A
Yes	0	0		
No	7 (100)	7 (100)		
Living conditions, *n* (%)			N/A	N/A
House (with garden)	4 (57.2)	7 (100)		
Flat	2 (28.6)	0		
Shared-flat	1 (14.3)	0		
Time on dialysis in years, median (IQR)	1.25 (5.5)	3.5 (2.2)	N/A	N/A
Years of working experience in dialysis, *n* (%)	N/A	N/A		
Less than 5 years			3 (42.8)	1 (14.3)
From 6 to 10 years			3 (42.8)	0 (0)
More than 10 years			1 (14.3)	6 (85.7)
Cause of chronic kidney disease, *n* (%)			N/A	N/A
Glomerulonephritis	3 (42.8)	2 (28.6)		
Polycystic kidney disease	1 (14.3)	1 (14.3)		
Diabetic nephropathy	0 (0)	1 (14.3)		
Vascular nephropathy	1 (14.3)	0 (0)		
Other/Unknown	2 (28.6)	3 (42.8)		
Comorbidities, *n* (%)			N/A	N/A
Hypertension	**7 (100)**	**2 (28.6)**		
Diabetes	0 (0)	1 (14.3)		
Cancer	1 (14.3)	0 (0)		
Cardiovascular disease	5 (71.4)	3 (42.8)		

HD, (in-center) hemodialysis; PD, peritoneal dialysis.
When comparing values of HD vs. PD patients, and values of nurses vs. physicians, p-value was calculated using the Fisher's exact test for categorical variables, and the Mann–Whitney U test for continuous variables; significant results are highlighted in bold.

Concerns about 'high-risk patient' status

PD patients did not understand what it meant to be a 'high-risk patient' and wanted more information about COVID-19 from their physicians or nurses during consultation. PD patients also stayed at home for longer intervals between appointments at the outpatient clinic. Some patients decided to call the PD team to get information related to COVID-19.

Little fear of COVID-19 as a patient on HD

In contrast to some PD patients, HD patients worried more about previous complications of their kidney disease or hospitalizations than about the current pandemic or the possibility of being infected, despite three times per week dialysis sessions.

> "The worst thing for me was that the calciphylaxis was supposed to be a deadly disease. I was more afraid then than I am of Corona (COVID-19) now because it was very threatening." HD patient, female, age 69.

Many HD patients had been previously confronted with critical health situations and had survived. Therefore, these patients were confident they could overcome COVID-19 if infected. Indirect

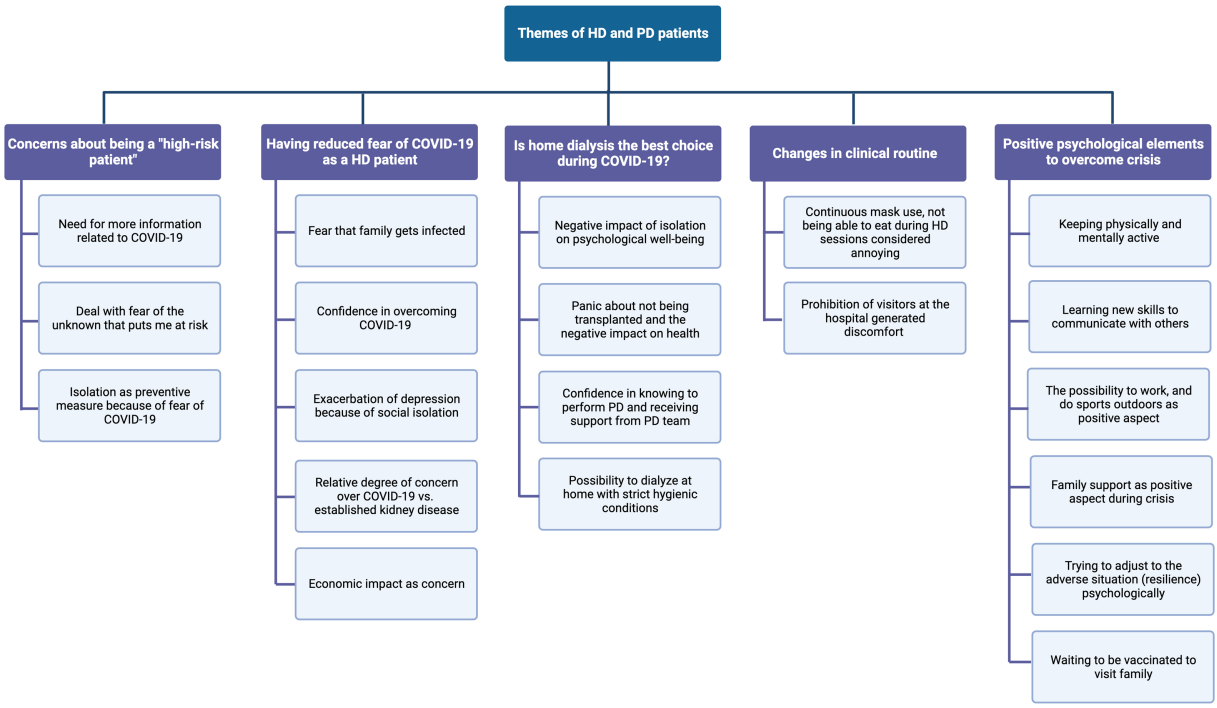

FIGURE 1
Coding tree identified through content analysis and natural language processing (LDA) of the interviews of dialysis patients.

impacts of the pandemic on their daily routine, on their families, or, more generally, on society were of greater importance to HD patients.

> "What scared me mostly was not being able to see my kids and friends [if they get infected with COVID-19]". HD patient, female, age 69.

Questions about home dialysis as a better choice during COVID-19

Most PD patients experienced high levels of anxiety and panic, especially previously anxious ones. PD patients were more strict with hygienic measures and intensified disinfection, for example, when PD supplies were delivered at home.

> "My husband disinfects what needs to be disinfected; other things are placed immediately underwater. At our house, [cleaning] is excessive". PD patient, female, age 62.

One PD patient's decision to self-isolate from his family and social environment to avoid contracting COVID-19 had a negative psychological impact. Another PD patient was distressed by the temporary suspension of the kidney transplantation program. On the other hand, some PD patients saw their autonomy over dialysis and the ability to contact the PD team as advantages.

> "I'm much more flexible with the PD, I can do it all at home. I have a family, I have a child, I have a dog, and I go to work. I do it [dialysis] for nine hours on the cycler at night, then I get up, and I'm almost fully fit. It's not like that with hemodialysis, a bigger strain on the body. And as long as my peritoneum plays along as a filter, it's ideal." PD patient, age 57.

Changes in clinical routine

Restrictions of caregivers on visiting patients during HD sessions generated discomfort in patients and their families. There were difficulties in accessing the hospital due to movement restrictions. Separate access to the hemodialysis unit worked adequately, but access through the hospital's main entrance for diagnostic tests or other interventions was sometimes more difficult. HD patients were not afraid to go to the dialysis unit because "they felt protected there" and had separate access from the rest of the patients in the hospital. Continuous use of face masks and the prohibition of eating during HD upset many patients.

> "I think getting tested once a week [for COVID-19 infection] is enough; three or four [patients] in a room is also a good, manageable number. To be all the time with the mask is tedious, but it is necessary. Unfortunately, eating is now almost forbidden or is no longer possible. That was always very practical because time flew." HD patient, male, age 26.

Positive psychological elements to overcome the crisis

During lockdown periods, patients adapted their daily routines to stay physically and mentally active. Patients tried to learn new skills to communicate with others; they performed exercises at home or outdoors.

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TABLE 2 Main themes with subthemes and exemplary quotes of peritoneal dialysis (PD) and hemodialysis (HD) patients.

Theme complexes	Main themes	Subthemes	Quotation (Participant Role, Sex, Age)
Concerns about Being a 'High-Risk Patient'	Lack of information related to COVID-19 implications for high-risk patients	Need for more information related to COVID-19 and special measures for high-risk patients	*"During the doctor's consultation, we did not explicitly discuss possible consequences of the virus for high-risk patients or whether I should comply with special measures. It would be good if someone addressed whether I have to pay special attention to certain things."* (PD patient, female, age 52)
		Deal with fear of the unknown that puts me at risk	*"Dealing with the fear was the biggest challenge for all of us because a virus massively restricted our lives. Nobody told me to do this and that in my situation to protect myself. I have no idea how bad this virus is and how it endangers me."* (PD patient, male, age 50)
		Isolation as a preventive measure because of fear of COVID-19	*"I moved into an empty house and lived alone for three months just to be safe. I have a family, a wife, and two children who can bring the virus home. I saw nobody, met nobody, nothing at all. I hardly went out on the street, either."* (PD patient, male, age 50)
Having Reduced Fear of COVID-19 as a HD Patient	Greater concern about personal difficulties related to COVID-19 or kidney disease	Fear that family gets infected	*"What scared me mostly was not being able to see my kids and friends."* (HD patient, female, age 69)
		Confidence in overcoming COVID-19	*"I'm a high-risk patient, but just because I'm a dialysis patient does not mean that if I get COVID, it has to end badly. I've had the swine flu before; I was isolated then; everyone ran around with masks, but I do not think my body's defenses are that bad."* (HD patient, female, age 65)
		Exacerbation of depression because of social isolation	*"I have had depression for a long time, and the symptoms slowly started to get stronger again because of always staying at home and avoiding social contact."* (HD patient, male, age 25)
		Relative degree of concern over COVID-19 vs. established kidney disease	*"I was more relaxed about [being a high-risk patient] because I knew my kidneys would fail at some point, mainly because they have been bad for a long time. The virus [coronavirus] damages the kidneys even more. It cannot get much worse for me."* (HD patient, male, age 25)
		Economic impact as concern	*"I was more worried about the economic situation than about myself. Wearing masks and disinfecting your hands from the beginning before going to a shop would have prevented so many unemployed people and companies that had to close."* (HD patient, female, age 65)
Is Home Dialysis the Best Choice During COVID-19?	Home therapy kept patients away from contact with the hospital, increasing anxiety	Negative impact of isolation on psychological well-being	*"I felt that if this virus infected me, I could die. I experienced generalized anxiety and hysteria. […] Returning home (after self-isolation) was a dangerous decision, but I consciously took this risk because being alone negatively affected me."* (PD patient, male, age 50)
		Panic about not being transplanted and the negative impact on health	*"I've been on a kidney waitlist for three and a half years, and my worst stressful situation was that the transplant program stopped. I am panicking that everything will be postponed, and I will have to wait even longer."* (PD patient, female, age 57)
	Autonomy of PD treatment as advantage	Confidence in knowing to perform PD and receiving support from the PD team	*"After being on PD for almost three and a half years, I know if I have any problem with PD or something is not working, I can call and go to the unit. I was not afraid that I would not get any information. [...] I think it was easier to dialyze from home and not risk of getting infected somewhere."* (PD patient, male, age 64)
		Possibility to dialyze at home with strict hygienic conditions	*"I can isolate my entire therapy process from the outer world and have total control over it. I can disinfect the devices and myself. I make sure that the medicines are stored properly and cleanly. I've seen doctors and nurses not always disinfecting their hands when they should."* (PD patient, male, age 50)
Changes in Clinical Routine	Limitations and changes during dialysis routine upset patients and their families	Continuous mask use, not being able to eat during HD sessions considered annoying	*"The mask bothers me because then I cannot breathe or talk. The exhaled air you breathe in is unhealthy because you get tired. So, this is not an ideal solution, but we have no other choice."* (HD patient, female, age 65)
		Prohibition of visitors at the hospital generated discomfort	*"My wife is so upset because she is not allowed to come into the dialysis unit. I am not afraid because you can keep in touch a bit* via *the internet so that you can see each other."* (HD patient, male, age 49)

(Continued)

TABLE 2 (Continued)

Theme complexes	Main themes	Subthemes	Quotation (Participant Role, Sex, Age)
Positive Psychological Elements to Overcome Crisis	Alternative routines to promote well-being	Keeping physically and mentally active	*"I do a lot of sports in the fresh air, and it works luckily quite well. Luckily, I am also allowed to work, and that is how time goes by faster. That is the way I do not get bored."* (HD patient, male, age 26)
		Learning new skills to communicate with others	*"The opportunity that lockdown has brought me is that only now have I experienced social media and Google. It became clear to me what these tools are for. I exercise with a YouTube video where a trainer exercises with you. This was something I could do at home."* (PD patient, female, age 62)
	Cultivating positive emotions to transform suffering	The possibility to work, and do sports outdoors as positive aspect	*"I am at the office, and I can ventilate it; it works quite well. Also, in public transport with the mask, I go to only a few stations."* (HD patient, male, age 26)
	Seeing the glass half full	Family support as positive aspect during crisis	*"I just could not see my daughter and son. However, we were very lucky. After all, we might see each other again because our house has a huge garden. Then we met outdoors, keeping our distance. We could at least see each other."* (HD patient, female, age 69)
		Trying to adjust to the adverse situation (resilience) psychologically	*"For me, fear is something that inhibits me and makes me insecure. I am trying to reduce that. I always make sure that I can master the current situation as well as possible, which often does not work, but I can get something good out of it every day in my current situation."* (PD patient, female, age 57)
	Vaccination as hope for high risk patients	Waiting to be vaccinated to visit family	*"It has been a year and a half now that I have not seen my sister. However, I am not going anywhere. First, I want to get the vaccine for safety."* (HD patient, female, age 54)

> "Then I thought to myself: I'm home alone, my husband is at work, I don't have anyone who can infect me, so why don't I go out into the garden?" PD patient, female, age 56.

Positive emotions such as resilience, hope, family support, gratitude, and psychological flexibility were more evident in HD patients than in PD patients.

> "I just couldn't see my daughter and son. However, we were very lucky. After all, we might see each other again because our house has a huge garden. Then we met outdoors, keeping our distance. We could at least see each other." HD patient, female, age 69.

HD patients saw vaccination as the possibility that all restrictions could be lifted.

> "I'm looking forward to the vaccination when it's finally time so that I can work with contact with people again. People want to get back into gastronomy, to book vacations, to just have plans for something because it's very monotonous and boring, but we have to keep going a bit and it will get better." HD patient, male, age 26.

Only a few PD patients mentioned coping strategies to improve their well-being and relieve fear and anxiety during the lockdown period.

> "The opportunity that lockdown has brought me is that only now have I experienced social media and Google. It became clear to me what these tools are for. I exercise with a YouTube video where a trainer exercises with you. This was something I could do at home." PD patient, female, age 62.

Key themes raised by nurses and physicians

Four main themes and subthemes characterized healthcare providers' experiences: (1) fear of COVID-19 infection (fear of infecting and being infected - as a patient/healthcare professional, fear of patients not receiving dialysis; (2) anxiety, sadness, and loneliness of PD patients (lack of contact with the hospital may contribute to anxiety, loneliness and sadness in PD patients); (3) negative impact of changes in the clinical routine on patients' well-being (challenges to access dialysis with minimal risk of COVID-19 infection, discomfort with preventive measures and restrictions at the hospital, reduction in patient-physician interaction, prioritization of healthcare resources; shortage of masks and hand disinfectants, difficulties in dealing with dialysis complications); (4) telehealth as a new modality of care (teleconsultation and remote patient monitoring as feasible tools). All topics are presented in a thematic coding tree (Figure 2). Exemplar quotes are included in Table 3.

Fear of infecting and being infected

Physicians mentioned that they did not perceive their patients' anxiety or fear of infection. Nurses pointed out that they noticed the fear of dialysis patients going to the hospital for appointments.

> "The patients were certainly afraid. They either have to use public transportation or they have to come by ambulance. They didn't want to come to the hospital at all." Nurse, female.

Some physicians did not proactively discuss patients' higher risk in case of being infected with COVID-19 "because patients already knew they were risk patients." Other physicians only talked about risks of COVID-19 infection if patients asked directly about any special or additional protective measures, such as immunosuppressive treatment

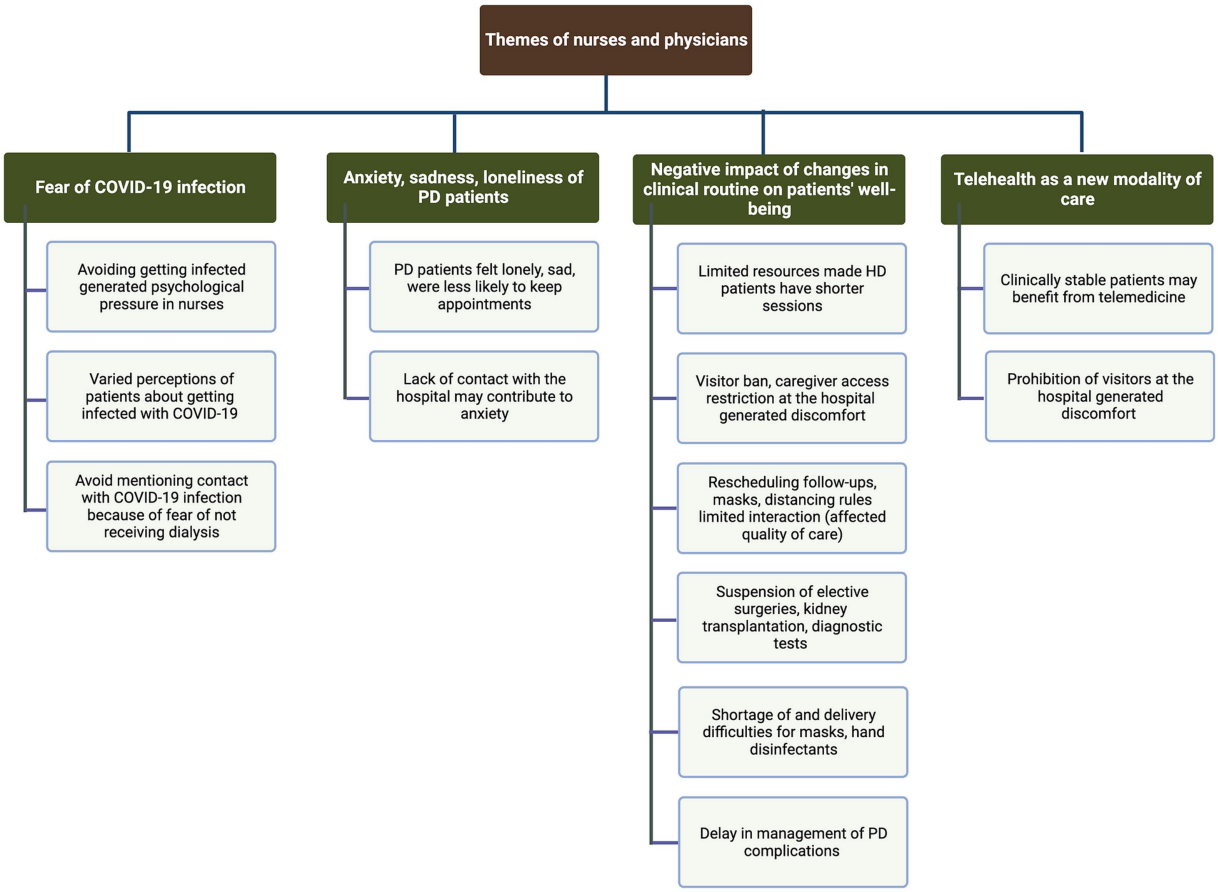

FIGURE 2
Coding tree identified through content analysis and natural language processing (LDA) of the interviews of nurses and physicians.

in the context of kidney graft failure. However, "very relaxed patients" were among those who felt they had already lived long enough. As this group of patients was not afraid of COVID-19 infection, they came to the hospital for follow-up, whereas more anxious PD patients preferred to stay at home for fear of being infected by healthcare providers.

Nurses also mentioned that avoiding getting infected with COVID-19 generated psychological pressure on them because they did not want to infect frail dialysis patients.

Fear of patients not receiving dialysis

Healthcare providers suspected that HD patients avoided mentioning any symptoms or contact with a COVID-19 infection due to fear of not receiving their scheduled dialysis. Confirmation of a COVID-19 infection would lead to the performance of HD at another hospital designated for COVID-19 patients, or HD would be performed during the night shift at the patient's usual dialysis unit.

> "Many patients said: 'What happens to my dialysis if I have contact with COVID-19 and have to go to quarantine?" Physician, female.

Anxiety, loneliness, and sadness of PD patients

Nurses, rather than physicians, noticed that PD patients were canceling appointments at the hospital more frequently than HD patients because they had the option to do so.

> "I noticed that PD patients are more likely to postpone their appointment than HD patients. HD patients come to their appointment because they have treatment there, and because PD patients have their dialysis at home, they often postpone the appointments for routine check-ups." Nurse, female.

Home treatment made some PD patients feel safe but, at the same time, more isolated and lonely.

> "When PD patients are at home with their family, they feel safe, but when they have a problem, then they have to go to the hospital and have to deal with others because they have to sit in a room with other patients." Nurse, male.

In contrast, HD patients had their "fixed social point" at the hospital and interacted with other patients and staff members. Some nurses and physicians mentioned that some married PD and HD patients experienced divorce or separation during the pandemic.

> "Some patients are socially lonely due to the lockdown. Dialysis patients usually feel isolated, even before the pandemic. I've already heard from two or three patients that they feel lonely after (relationship) breakups, and I then offered them psychological care." Nurse, female.

TABLE 3 Main themes with subthemes and exemplary quotes of nurses and physicians.

Theme complexes	Main themes	Subthemes	Quotation (Participant Role, Sex)
Fear of COVID-19 Infection	Fear of infecting and being infected	Avoiding getting infected generated psychological pressure to nurses	*"My biggest challenge was avoiding COVID-19 spread among patients. We take care of the patient still worrying about doing everything right, taking all measures correctly without forgetting something."* (Nurse, female)
		Varied perceptions of patients about getting infected with COVID-19	*"The PD patients who came to the PD unit during the lockdown were very relaxed. Sometimes I also have the impression that many older people have thought they had already lived long and enjoyed life, and it had to be over at some point."* (Physician, female)
			"There were a few patients who were terribly afraid. The nursing staff can get infected, so it's important that both patient and staff follow the guidelines." (Nurse, female)
	Fear of not receiving dialysis	Avoid mentioning contact with COVID-19 infection	*"Many patients said: 'What happens to my dialysis if I have contact with COVID-19 and have to go to quarantine"* (Physician, female)
Anxiety, Sadness, and Loneliness of PD Patients	PD patients felt lonely, sad, were less likely to keep appointments	The flexibility of home dialysis made PD patients have longer intervals between appointments	*"HD patients have their dialysis treatment at the hospital and because PD patients have their dialysis at home they often postpone their routine check-ups."* (Nurse, female)
			"PD patients experienced loneliness and sadness because their families could not visit them. A HD patient comes to the hospital three times weekly and has a social environment. He/she talks to neighboring patients or the nurse." (Nurse, male)
	Lack of contact with the hospital and anxiety	Information from healthcare providers was reassuring for patients	*"After the short talk during a consultation, all questions were answered quite well, and patients were then a little more confident and no longer anxious."* (Physician, female)
Negative Impact of Changes in Clinical Routine on Patients' Well-Being	Challenges to access dialysis with minimal risk of COVID-19	Limited resources made HD patients have shorter sessions	*"Patients did not arrive on time to dialysis because the ambulances transported patients individually. As a result, dialysis quality has suffered."* (Nurse, female)
	Preventive measures at hospital	Visitor ban, caregiver access restriction generated discomfort	*"Patients often needed relatives,* e.g., *for training or for interpreting, if they do not speak the language. […] Some patients cannot walk alone or need help with many things."* (Physician, female)
	Reduced patient-doctor interaction affected the quality of care	Rescheduling follow-ups, masks, distancing rules limited interaction	*"There are room dividers between all patients on HD. They cannot even talk to the patient or staff member next to them. All the nurses wear masks and do not talk to the patient unless necessary."* (Physician, female)
	Prioritization of healthcare resources	Suspension of elective surgeries, kidney transplantation, diagnostic tests	*"Routine annual examinations that all patients have to undergo or appointments for patients without life-threatening conditions were postponed because there was simply no capacity."* (Nurse, male)
	Shortage of protective material	Shortage of and delivery difficulties for masks, hand disinfectants	*"There were problems with the delivery of products for PD patients. One company ran out of hand disinfectant."* (Nurse, female)
Negative Impact of Changes in Clinical Routine on Patients' Well-Being	Difficulties dealing with dialysis complications	Delay in management of PD complications	*"A PD patient with fever was not allowed to come to the outpatient clinic although his (catheter) exit-site might have been infected. The result of the COVID-19 smear did not arrive in time; he was critically ill with sepsis and was admitted to another hospital. […] PD patients cannot really be treated at other hospitals because they do not have the necessary materials."* (Nurse, female)
Telehealth as a New Modality of Care	Teleconsultation, remote patient monitoring as feasible tools	Clinically stable patients may benefit from telemedicine	*"PD patients have appointments at relatively long intervals, so remote patient monitoring is a good option for stable PD patients because you can monitor dialysis data readout."* (Physician, male)

Lack of contact with the hospital and anxiety in PD patients

Physicians suspected that lack of contact with the PD team made PD patients feel more anxious, with more concerns related to the implications of COVID-19 for their clinical or personal situation. In contrast, the frequent contact of HD patients with healthcare providers and the hemodialysis setting contributed to their less prominent fear of coronavirus infection related to treatment.

> "Other PD patients were more anxious and moved their appointments to longer intervals; they went to the laboratory and then sent their results and talked with us via telephone because

> they did not want to come to the hospital. […] And then others were alone and isolated." Physician, female.

Challenges to access dialysis with minimal risk of COVID-19 infection

Nurses mentioned that HD patients were at elevated risk of COVID-19 exposure during their ambulance transport to and from dialysis sessions. More autonomous PD patients traveled by car or taxi to avoid virus exposure. HD unit schedules were busy, and ambulance availability was limited because each HD patient was transported separately to minimize exposure among patients. The quality of dialysis was affected by occasional delays in session start times and occasional reductions in dialysis duration. Interestingly, frequent contact with other patients and medical staff did not worry HD patients.

> "The HD patients had confidence that preventive measures would be followed at the ambulances to transport them to the dialysis unit, where they had completely separate access." Nurse, male.

Discomfort with preventive measures and restrictions at the hospital

Triage sites for screening patients were placed at the hospital and dialysis unit entrances, delaying patients' access to the hospital. Caregivers and family members were not allowed to join patients. Healthcare providers felt this was especially burdensome for PD patients, who frequently needed assistance from their spouse.

Reduction in patient-physician interaction

Communication barriers increased as the frequency of medical rounds decreased, and facemask use increased, while room dividers were placed between HD patients during HD sessions. Some physicians tried to maintain physical distance from patients during consultations.

> "Personally, patients have not asked me about COVID-19 information. At the beginning of the whole story, there was very little doctor-patient contact because we did not go on [clinical] rounds. If there was a contact, it was rather with the nurses." Physician, male.

Prioritization of healthcare resources

There was greater concern about health deterioration because of the deferral of kidney transplantation and the possibility of future changes in the dialytic regimen.

> "There have been patients who, unfortunately, have their selective surgeries postponed, and the problem has become bigger over time. (...) For example, patients with problems in the musculoskeletal system have also waited longer and thus had to take more painkillers until they have their surgery." Physician, female.

Routine diagnostic tests were canceled, including periodic tests for kidney transplant eligibility. Physicians mentioned patient concerns about registration on the transplant waitlist.

> "The kidney transplant was a major concern for all listed patients. Many PD patients know that the transplantation program has stopped for a time. Some have asked what happens if there is a (kidney) offer during that time, if the waiting period starts over again." Physician, female.

One patient waiting for kidney transplantation chose removal from the transplant waitlist due to increased risk of severe COVID-19 infection during post-transplant immunosuppression.

Shortage of masks and hand disinfectants

Healthcare providers mentioned shortages of masks and hand disinfectants at the beginning of the pandemic. Although nurses initially feared problems with the corporate delivery of PD solutions due to border restrictions during the first COVID-19 wave, supplies of PD solutions remained adequate.

Difficulties in dealing with dialysis complications

Febrile patients with possible PD-associated problems (e.g. peritonitis) could not visit the PD unit directly because a COVID-19 screening was needed.

> "If PD patients have a problem and are COVID-19 positive, they cannot come to the PD unit. If they have problems with the machine (cycler) or the (cycler card) or inflow catheter problems, that's certainly a bit difficult logistically to send a nurse to their homes." Physician, male.

A physician mentioned difficulties for patients to access the outpatient PD clinic or the HD unit when reporting specific symptoms of COVID-19 at triage.

> "To what extent are these symptoms now dependent on dialysis or uremia (fatigue, dizziness, dyspnea, or headaches), or are these related to COVID-19?" Physician, female.

Moreover, those hospitals designated for dialysis of COVID-19 patients were not equipped with devices from all PD providers used by patients, resulting in difficulties to organize treatment if they were admitted to these other hospitals.

> "The patient was admitted to another hospital because of bacterial pneumonia (initially suspected to be a COVID-19 infection). His wife brought him the [cycler] machine, which weighs about 13 kilograms, and a box that weighs 10 kilograms with the dialysate bags he needed." Nurse, female.

Telehealth as a new modality of care

Physicians stated that teleconsultation and remote patient monitoring devices could help care for fragile patients with advanced age or significant comorbidities.

> "I think telemedicine would be ideal if we could implement it (in our PD outpatient clinic) if there is an increase in cases or a new virus comes because PD patients then have a [cycler software] card. If it can be read, they do not have to go to the hospital" Physician, female.

Nevertheless, nurses thought that providing patients with exclusively virtual training in practical skills at PD initiation might not be adequate.

Similar and distinctive themes between groups of participants

We summarize the most distinctive themes mentioned by patients and healthcare providers in Figure 3.

In the case of PD patients, fear of being infected, social isolation, and concern (e.g., about not being transplanted) were frequent themes that emerged from the interviews. Conversely, in the case of HD patients, words frequently mentioned related to spending more time with family, hope that the crisis would be over (with vaccination), and trust in their dialysis team. We identified a greater fear of going out and more anxiety in PD patients. Negative terms were more frequently mentioned by PD patients ("hysteria," "panic," "danger," "fear," and "lonely").

HD patients focused mostly on positive aspects of the pandemic. Positive terms such as "lucky" (e.g., if they were retired, it was easier for them to resist staying at home, or if they worked, they said going out to work was a distraction); "hope" (when talking about the returning to "normality" and vaccination) were more frequently mentioned.

Physicians and nurses agreed that PD patients were younger, more active, and more autonomous. Conversely, most of the HD patients were more fragile, with more comorbidities than PD patients, which could increase their fear of going to the hospital for dialysis. However, younger HD patients were less afraid of COVID-19 infection, and some older patients were more worried about their family getting infected or complications of their kidney disease or other comorbidities.

Nurses mentioned aspects related to the social isolation of patients and organizational difficulties more frequently in the interviews (ambulance transportation, visitors ban, difficulties at the hospital entrance, and patient education on the prevention of COVID-19 infection). Physicians more frequently mentioned aspects related to disruptions in health care with negative impacts on patients' health (suspension of the transplantation program, suspension of elective surgical interventions, cancelation of appointments, hemodialysis night shift for COVID-positive patients).

Aspects related to changes in the mental health of dialysis patients (e.g., increased anxiety, fear, worry, isolation) were more frequently mentioned by nurses. Nurses and physicians agreed that PD patients were more anxious about attending the outpatient clinic and that HD patients were also scared of being infected with the coronavirus when going to the hospital. Nurses and physicians noted increased anxiety in dialysis patients when the transplantation program was temporarily stopped.

Concerning discussion of preventive measures for COVID-19 with patients, nurses mentioned that they emphasized hygiene education of dialysis patients. Physicians reported that although they

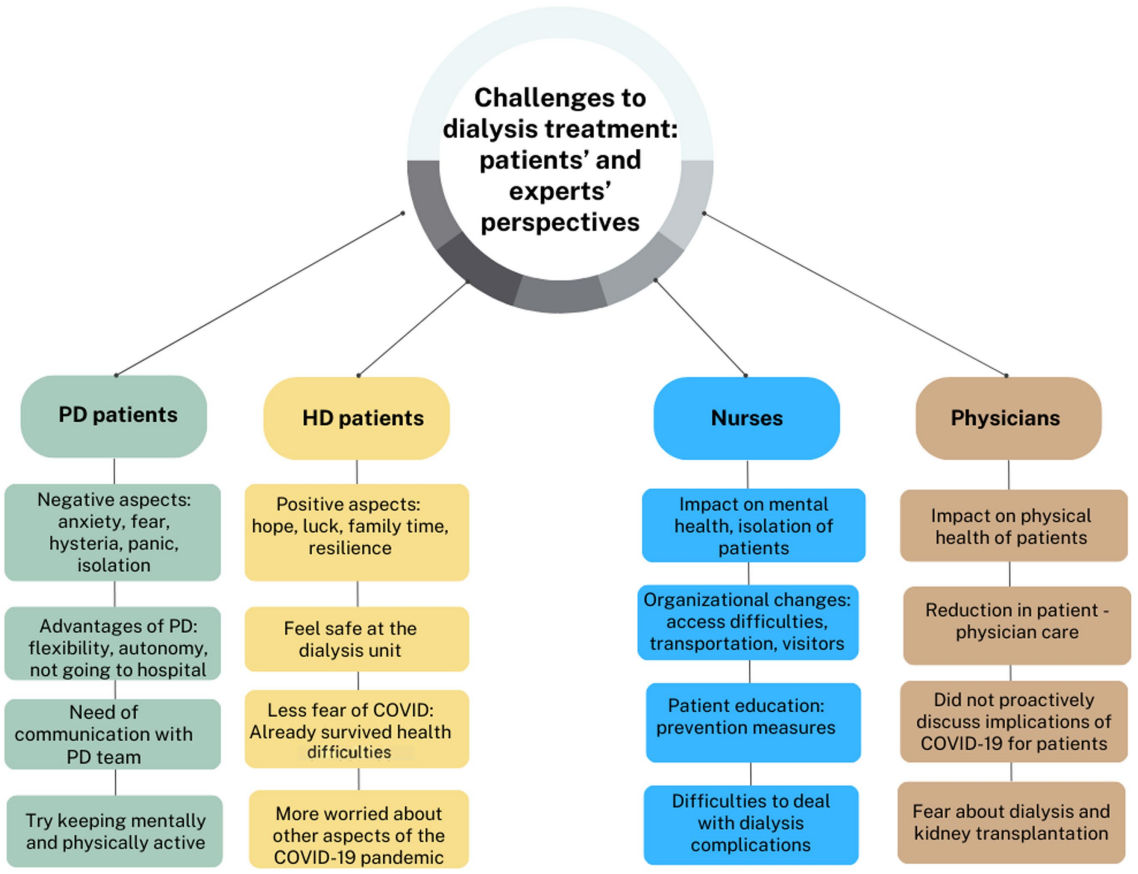

FIGURE 3
Distinctive themes identified in the four groups of participants.

answered patients' questions, they did not discuss preventive measures and hygiene with all patients.

Discussion

This qualitative study evaluated challenges faced by in-center HD and PD patients after the COVID-19 outbreak and compared their perspectives with those of their healthcare providers. Higher anxiety levels, fear of infection, and social isolation depended on dialysis modality and pre-pandemic mental health status. PD patients appeared more profoundly impacted psychologically, probably due to a lack of contact with the group dialysis setting. We found a relevant knowledge gap between patients and healthcare providers, possibly reflecting reduced patient-physician interaction. Many physicians did not proactively assess aspects related to COVID-19 during consultations, whereas nurses more often perceived patients' psychological issues. Healthcare institutions should provide access to reliable and updated information about COVID-19 to address dialysis patients' concerns.

Chronically ill patients exhibit a high risk for adverse clinical outcomes of COVID-19, with psychological implications (Brown et al., 2020; Lee et al., 2020; Bonenkamp et al., 2021; Arevalo Iraheta et al., 2022). Current recommendations to increase home dialysis during the pandemic cannot be confirmed (Brown et al., 2020; Cozzolino et al., 2021). Our findings reveal that lack of contact between PD patients with the hospital and the PD team was associated with heightened concern about the impact of COVID-19 on the future of their dialysis or kidney transplantation. We noted that PD offered patients the advantages of home dialysis, with extended intervals between routine follow-ups, a pattern unavailable to most in-center HD patients. However, PD patients more frequently highlighted negative aspects of the pandemic, including fear of being infected, social isolation, and concern about not being transplanted.

In contrast, HD patients focused more frequently on positive aspects, like having more time to spend with family, hope that the crisis would come to an end (with the advent of vaccination), and trust in their dialysis team. Especially anxious dialysis patients and their caregivers had a greater need for reliable information related to COVID-19 (Arevalo Iraheta et al., 2022; Sousa et al., 2022). Many dialysis patients feared COVID-19 due to their high-risk status (Sousa et al., 2021; Arevalo Iraheta et al., 2022). PD patients frequently canceled outpatient clinic appointments. Differences in anxiety levels and dealing with fear of infection were also reflected in the intensity of measures adopted by patients, such as hypervigilance with hygiene (Arevalo Iraheta et al., 2022) or self-isolation, more frequently among patients with previous mental health conditions. One PD patient even moved away from his family into "prophylactic quarantine" for several months, with negative psychological consequences. On the other hand, HD patients adhering to their dialysis schedule did not fear infection during transport or at the dialysis unit, in contrast to the findings of another study (Lee et al., 2020). The change in personal routines (e.g., not meeting family or friends), complications associated with advanced kidney disease (e.g., calciphylaxis) and the economic impact of COVID-19 on society generated more significant concern in HD patients than the risk of infection.

Our findings showed that PD patients mentioned aspects of social isolation more frequently than did HD patients, especially those living alone. During Austrian lockdowns in March and November 2020, many patients had stricter quarantines with extended periods of isolation, affecting their mental health (high levels of anxiety, depression) and even disrupting personal relationships (separation, divorce). Patients with a partner, those living in a flat-sharing community or a house with a garden, and employed patients were more likely to tolerate lockdown. Many HD patients did not perceive a change in social isolation because there was already loose contact with the family before the pandemic or patients were already restricted due to the rigid three-times-per-week dialysis regimen or due to other illnesses (e.g., amputations). Importantly, living alone has been perceived as a barrier to patients choosing or being offered treatment with PD in areas without assisted PD programs (Brown, 2008). Thus, PD patients often have a better social environment. Nonetheless, our study showed that PD patients felt isolated because of lack of contact with the PD team. In contrast, the three-times-weekly HD treatment represents an opportunity to maintain social contact in HD patients (Lee et al., 2020; Bonenkamp et al., 2021; Malo et al., 2022). However, some depressed HD patients noted worsening symptoms due to isolation from family and friends during lockdown (Lee et al., 2020).

Deferral of elective surgical interventions, diagnostic procedures, and implementation of longer intervals between PD unit appointments could have harmed patients' physical and mental health (Guha et al., 2020; Arevalo Iraheta et al., 2022). We also confirmed that suspending the kidney transplantation program led to panic and high stress levels in some patients, who feared deterioration in their health in the face of increased uncertainty about future transplantation (Guha et al., 2020). On the other hand, one patient rejected future transplantation due to concerns about increased COVID-19 risk when immunosuppressed. Therefore, patients should have access to psychological support and informed decision-making.

Assessment of dialysis-related complications (e.g., peritonitis and catheter problems) was impeded by restriction measures in the presence of symptoms suggesting COVID-19 infection. Dyspnea, headache, dizziness, or fatigue are common uremic symptoms in dialysis patients that are not specific to COVID-19. PD patients with confirmed COVID-19 infection were transferred to other centers, where PD equipment or cyclers of only one provider type were available. This resulted in difficulties for some patients in performing their usual treatment regimen. Some HD patients avoided mentioning symptoms possibly related to COVID-19, fearing that they would not receive regular dialysis treatment or be transferred to another center.

Healthcare professionals in our study reported that using facemasks, distancing between patients and healthcare providers, and teleconsultation represented barriers to communication, leading to less frequent patient-physician interaction. Healthcare professionals further stated that regular telemedical or telephone consultation is a feasible option to minimize in-person interaction for outpatients (not on dialysis) and high-risk or stable PD patients (Cozzolino et al., 2020). The use of telemedicine for in-center and home-hemodialysis patients has promoted independence and satisfaction with patient care (Antoun et al., 2021).

Interestingly, positive psychological elements such as resilience, hope, gratitude, and social support were more evident in HD patients than in PD patients. As noted by others, family members and friends played an important supportive role for patients (Sousa et al., 2021, 2022). Resilience during the COVID-19 pandemic was greater in HD patients with more prolonged dialysis vintage (Malo et al., 2022).

Patients who had already survived critical health experiences had more psychological resources and flexibility to cope with the long pandemic than healthier patients not exposed to these situations. In contrast to other findings (Xia et al., 2021), we noted higher confidence in overcoming COVID-19 in HD patients than in some PD patients. Dialysis patients adapted their routine during lockdown to promote physical and mental well-being (Mosor et al., 2021). Psychological flexibility, the ability to adjust cognition and behavior according to personal needs, is related to lesser anxiety and depression, explaining resilience and preservation of mental health (Israelashvili, 2021; Pellerin et al., 2022).

A strength of our study is its status as the first qualitative study comparing dialysis patients (PD and in-center-HD patients) and their healthcare providers. Our study gathered information on how healthcare providers perceived patients' views during the COVID-19 pandemic and, on the other hand, what patients themselves expressed. Our study also implemented a thematic content analysis supported by a natural language processing technique, a new methodological approach not previously applied in this context.

Among the limitations of our study is its exploratory nature, with a small sample size (n = 28) from a single clinical center. Thus, validation will require larger dialysis populations distributed internationally. Our selection of participants was purposive. This recruitment method may have generated a selection bias and may not reflect the experiences and challenges of patients or healthcare providers who did not participate in these interviews. The time span of our interviews ranged from March 2020 to February 2021. Understanding of patients being at high risk and requiring information about COVID-19 may have changed over time. We also did not assess personal experiences about testing positive for COVID-19 of patients or their families, which may limit the generalizability of our study.

Implications for future strategies

The general population's fear of COVID-19 infection has decreased over time. Since patients have become less adherent to anti-COVID-19 measures, the dialysis team should intervene and reinforce information about and preventive measures against COVID-19. In the event of recurrent waves of COVID-19 or future pandemics, assessment of dialysis patients should incorporate more frequent psychological evaluation. Selection or modification of dialysis modality after the COVID-19 pandemic outbreak should include a careful analysis of individual psychosocial conditions by the dialysis team. Structural improvements at the dialysis units (redesign/enlargement of waiting and entrance areas) and more extensive teleconsultation implementation are needed to manage future pandemics. Our findings should serve as a basis for developing more personalized guidelines or strategies for dialysis facilities during pandemics which should be adapted to individual dialysis patients' treatment goals and needs.

Data availability statement

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

Ethics statement

The study was approved by the intra-university Data Protection Committee and the Local Ethics Committee of the Medical University of Vienna (study protocol EK 1725/2020). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided written informed consent to participate in this study.

Author contributions

KOF and AV developed the concept and design of the study, had full access to all data, and took responsibility for the integrity and accuracy of data and subsequent analysis. KOF, AV, and VR performed data collection and contributed to the interpretation of data. KOF, VR, and TS conducted interviews analysis. KOF drafted the initial manuscript. KOF, TS, SA, VR, and AV did a critical revision of the manuscript for important intellectual content. All authors contributed to the article and approved the submitted version.

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Conflict of interest

AV has received honoraria and travel grants from Baxter and Fresenius and consulting fees from Baxter unrelated to this study.

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SA is a consultant to the Medical University of Vienna.

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

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1185411/full#supplementary-material

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Resilience mediates the effect of the COVID-19 pandemic on mental health in a sample of adults in Panama

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Background: The COVID-19 pandemic was characterized by global increases in depression, anxiety, and stress symptoms. Previous studies have shown that resilience mitigates these symptoms, however there is limited research exploring the link between resilience and mental illness during the COVID-19 pandemic in Central America.

Objective: To examine the role of resilience as it relates to the perceived effect of the pandemic on mental health symptoms.

Methods: A sample of 480 adults in Panama were recruited from March to May 2021 to complete an online survey. The online survey consisted of sociodemographic questions and scale measures assessing depression, anxiety and stress symptoms, resilience, and social support.

Results: Results indicated that resilience mediated the relationship between the perceived effect of the COVID-19 pandemic and mental health symptoms; participants who felt more personally affected by the pandemic reported more depression, anxiety, and stress symptoms via decreased resilience. Further analyses revealed that resilience was moderated by sex and social support, showing that the indirect effect of resilience was greater for women and individuals who perceived low social support.

Discussion: These findings contribute to a growing body of research documenting the adverse effects of the COVID-19 pandemic on mental health and reveal potential mechanisms through which pandemic-related distress decreases resilience, thereby increasing symptoms of mental illness.

KEYWORDS

mental health, COVID-19, resilience, Latin America, mediation, stress, depression, anxiety

1. Introduction

The SARS-CoV-2 coronavirus disease 2019 (COVID-19) pandemic profoundly affected people around the world. At the height of the pandemic (i.e., January 2020 to December 2021) there were an estimated 14.83 million excess deaths worldwide (Msemburi et al., 2023). During this time period, most countries implemented strategies to reduce contagion, ranging from mask mandates and social distancing to strict lockdown measures such as quarantines, mobility restrictions, school suspensions, and border closures. Amidst health and safety concerns, the

lockdowns disrupted social life and devastated many peoples' livelihoods. These events coincided with global increases in depression, anxiety, stress, insomnia, and somatic symptoms (Huang et al., 2020; Majumdar et al., 2020; Olff et al., 2021; Mahmud et al., 2022). Hence, it has been argued that the pandemic precipitated a worldwide mental health crisis (Moreno et al., 2020; Tsamakis et al., 2021) that disproportionately affected certain vulnerable groups, such as young people (Cunningham et al., 2021), women, expectant mothers (Arzamani et al., 2022), people experiencing grief (Nohesara et al., 2022), people with preexisting mental health and chronic health conditions (Connor et al., 2020), people with limited access to social and health services (Clark et al., 2020), and people residing in low-and-middle income countries (Buitrago Ramírez et al., 2021; Ciria Villar and Día Sahún, 2021; González-Soto et al., 2021; Moya et al., 2021). Researchers have identified several protective factors that mitigated the adverse effects of the pandemic on mental health, such as social support, spiritual beliefs, self-efficacy, and a sense of purpose (Brailovskaia and Margraf, 2020; Cabanillas, 2020; Memaryan et al., 2021; Racine et al., 2022; Beck and Daniels, 2023; Diotaiuti et al., 2023). This article investigates the role of resilience in relation to the effect of the pandemic on mental health.

Resilience refers to the ability to adapt to adversity and recover from difficult experiences (Southwick et al., 2014). The construct of resilience comprises several interrelated psychological phenomena, which include stress tolerance, emotion regulation, cognitive appraisal, and self-efficacy (Herrman et al., 2011). That is, resilience stems from a combination of psychological and behavioral mechanisms that provide mental resources and strategies for navigating difficult experiences. Previous work has shown that high resilience buffers against acute stressors and facilitates post-traumatic growth (Carver, 1998; Connor and Davidson, 2003; Davidson et al., 2005; Wolmer et al., 2011), and it follows that individuals' psychological response to the COVID-19 pandemic depended, in part, on resilience (Macías-Valadez Treviño et al., 2020). Indeed, research during the pandemic shows that higher resilience is associated with the use of healthy coping strategies, greater subjective well-being, and fewer symptoms of mental illness (Zhang et al., 2020; Finstad et al., 2021; Gundogan, 2021; Li et al., 2021; Verdolini et al., 2021).

Some scholars argue that social support was essential for cultivating resilience during the COVID-19 pandemic (PeConga et al., 2020). Social support involves the provisioning of assistance and comfort to individuals within relationship networks (e.g., friends, family, neighbors, etc.), and consists of behaviors such as physical aid, emotional support, advice, and companionship. There are several potential mechanisms through which social support increases resilience (Thoits, 2011). For instance, social support may promote resilience by creating safety networks, reducing loneliness and isolation, providing tangible resources (e.g., financial aid), and fostering optimism about the future. A large body of research has explored the connection between social support and psychological well-being (Uchino, 2006; Chu et al., 2010; Wang et al., 2018), including its role in mitigating psychological distress. Previous research has shown that people with higher self-perceived social support have less depression symptoms (Cohen and Wills, 1985; Cho et al., 2022) and lower risk of mortality (Turner and Lloyd, 1995) following a stressful life event, and have less severe trauma symptoms (Evans et al., 2013). Consequently, individuals who reported higher perceived social support during the COVID-19 pandemic had fewer depression, anxiety, and stress symptoms (Guo et al., 2021; Choi et al., 2022; Gabarrell-Pascuet et al., 2023). In sum, resilience may buffer against pandemic-related distress to the extent that individuals possess adequate social support.

Research during the pandemic has also documented sociodemographic differences in mental health that are attributed to differences in resilience. For instance, older adults reported less psychological distress than younger adults during the pandemic, in part because they are, on average, more resilient (Vahia et al., 2020; Mccleskey and Gruda, 2021). Because young adults experience loss and trauma with greater emotional intensity and have greater difficulty processing unpleasant emotions such as fear, anger, irritability and aggression (Ang et al., 2018; Viejo and Jesús, 2020; Martínez Arriaga et al., 2021), they may have been less resilient to the challenges presented by the pandemic. Individuals who experienced greater economic hardship during the pandemic reported more symptoms of mental illness and lower levels of resilience, perhaps due to increased uncertainty about the future or the inability to meet basic needs (Kimhi et al., 2020). Moreover, several studies suggest that women were more vulnerable to pandemic-related distress compared to men, resulting in worse mental health outcomes (Kumar et al., 2022; Manchia et al., 2022). Because women are more likely than men to develop stress-related psychological symptoms in response to traumatic events (North, 2016) and were disproportionately burdened with domestic and psychosocial responsibilities during the pandemic (e.g., childcare; Lowe et al., 2021), they may have experienced greater psychological distress that resulted in lower resilience (Hirani et al., 2016) and therefore more symptoms of mental illness.

Following previous research (Ye et al., 2020; Rossi et al., 2021; Ke et al., 2022; Noh and Park, 2022; Shi et al., 2022; Hirai et al., 2023; Park et al., 2023) the current study used a mediation approach to evaluate a potential mechanism through which pandemic-related stress decreases resilience, resulting in more symptoms of mental illness. In addition, this study explored the moderating effects of perceived social support and sex on resilience. The current study leveraged a sample of participants from a unique social context to examine the effect of the COVID-19 pandemic on mental health–Panama. Despite being one of the most affluent and developed countries in the Central American region, Panama had high rates of disease transmission and a high number of deaths per million inhabitants due to health complications from the virus (Pearson et al., 2021). Panama simultaneously implemented one of the strictest lockdowns in the world (Pescarini et al., 2020), which included curfews, severe mobility and travel restrictions, and suspension of most in-person activities, including compulsory education. These lockdown measures remained in effect until late 2021, with many restrictions continuing well into 2022. During the lockdown, Oviedo et al. (2022) documented a high prevalence of psychosocial disturbances, such as perceived isolation and strained social relationships, as well as poor mental health outcomes in a sample of Panamanian adults (Oviedo et al., 2022). Social support and resilience were both negatively associated with depression, anxiety, and stress symptoms, and women reported more depression, anxiety, and stress symptoms, suggesting that individuals' response to pandemic-related stress depend on these factors in the Panamanian context.

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1.1. Hypotheses

We hypothesized that resilience would mediate the relationship between the perceived effect of the COVID-19 pandemic and psychological symptoms. Specifically, individuals who feel more affected by the pandemic will report lower resilience, and more depression, anxiety, and stress symptoms through the indirect effect of resilience (*H1*). In addition, we hypothesized that perceived social support and sex would moderate the indirect effect of resilience. That is, individuals with lower perceived social support, particularly women, would also report lower resilience, and therefore more depression, anxiety, and stress symptoms through the indirect effect of resilience (*H2*).

2. Methods

2.1. Participants and procedure

Raosoft Sample Size Calculator was used to estimate an adequate sample size for the study. The estimated minimum sample size required was 323 participants given that there are 2,958,577 adults 18 and older in Panama (Contraloría General de la Nación, 2010), and the estimated prevalence rates of depression (50.9%), anxiety (57.4%), and stress (58.6%) during the pandemic (Bareeqa et al., 2021), with 95% confidence and 5% error. Convenience sampling was used to recruit a total of 480 adult residents in Panama (388 Women, 92 Men), aged 18 years or older (M = 32.7; SD = 14.6, Range = 18–66). A flyer was divulged on social media (e.g., Instagram, Twitter, Facebook, WhatsApp) to recruit participants. It contained a description of the study and contact information. Inclusion criteria included being 18 years or older, residing in Panama, having access to an electronic device such as a laptop, tablet, or cellphone, and not suffering from a physical condition that would make it difficult to access the survey or answer questionnaires (e.g., cognitive or visual impairment, illiteracy, etc.). Access to an online survey via a Google Forms link was sent to individuals who contacted a member of the research team. Participants were first prompted to participate by answering a few questions to verify they met the inclusion criteria. Data was collected from March to May 2021. This study was approved by the National Research Bioethics Committee of Panama (CNBI code PT-023). The participants signed informed consent in accordance with the World Medical Association (2023). The online survey included sociodemographic information such as age, sex, nationality, educational level, marital status, cohabitation, employment status, monthly household income, and scale measures of psychological constructs.

TABLE 1 Sociodemographic characteristics.

	Total (*n* = 480)	Female (*n* = 388)	Male (*n* = 92)
	n (%)/M (SD)	*n* (%)/M (SD)	*n* (%)/M (SD)
Sex			
Female	388 (80.8%)		
Male	92 (19.2%)		
Age	32.7 (14.6)	32.4 (14.3)	33.8 (15.6)
Nationality			
Panamanian	425 (88.5%)	344 (88.7%)	81 (88.0%)
Other	55 (11.5%)	44 (11.3%)	11 (12.0%)
Marital status			
Married or partnered	99 (20.6%)	77 (19.8%)	22 (23.9%)
Single, divorced, or widowed	381 (79.4%)	311 (80.2%)	70 (76.1%)
Educational attainment			
High school diploma	66 (13.8%)	48 (12.4%)	18 (19.6%)
Bachelor's degree	235 (49.0%)	189 (48.7%)	46 (50.0%)
Graduate degree	130 (27.1%)	110 (28.4%)	20 (21.7%)
Employment status			
Unemployed	179 (37.3%)	144 (37.1%)	35 (38.0%)
Independent work	76 (15.8%)	63 (16.2%)	13 (14.1%)
Permanent contract	151 (31.5%)	121 (31.2%)	30 (32.6%)
Other	74 (15.4%)	60 (15.5%)	14 (15.2%)
Monthly household income			
$800–$1,500	94 (19.6%)	79 (20.4%)	15 (16.3%)
$1,500–$2,000	83 (17.3%)	65 (16.8%)	18 (19.6%)
>$2000	222 (46.3%)	177 (45.6%)	45 (48.9%)
Other	81 (16.8%)	67 (17.3%)	14 (15.2%)
Cohabitation			
Live alone	27 (5.6%)	21 (5.4%)	6 (6.5%)
2 Cohabitants	111 (23.1%)	89 (22.9%)	22 (23.9%)
3 Cohabitants	116 (24.2%)	93 (24.0%)	23 (25.0%)
4 Cohabitants	126 (26.3%)	103 (26.5%)	23 (25.0%)
5+ Cohabitants	100 (20.8%)	82 (21.1%)	18 (19.6%)

2.2. Measures

2.2.1. Sociodemographic questionnaire

Participants reported their sex (0 = Female, 1 = Male), age, educational attainment (0 = Primary School, 1 = Secondary School, 2 = Technical Degree, 3 = Professional Licensure, 4 = Bachelor's Degree, 5 = Post-Graduate Degree [Master's or Doctorate]), monthly income in USD (0 = Less than $250, 1 = $250–$500, 2 = $500–$800, 3 = $800–$1,500, 4 = $1,500–$2,000, 5 = greater than $2000), and the number of cohabitants living with them in the same household (Table 1). Participants also indicated the extent to which they were personally affected by the COVID-19 pandemic (0 = Not at all affected, 1 = Affected very little, 2 = Affected, 3 = Greatly affected).

2.2.2. Depression, anxiety, and stress scale-21

Participants reported how frequently they experienced depression, anxiety, and stress symptoms during the past week using the Depression, Anxiety and Stress Scale-21 (Bados et al., 2005). The DASS-21 consists of 21 Likert-scale items with response scores ranging from 0 to 3 (0 = It has not happened to me, 1 = It has happened to me a little or part of the time, 2 = It has happened to me quite a lot or for a good amount of the time, 3 = It has happened to me a lot, or most of the time) and contains three subscales with 7 items in each

subscale. The depression subscale measures symptoms such as dysphoria, dulled senses, self-deprecation, loss of interest, and anhedonia. The anxiety subscale measures subjective and somatic symptoms of fear, autonomic activation, situational anxiety, and anxious attachment. The stress scale measures non-specific and persistent hypervigilance, difficulty relaxing, irritability, and impatience. Following previous research (Román et al., 2016), a sum score was calculated for each subscale, which produced scores ranging from 0 to 21. A total sum score of all 21 items was computed by aggregating the scores for all three subscales. Cronbach's alpha indicated high internal consistency for the measure ($\alpha = 0.95$).

2.2.3. The Connor-Davidson resilience scale

Participants reported how psychologically resilient they felt during the past month using the Connor-Davidson Resilience Scale (Broche-Pérez et al., 2012). This scale consists of 25 Likert-scale items with responses ranging from 0 to 4 (0 = Never, 1 = Rarely, 2 = Sometimes, 3 = Often, 4 = Almost Always), and measures self-perceived competence, resolve, trust in one's intuition, stress tolerance, positive acceptance to change, and locus of control. Examples of items include "I am able to adapt myself when changes arise" and "I remain focused and think clearly when under pressure." A sum score was computed for all 25 items. Cronbach's alpha indicated high internal consistency for the measure ($\alpha = 0.91$).

2.2.4. Multidimensional scale of perceived social support

Participants completed the Multidimensional Scale of Perceived Social Support (Ruiz-Jiménez et al., 2017), a 12-item measure that assesses the perceived quality of social support from family, friends, and relationship partners using a 5-point Likert scale (0 = Strongly disagree, 5 = Strongly agree). Examples of items include "My family really tries to help me" and "I can count on my friends when things aren't going well." A sum score was computed for all 12 items. Cronbach's alpha indicated high internal consistency for the measure ($\alpha = 0.94$).

A full list of items for each scale measure is provided in Supplemental Materials.

3. Results

3.1. Statistical analyses

Five participants were removed from the dataset prior to analyses due to non-responses on scale measures. First, a correlation matrix was constructed using SPSS version 28 to inspect the associations between variables of interest and to report means and standard deviations. Next, a simple mediation analysis was conducted using the SPSS Macro PROCESS version 4.1 (Hayes, 2017). PROCESS model 4 was selected because it estimates the indirect path of the effect of the COVID-19 pandemic on depression, anxiety, and stress symptoms through resilience (see Figure 1). Lastly, a moderated-mediation analysis was conducted using PROCESS 4.1. PROCESS model 12 was selected for the moderated-mediation analysis because it estimates the indirect path of the effect of the COVID-19 pandemic on depression, anxiety, and stress symptoms through resilience, and simultaneously allows the effect of social support and sex to jointly moderate the indirect effect of resilience. A conceptual illustration of the moderated mediation model is shown in Figure 2.

For each mediation model, the mean score of the effect of the COVID-19 pandemic was entered as the focal antecedent variable (i.e., X), the sum score of resilience was entered as the mediator variable (i.e., M), and the sum score of depression, anxiety, and stress symptoms (DASS) was entered as the outcome variable (i.e., Y). Sex, age, educational attainment, monthly income, and the number of cohabitants in the same household were entered as covariates in the simple mediation model to adjust for their effects on depression, anxiety, and stress symptoms. The moderated-mediation model included the sum score of social support as a moderator (i.e., W) and sex (male, female) as a dichotomous moderator (i.e., Z), and age, educational attainment, monthly income, and the number of cohabitants in the same household as covariates. Two-way interaction terms were computed for the effect of the COVID-19 pandemic and social support ($X \times W$), the effect of the COVID-19 pandemic and sex ($X \times Z$), social support and sex ($W \times Z$), as well as a three-way interaction term using the effect of the COVID-19 pandemic, social support, and sex ($X \times W \times Z$). Mediation was inferred from the indirect path via the predictors (e.g., effect of the pandemic, sex, social support) to the outcome (DASS) through the mediator (resilience), and significance was determined based on boot-strapped confidence intervals of the indirect effects. Moderation of mediation was determined if the slopes of the moderators (sex, social support) defining the size of the indirect effects were different from zero (i.e., the indices of moderated mediation) using bootstrapped confidence intervals (Hayes, 2015).

3.2. Zero-order correlations

A correlation matrix was constructed to investigate zero-order relationships between sociodemographic variables, depression, anxiety, and stress symptoms (DASS), resilience, social support, and the effect of the COVID-19 pandemic (Table 1). Results and descriptive statistics are summarized in Table 2.

3.3. Simple mediation analysis

Estimated regression coefficients and statistical models of direct and indirect effects are presented in Tables 3, 4 and illustrated in Figure 1. Results indicated that the effect of the COVID-19 pandemic on DASS score was negatively associated with resilience, such that participants who were more affected by the pandemic scored lower on resilience relative to those who were less affected by the pandemic ($a_1 = -3.59$ [95% CI = −5.45, −1.73], $p < 0.001$). Holding constant the effect of the pandemic, resilience was negatively associated with DASS, such that participants who reported greater resilience reported lower DASS relative to those who reported lower resilience ($b_1 = -0.41$, [95% CI = −0.49, −0.34], $p < 0.001$). There was a direct effect of the pandemic on DASS ($c_1 = 6.59$ [95% CI = 5.09, 8.10], $p < 0.001$), indicating that participants who were more affected by the pandemic experienced greater depression, anxiety, and stress symptoms. Furthermore, the indirect effect of resilience mediated the effect of the pandemic on DASS ($c' = 1.48$ [95% CI = 0.67, 2.36]). These findings supported the first hypothesis, namely, that participants who felt more

affected by the COVID-19 pandemic reported lower resilience, which predicted greater depression, anxiety, and stress symptoms.

3.4. Moderated-mediation analysis

Estimated regression coefficients and statistical models are presented in Table 5. Results indicated that there was an effect of the COVID-19 pandemic ($a_1 = -0.62$ [95% CI = −4.60, −0.65], $p < 0.01$) and social support ($a_2 = 0.33$, [95% CI = 0.25, 0.42], $p < 0.001$), and a two-way interaction of the effect of the pandemic and social support on resilience ($a_4 = 0.18$, [95% CI = 0.05, 0.30], $p < 0.01$), such that participants who were more affected by the pandemic and who perceived less social support reported lower resilience. After including sex and social support in the model, the moderated mediation analysis only explained an additional ~2% of the variance in depression, anxiety, and stress symptoms compared to the simple mediation analysis. However, the inclusion of social support explained an additional ~13% of the variance in resilience and revealed both direct and indirect effects on depression, anxiety, and stress symptoms.

The effect of sex, the two-way interaction between the effect of the pandemic and sex, the two-way interaction between sex and social support, and the three-way interaction between the effect of the pandemic, sex, and social support were not significantly related to resilience. Holding constant the effect of the pandemic, sex, social support, and all 2-way and 3-way interactions, resilience was negatively associated with DASS, such that participants who scored higher in resilience reported less depression, anxiety, and stress symptoms ($b_1 = -0.37$, [95% CI = −0.45, −0.28], $p < 0.001$). There was a direct effect of the pandemic ($c_1 = 7.41$, [95% CI = 5.70, 9.12], $p < 0.001$), social support ($c_2 = -0.08$, [95% CI = −0.16, −0.01], $p < 0.05$), sex ($c_3 = -3.59$, [95% CI = −6.04, −1.15], $p < 0.01$), a two-way interaction of the effect of the pandemic and social support ($c_4 = -0.12$, [95% CI = −0.23, −0.01], $p < 0.05$), and a two-way interaction of the effect of the pandemic and sex ($c_5 = -3.83$, [95% CI = −7.33, −0.34], $p < 0.05$) on DASS. The two-way interaction between sex and social support, and the three-way interaction between the effect of the

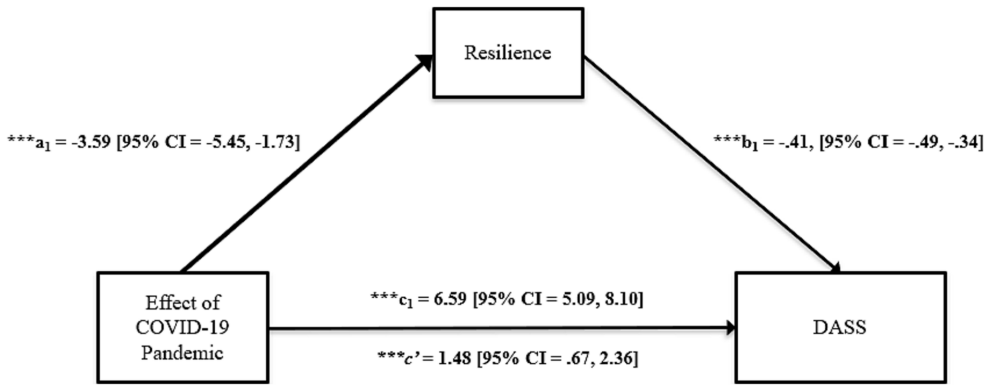

FIGURE 1
Simple mediation estimating the perceived effect of the COVID-19 pandemic on depression, anxiety, and stress symptoms through resilience. $p < 0.05$*, $p < 0.01$**, $p < 0.001$***.

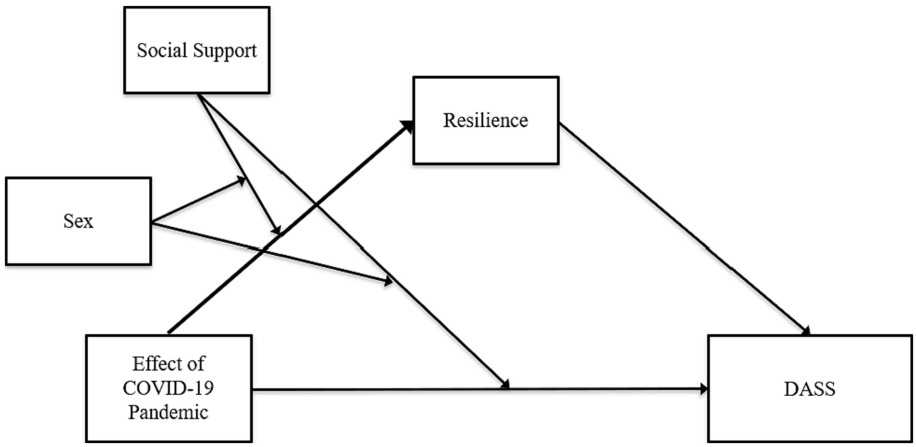

FIGURE 2
Conceptual illustration of the moderated mediation estimating the effect of the COVID-19 pandemic on depression, anxiety, and stress symptoms through resilience, moderated by social support and participant sex.

TABLE 2 Correlations between sociodemographic variables and depression, anxiety, and stress symptoms, resilience, social support, and the effect of the COVID-19 pandemic.

Variable	1	2	3	4	5	6	7	8	9
1. Sex	___								
2. Age	0.04	___							
3. Education	−0.06	0.33***	___						
4. Income	0.04	0.10*	0.25***	___					
5. Effect of Pandemic	−0.02	−0.10*	−0.03	−0.15***	___				
6. DASS	−0.14**	−0.33***	−0.12**	0.09*	0.42***	___			
7. Resilience	0.09	0.35***	0.18***	0.15**	−0.21***	−0.54***	___		
8. Social Support	−0.04	0.05	0.05	0.15**	−0.10*	−0.26***	0.36***	___	
9. Cohabitation	−0.02	−0.25***	−0.21***	−0.15***	0.16***	0.16***	−0.14**	0.012	___
Mean	N/A	32.78	3.80	3.82	1.72	19.22	71.59	67.05	2.54
Standard Deviation	N/A	14.65	1.13	1.40	0.66	13.74	14.21	15.33	1.52

$p < 0.05$*, $p < 0.01$**, $p < 0.001$***; Zero-order correlations and descriptive statistics for participant sex, age, educational attainment, monthly income, depression, anxiety, and stress symptoms (DASS), resilience, social support, and the effect of the COVID-19 pandemic.

TABLE 3 Simple mediation estimating the perceived effect of the COVID-19 pandemic on depression, anxiety, and stress symptoms through resilience.

	Resilience (*M*) coefficient	95% CI	DASS (*Y*) coefficient	95% CI
Effect of Pandemic (*X*)	a_1−3.59 (0.95)***	−5.45, −1.73	c_1 6.59 (0.77)***	5.09, 8.10
Resilience (*M*)			b_1−0.41 (0.04)***	−0.49, −0.34
Sex	2.28 (1.56)	−0.78, 5.35	−3.38 (1.25)**	−5.84, −0.93
Age	0.29 (0.04)***	0.20, 0.38	−0.13 (0.04)***	−0.21, −0.06
Education	1.85 (1.24)	−0.59, 4.29	−0.67 (0.10)	−2.63, 1.28
Income	0.75 (0.47)	−0.18, 1.68	0.46 (0.38)	−0.29, 1.20
Cohabitation	0.01 (0.43)	−0.84, 0.85	0.12 (0.34)	−0.56, 0.79
Constant	58.86 (4.75)***	49.53, 68.19	42.65 (4.40)***	34.01, 51.30
	$R^2 = 0.17$		$R^2 = 0.43$	
	F (6, 445) = 14.86***		F (7, 444) = 48.26***	

$p < 0.01$**, $p < 0.001$***; standard errors in parentheses. Unstandardized regression coefficients, standard errors, and confidence intervals estimating the effect of the COVID-19 pandemic on depression, anxiety, and stress symptoms (DASS) through resilience, controlling for sex, age, educational attainment, monthly income, and number of cohabitants.

TABLE 4 Simple Mediation: total, direct, and indirect effects of the perceived effect of the COVID-19 pandemic on depression, anxiety, and stress symptoms through resilience.

Total effect	Direct effect	Indirect effect
Coefficient *t*-value	Coefficient *t*-value	Effect 95% CI
8.07 (0.85)*** 9.50	6.59 (0.77)*** 8.59	1.48 (0.43)*** 0.67, 2.36

Boot-strapped confidence interval does not include zero***.

pandemic, sex, and social support were not significantly related to DASS. Conditional direct effects split by sex and social support are summarized in Table 6 and illustrated in Figure 3.

The moderated mediation analysis also yielded indirect effects of the pandemic on DASS through resilience. Although the index of moderated-moderated mediation was not significant [95% CI = −0.14, 0.06], the indices of conditional moderated mediation were significant for both men [95% CI = −0.19, −0.02] and women [95% CI = −0.13, −0.003], indicating that the mediator (resilience) varied as a function of perceived social support for both sexes. Specifically, women with low ($b = 1.79$, [95% CI = 0.50, 3.23]) and moderate ($b = 0.73$, [95% CI = 0.03, 1.51]) perceived social support, and men with low perceived social support ($b = 2.09$, [95% CI = 0.53, 3.70]) scored higher in DASS via lower resilience (see Tables 7–9). These findings support the second hypothesis by showing that participants who felt more affected by the COVID-19 pandemic and perceived less social support reported lower resilience, which predicted greater depression, anxiety, and stress symptoms. Further, the results suggest that the moderating effect of social support on resilience was more pronounced for women.

4. General discussion

This study examined the relationships between COVID-19 pandemic-related stress, resilience and social support, and mental health in a sample of adults in Panama. The goal of this research was to examine the role of resilience as it relates to the perceived effect of the pandemic on mental health symptoms, and whether resilience depends on perceived social support. Preliminary correlation analyses identified demographic and psychosocial factors associated with mental health. In line with previous research (Kimhi et al., 2020),

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TABLE 5 Moderated mediation estimating the effect of the COVID-19 pandemic on depression, anxiety, and stress symptoms through resilience, moderated by social support and participant sex.

	Resilience (*M*) coefficient	95% CI	DASS (*Y*) coefficient	95% CI
Effect of Pandemic (*X*)	a_1−2.62 (1.01)**	−4.60, −0.65	c_1 7.41 (0.87)***	5.70, 9.12
Social Support (*W*)	a_2 0.33 (0.04)***	0.25, 0.42	c_2 -0.08 (0.04)*	−0.16, −0.01
Sex (*Z*)	a_3 2.55 (1.44)	−0.29, 5.38	c_3 -3.59 (1.24)**	−6.04, −1.15
X × *W*	a_4 0.18 (0.07)**	0.05, 0.30	c_4 -0.12 (0.06)*	−0.23, −0.01
X × *Z*	a_5 0.82 (2.07)	−3.25, 4.89	c_5 -3.83 (1.78)*	−7.33, −0.34
W × *Z*	a_6−0.12 (0.09)	−0.29, 0.06	c_6 0.02 (0.08)	−0.13, 0.17
X × *W* × *Z*	a_7 0.13 (0.11)	−0.09, 0.34	c_7 0.05 (0.09)	−0.13, 0.24
Resilience (*M*)			b_1−0.37 (0.04)***	−0.45, −0.28
Age	0.30 (0.04)***	0.22, 0.38	−0.15 (0.04)***	−0.22, −0.07
Education	1.13 (1.15)	−1.13, 3.39	−0.45 (0.99)	−2.40, 1.49
Income	0.23 (0.44)	−0.63, 1.10	0.57 (0.38)	−0.17, 1.32
Cohabitation	−0.09 (0.40)	−0.87, 0.70	0.15 (0.34)	−0.52, 0.82
Constant	57.23 (4.09)***	49.20, 65.26	49.76 (4.22)***	41.47, 58.06
	$R^2 = 0.30$		$R^2 = 0.45$	
	$F(11, 440) = 17.40$***		$F(12, 439) = 29.96$***	

$p < 0.05$*, $p < 0.01$**, $p < 0.001$***; Standard errors in parentheses. Unstandardized regression coefficients, standard errors, and confidence intervals estimating the effect of the COVID-19 pandemic on depression, anxiety, and stress symptoms (DASS) through resilience, moderated by social support and participant sex. Age, educational attainment, monthly income, and number of cohabitants were entered as covariates.

TABLE 6 Moderated Mediation: Conditional direct effects of the COVID-19 pandemic on depression, anxiety, and stress symptoms, split by sex and social support.

Sex	Social support	Effect	Standard error	*t*	95% CI
Female	Low	9.00***	1.14	7.92	6.77, 11.23
Male	Low	4.46**	1.56	2.85	1.38, 7.53
Female	Moderate	6.98***	0.89	7.81	5.22, 8.74
Male	Moderate	3.34*	1.66	2.01	0.07, 6.61
Female	High	5.70***	1.18	4.82	3.38, 8.02
Male	High	2.62	2.14	1.23	−1.57, 6.82

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

results showed that older, more educated, and more affluent adults reported higher resilience. Being female, poorer, less educated, and having low resilience and social support was associated with increased depression, anxiety, and stress symptoms.

The main analysis investigated whether resilience mediates the association between the perceived effect of the pandemic and self-reported mental health symptoms, revealing both direct and indirect pathways from pandemic-related stress to depression, anxiety, and stress symptoms. Holding constant several demographic variables, individuals who felt more affected by the pandemic reported more depression, anxiety, and stress symptoms, and resilience mediated the association between the effect of the pandemic and mental health symptoms. Inversely, individuals with higher levels of resilience showed less of these symptoms. These results provided support for the first hypothesis. A moderated-mediation analysis similarly showed that perceived effect of the pandemic on mental health symptoms was mediated by resilience, but also indicated that the indirect effect of resilience was moderated by social support and sex, which supported the second hypothesis. Specifically, the indirect effect of resilience was greater for men with lower perceived social support, and women with low and moderate perceived social support. The mediation analyses also yielded direct effects showing that individuals who felt more affected by the pandemic and less resilient reported more depression, anxiety, and stress symptoms. Furthermore, the direct effect of the pandemic on mental health symptoms was greater for women and for individuals who perceived less social support.

In line with previous studies, these findings suggest that resilience may play an important role in coping with pandemic-related distress (Wolmer et al., 2011; Ke et al., 2022). That is, individuals' psychological adjustment to the pandemic depended, in part, on the perception that they were capable of coping with the pandemic (i.e., resilience). It is possible that highly resilient individuals viewed the pandemic as less impactful or felt more capable of overcoming its challenges, which resulted in less distress and fewer symptoms of mental illness. Alternatively, people who felt more affected by the pandemic may have become less resilient to the ongoing stressors, thereby resulting in poorer mental health. Further, the results show that low psychological resilience, low social support, and sex are significant risk factors for negative mental health outcomes during the pandemic.

This study offers several contributions to the literature on the psychosocial effects of the COVID-19 pandemic. For instance, the current study replicated existing research on the mediating effect of resilience on psychological distress and mental health symptoms (Bareeqa et al., 2021), the negative association between perceived social support and mental health symptoms (Bados et al., 2005; Román et al., 2016), and sex differences in mental health symptoms (Broche-Pérez et al., 2012; Hayes, 2015; Hayes, 2017; Ruiz-Jiménez et al., 2017). On one hand, the results show that low psychological resilience and low social support are significant risk factors for

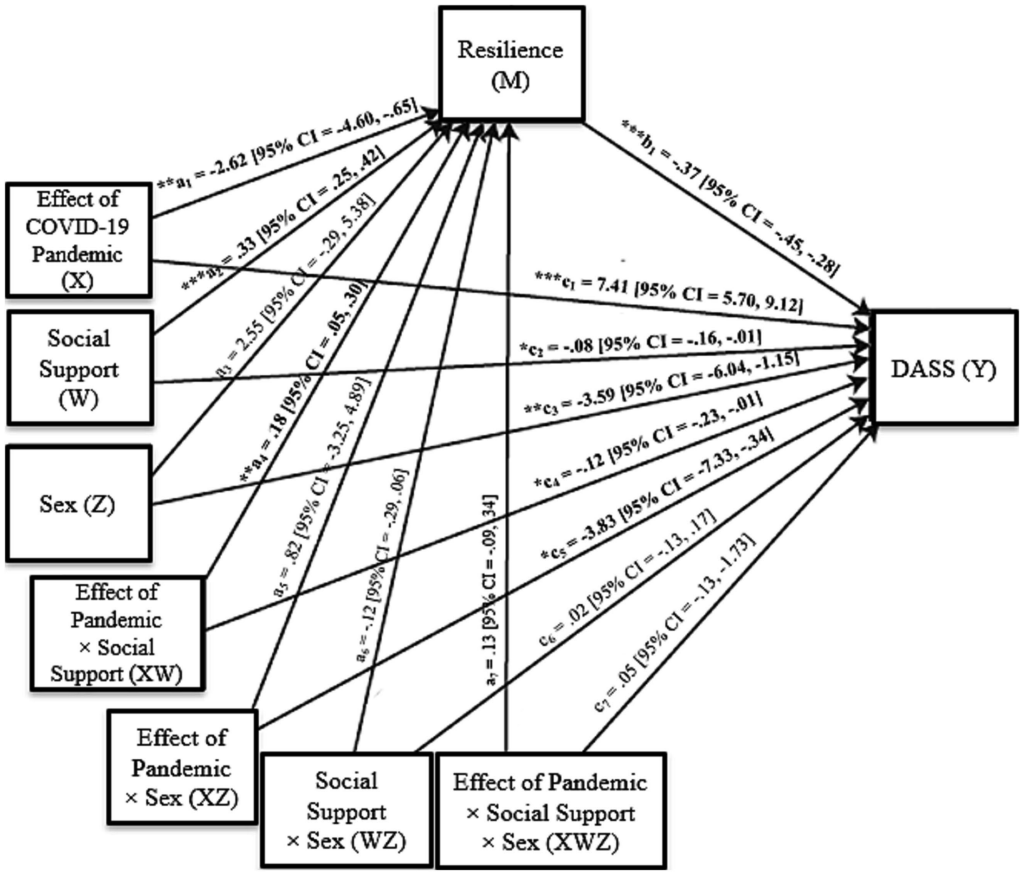

FIGURE 3
Moderated mediation estimating the direct effect of the COVID-19 pandemic on depression, anxiety, and stress symptoms through resilience, moderated by social support and participant sex. $p < 0.05$*, $p < 0.01$**, $p < 0.001$***.

TABLE 7 Moderated mediation: conditional indirect effects of the COVID-19 pandemic on depression, anxiety, and stress symptoms, split by sex and social support.

Sex	Social support	Effect	Standard error	95% CI
Female	Low	1.79***	0.68	0.50, 3.23
Male	Low	2.09***	0.79	0.53, 3.70
Female	Moderate	0.73***	0.37	0.03, 1.51
Male	Moderate	0.27	0.67	−1.00, 1.66
Female	High	0.06	0.46	−0.89, 1.01
Male	High	−0.88	0.90	−2.52, 1.03

Boot-strapped confidence interval does not include zero***.

TABLE 8 Index of moderated-moderated mediation: social support and sex as joint moderators of resilience.

Index	Standard error	95% CI
−0.05	0.05	−0.14, 0.06

negative mental health outcomes. On the other hand, these findings suggest that social support is an underlying component of psychological resilience as it relates to COVID-19 pandemic distress and mental health symptoms.

TABLE 9 Indices of conditional moderated mediation: social support as a moderator of resilience, split by sex.

Sex	Index	Standard error	95% CI
Female	−0.06***	0.03	−0.13, −0.003
Male	−0.11***	0.04	−0.19, −0.02

Boot-strapped confidence interval does not include zero***.

4.1. Implications

This research has implications for theory and practice. First, the study supports the predictions of Resilience Theory (Greene et al., 2004), which proposes that different promotive psychosocial factors, such as social support can mitigate the psychological distress associated with traumatic experiences and is an essential component of resilience. Our analyses showed that perceived social support explained significant variation in resilience, which supports the idea that resilience is enhanced by supportive interpersonal relationships and can help individuals maintain well-being amidst difficult circumstances (Southwick et al., 2014). Second, the results corroborate the prediction that the pandemic disproportionately impacted certain vulnerable groups, such as people with lower socioeconomic status, less education, younger adults, and women. Third, this study can help mental health professionals in developing psychoeducational resources that reduce

the psychosocial impact of COVID-19 by implementing healthy coping behaviors and cultivating resilience (Diotaiuti et al., 2021; D'Oliveira et al., 2022; da Cruz et al., 2022). One potential path forward from the COVID-19 pandemic is to implement mental health interventions that emphasize social support — particularly for women — to mitigate the harmful effects of pandemic-related stress. Finally, this study contributes to the literature on the psychosocial effects of the COVID-19 pandemic by replicated existing research on the mediating effect of resilience on psychological distress and mental health symptoms (Tuxunjiang et al., 2022), the negative association between perceived social support and mental health symptoms (Grey et al., 2020; Caccia et al., 2021), and sex differences in mental health symptoms (Dubey et al., 2020; Wang et al., 2020; Callís-Fernández et al., 2021; Jawad et al., 2021).

4.2. Limitations

The design of this study was correlational and cross-sectional, which precludes any causal inferences about how resilience underlies pandemic-related stress and mental health symptoms. We contend that the mediation analyses were appropriate for these data given that the construct of resilience is a relatively stable trait (Herrman et al., 2011), whereas mental health symptoms can fluctuate in response to stressors (e.g., the COVID-19 lockdown). Additionally, participants were recruited via convenience sampling, and therefore were not representative of the Panamanian population. However, restrictions at the time of data collection did not permit in-person recruitment or direct contact with local communities. Despite these limitations, these data contribute to a growing body of research documenting the adverse effects of the COVID-19 pandemic on mental health in Latin America and is among the first studies conducted in Central America on this topic.

5. Conclusion

The current research explored the role of resilience as it relates to the impact of the COVID-19 pandemic on mental health. Resilience plays an important role in individuals' psychosocial response to the pandemic, and social support may be essential for cultivating resilience during the pandemic. This study corroborates recent research documenting that high resilience coupled with strong social support is associated with better mental health outcomes. This study also corroborates other recent studies documenting that resilience and perceived social support are uniquely associated with depression, anxiety, and stress symptoms, independent of socioeconomic and other demographic variables. In conclusion, the study contributes to a growing body of research documenting the adverse effects of the COVID-19 pandemic on mental health in Latin America and is among the first studies conducted in Central America on this topic.

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 humans were approved by National Research Bioethics Committee of Panama (CNBI code PT-023). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

DCO and AET: conceived and wrote the manuscript. MSP, SR-A, EP-Q, CC, CPR and GBB: read, reviewed, wrote sections, and equally contributed to the intellectual content and format of 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.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1235935/full#supplementary-material

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Lived experience of Iranian pre-hospital medical staff during the COVID-19 pandemic: a descriptive phenomenological study

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Background: Pre-hospital medical staff faced numerous challenges during the COVID-19 pandemic. However, these challenges specific to pre-hospital services have not been thoroughly explored in Iran. This qualitative study aimed to examine the essence of pre-hospital care during the COVID-19 pandemic.

Methods: This phenomenological study was conducted from June to August 2021 in Tehran, Iran. Semi-structured interviews were conducted with pre-hospital medical staff. Data analysis was performed using Colaizzi's approach, and rigor was ensured by adhering to the consolidated criteria for qualitative reporting research.

Results: A total of 17 pre-hospital medical staff were interviewed, and five themes were extracted from the data: workload and resilience, damage, lack of control, under preparedness, and post-traumatic growth. These themes highlight the resilience demonstrated by pre-hospital medical staff, who faced an unprecedented crisis with limited preparedness and significant damage.

Conclusion: The findings of this study indicate that pre-hospital medical staff in Iran encountered challenges during the COVID-19 pandemic due to a lack of preparedness and substantial damage. Despite these adversities, the participants exhibited resilience and experienced post-traumatic growth. The study emphasizes the importance of proper planning and preparedness to enhance the resilience of emergency medical services during pandemics. Furthermore, the results underscore the need to address the challenges faced by pre-hospital medical staff and improve the quality of care provided to patients during crises such as the COVID-19 pandemic.

KEYWORDS

COVID-19, lived experience, qualitative study, pre-hospital services, emergency medical staff

1 Introduction

There were over 570 million global COVID-19 cases and 6 million fatalities as of July 24, 2022 (WHO, 2020a). During the same period in Iran, there were 7,319,322 confirmed cases and 141,650 reported deaths (WHO, 2020a). The Delta variant of COVID-19 has resulted in an unprecedented surge in the death rate across all age groups, with an average of 750 deaths per day, posing significant challenges to the prevailing conditions (Shakibnia et al., 2021).

The COVID-19 pandemic has posed unprecedented challenges for prehospital medical staff globally (WHO, 2020b; Shakibnia et al., 2021; Heidari et al., 2023), including those in Iran (Heidari et al., 2023). Reluctance to care for highly infectious patients has led to adverse events during prehospital transport, even for short distances, potentially resulting in life-threatening situations (Baru et al., 2022). Studies have revealed a 80% increase in out-of-hospital cardiac arrests during the peak of the pandemic in certain regions (Fothergill et al., 2021). Additionally, the disruption of essential health services during epidemics can contribute to higher mortality rates, surpassing the direct deaths attributed to the disease itself (Neyazi et al., 2023).

Prehospital medical staff's experiences during the COVID-19 pandemic are shaped by occupational hazards and psychological challenges They navigate complex environments, swiftly adapting to escalating demands (Mohammadi et al., 2021). Challenges include infection risk, personal protective equipment (PPE) shortages, exposure to distressing scenes, patient mortality, and the psychological toll of witnessing suffering and fearing transmission to loved ones (Jafari et al., 2019; Fatahi et al., 2022; Mohammadi et al., 2022).

Prehospital medical staff worldwide have faced significant job stress during the COVID-19 pandemic (Dami and Berthoz, 2020; Shahzad et al., 2020; Piotrowski et al., 2021; Nyashanu et al., 2022; Tune et al., 2022). COVID-19 has caused shifts in demand for emergency medical services in Canada (Ferron et al., 2021), an increase in nationwide EMS responses and deaths attended by EMS in the United States (Lerner et al., 2020), severe overload in Denmark's emergency dispatch facility (Jensen et al., 2020), and overwhelming prehospital services in Iran with a surge in confirmed cases and record-breaking daily dispatches (Mohamadian et al., 2021). In Iran, prehospital services are overwhelmed with record-breaking 4,557 daily dispatches and a 347% surge in call volumes (Saberian et al., 2020).

While several international studies have examined the experiences of prehospital medical staff during the COVID-19 pandemic (Piotrowski et al., 2021; Nyashanu et al., 2022; Tune et al., 2022), limited research exists on the specific challenges faced by Iranian prehospital medical staff during the COVID-19 pandemic, particularly during the Delta wave (Hadian et al., 2022; Heidari et al., 2023). Hadian et al. highlighted the adverse impact of inadequate equipment and job overload on mental health and emergency care quality (Hadian et al., 2022), while Heidari et al. identified individual and systemic challenges requiring organizational planning and policy attention (Heidari et al., 2023). However, there is still a noticeable gap and limitations in understanding the lived experiences of Iranian prehospital medical staff within the unique context of their services, especially during the Delta wave.

Gaining an understanding of the lived experiences of Iranian prehospital medical staff could offers more valuable insights into their distinct challenges, support systems, and opportunities for enhancement. The prehospital services in Iran, primarily operated by governmental organizations like EMS and Red Crescent Society, as well as the private sector, confront unique obstacles such as resource limitations and geographical disparities. The prehospital services have been provided by male staff. Furthermore, our study may offer unique insights into the experiences of pre-hospital medical staff during the prevailing Delta wave in Iran, which has been relatively understudied compared to other health workers such as physicians (Liu et al., 2020), nurses' (Ruiu, 2020), and family caregivers' (Jafari-Oori et al., 2022). During the summer of 2021, the Delta wave of the COVID-19 pandemic in Iran was distinguished by the rapid transmission of the highly contagious Delta variant. This period witnessed a significant increase in cases, placing immense strain on healthcare systems and leading to a rise in hospitalizations and fatalities. The Delta variant's heightened transmissibility and potential for more severe disease outcomes compared to earlier variants heightened alarm, prompting the implementation of targeted measures to curb its spread (Zali et al., 2022).

To bridge the above mentioned gap, it is essential to gain a more comprehensive understanding of the lived experiences of pre-hospital medical staff. Using qualitative methods like phenomenology provides valuable insights into the perspectives, emotions, and coping mechanisms of prehospital staff. This approach enables a deeper understanding of the unique challenges they face, informing targeted policy improvements and support systems that address their specific needs (Husserl, 2019). Therefore, the research question guiding this study is: "What are the lived experiences of Iranian pre-hospital medical staff during the Delta wave of COVID-19 pandemic?" By employing a descriptive phenomenological method, our aim is to delve into these experiences and make a valuable contribution to the existing literature.

2 Methods

2.1 Design and setting

The study utilized phenomenology as the qualitative approach to delve into the lived experiences of prehospital medical staff during the COVID-19 pandemic. Phenomenology was chosen because its purpose aligns with the aim of describing the essence of these experiences, capturing the subjective and nuanced aspects of the participants' perceptions and interpretations (Bengtsson, 2016). Colaizzi's phenomenological approach, in particular, was employed due to its emphasis on identifying shared experiences among participants. This method involves a rigorous analysis of interview data to uncover common themes and essential elements that represent the essence of the phenomenon under investigation (Colaizzi, 1977).

2.2 Participants

The study population comprised pre-hospital medical staff who provided pre-hospital services during the prevalence of the Delta variant of the virus. Purposive sampling was employed to select the participants, including both nurses and EMTs, in order to ensure maximum variation in their profession, education level, and years of experience. This variation encompassed different education levels

(bachelor's degree, associate's degree, and master's degree) and a range of experience from 4 to 25 years.

To implement purposive sampling and identify suitable participants, the researchers took an active approach. They collaborated with relevant institutions and utilized personal contacts to reach out to potential participants who met the specific criteria for maximum variation. The researchers clearly explained the purpose of the study and sought individuals who were willing to share their experiences as prehospital medical staff during the pandemic. By employing this strategy, the researchers aimed to capture a diverse range of perspectives and insights from participants with varying backgrounds and experiences in the field of prehospital care. Inclusion criteria for participants in this study were:

1 Pre-hospital medical staff working in Iran during the COVID-19 pandemic.
2 Nurses and pre-hospital medical staff involved in pre-hospital services.
3 Individuals with different levels of education (e.g., bachelor's degree, associate's degree, or master's degree) in nursing or prehospital emergency care.
4 Participants with a minimum number of years of experience in pre-hospital care (e.g., 1 year or more).
5 Willingness to share their experiences and perspectives regarding the challenges and lived experiences during the COVID-19 pandemic.

Pre-hospital medical staff who did not complete the interview or provide sufficient data for analysis were excluded.

2.3 Data collection

The interviews were conducted between June and August of 2021. The data collection process involved in-depth interviews conducted by two authors, M.J.O (an assistant professor) and H.S. (a PhD student). The interviews began with open-ended questions and gradually progressed to more specific inquiries, as outlined in Table 1.

TABLE 1 The semi-structured interview form.

Main questions	1. May you describe your pre-hospital emergency care during the COVID-19 pandemic? 2. What challenges have you faced with caring for patients during the COVID-19 pandemic? 3. What strategies did you use for the aforementioned challenges? 4. How did you feel when transferring the COVID-19 patients? 5. How did caring for patients with COVID-19 affect your personal life? 6. How did you cope with the changes induced by caring for COVID-19 in your personal life?
Exploratory questions	"Could you explain this more?" "Can you make this clearer?" "Can you clarify what you mean with an example?" "What do you mean?"

Prior to each interview, the research team emphasized the significance of the study and provided an overview of the research conditions. The interviews were recorded, and their durations varied, with an average length of approximately 50 min. The interviews ranged from 40 to 60 min in duration. All interviews took place in EMS centers in a quiet room at the end of the staff's shift. Throughout the interviews, field notes were taken to ensure accurate and comprehensive documentation of the responses. There were no interruptions during the interviews, and the data collection proceeded without any disruptions. In order to protect the participants' privacy, we assigned them code names such as p1, p2, and so on.

Each interview was conducted individually. The researchers continued conducting interviews until the point of data saturation was reached. Data saturation refers to the stage at which no new information can be obtained and coding becomes unfeasible (Lewis, 2018). After 15 interviews, data saturation was achieved; however, the researchers conducted two additional interviews with pre-hospital medical staff to ensure data replication. Notably, the heterogeneity in participants' education levels, work experiences, and time spent working during the COVID-19 pandemic was reflected in the data saturation, indicating that each group of participants had no new data to contribute after reaching saturation.

M.J. O. and H.S., the interviewers, possess over 10 years of research experience and have completed relevant qualitative research courses, including training in interviewing, coding, and reporting. They also actively instruct students in qualitative research methods, showcasing their expertise and commitment to advancing the field. With their extensive qualifications, training, and experience, M.J. O. and H.S. are well-equipped to conduct interviews and provide valuable insights into the subject matter.

2.4 Data analysis

The data analysis followed a rigorous and systematic approach, utilizing the following 7 stepts of Colaizzi's seven-step method (Edward and Welch, 2011; Morrow et al., 2015).

Step 1: The researcher (M.J. and M.D.) read a description of each person participating in the study to gain a sense of the participants. This involved carefully reviewing the data collected, such as interview transcripts or field notes, to become familiar with the participants' experiences and perspectives.

Step 2: The researcher extracted statements with significance to the research question. These statements, often in the form of direct quotations from the participants, captured key aspects of their experiences or perspectives. These statements were referred to as "meaning units" as they contained the core meaning or essence relevant to the research question.

Step 3: The researcher began to articulate what the statements meant. This involved a process of reflection and interpretation to explore the underlying meanings embedded within the extracted statements. The researcher engaged in a thorough analysis to understand the nuances, emotions, and insights conveyed by the participants.

Step 4: Themes were created from the meanings. Based on the interpretations made in Step 3, the researcher identified common patterns, recurring ideas, or significant concepts across the meaning

units. These patterns were organized into themes that captured the essence of the participants' experiences or perspectives.

Step 5: The researcher grouped similar themes together and organized them into categories. This step involved a higher-level analysis where the researcher looked for connections and relationships among the identified themes. Themes that shared similarities or related to a broader concept were grouped together, and overarching categories were formed to provide a structured framework for organizing the data.

Step 6: Finally, the researcher integrated the results into a comprehensive description of the topic. By systematically analyzing and organizing the themes and categories, the researcher constructed a coherent and comprehensive narrative that captured the essence of the participants' experiences or perspectives. This description aimed to provide a rich understanding of the research topic based on the data collected.

Step 7: The researcher returned to each participant to verify the results. This step involved member checking, where the researcher sought feedback from the participants to validate the accuracy and trustworthiness of the findings. This iterative process allowed participants to review and confirm the interpretation of their experiences, ensuring the research findings aligned with their viewpoints. MAXQDA software version 10 was used to analyze the data (Kuckartz and Rädiker, 2019). The final analysis was reviewed and confirmed by two additional researchers (T.M. and A.E.), enhancing the credibility and reliability of the analysis process. During the analysis, a total of 475 primary codes were initially extracted. To ensure clarity and avoid redundancy, the codes were carefully reviewed, merged, and duplicates were eliminated. As a result, the remaining codes were organized into five overarching themes that captured the essence of the data.

2.5 Rigor

The consolidated criteria for qualitative reporting research (COREQ) was used to guide this study (Tong et al., 2007) (Supplementary file S1). Further, the authors employed several strategies to ensure rigor in their study. They utilized triangulation by combining multiple sources of data, methods, and perspectives to provide a comprehensive understanding of the research topic. Member checking was conducted, involving the verification of findings by sharing preliminary results with participants and seeking their feedback. Peer debriefing was employed, allowing for discussions with colleagues and experts to gain valuable insights and enhance the credibility of the research. The authors addressed reflexivity by being aware of their biases and reflecting on their influences throughout the research process. They incorporated thick description, providing rich and detailed descriptions of the research context, participants, and findings to enhance credibility. Saturation was assessed, ensuring that a sufficient amount of data had been collected to capture the breadth and depth of the research topic.

2.6 Ethical considerations

The research project was approved by Baqiyatallah University of Medical Sciences (BUMS) (ID: IR.BMSU.REC 0.1399.133). Participants were informed that the interviews would be recorded before beginning the interviews, and their permission was requested. Participants were informed that they could withdraw at any time without penalty. The participants' names were kept private, and the codes (P1, P2, P3, etc.) were provided.

3 Findings

3.1 Participant characteristics

The study aimed to capture the experiences of 17 pre-hospital medical staff members who had at least 1 year of experience in the field during the COVID-19 pandemic. The participants had a mean age of 39.13 years (SD = 1.60) and an average work experience of 13.8 years (SD = 1.76). Among the participants, three reported a previous positive COVID-19 test, indicating that they had contracted the disease. However, several other participants mentioned experiencing mild symptoms associated with COVID-19, such as cough, fever or chills, headache, sore throat, muscle pain, or dyspnea, either presently or in the past. Due to the intermittent and relatively mild nature of their symptoms, they had not undergone COVID-19 testing. A comprehensive overview of the participants' characteristics can be found in Table 2. To ensure data replicability, two additional pre-hospital medical staff members were interviewed, even though data saturation had been reached with 15 participants.

The study identified five main themes, namely workload and resilience, damage, lack of control, under preparedness, and post-traumatic growth (Table 3).

3.2 Theme 1: workload and resilience

The COVID-19 pandemic brought about unexpected surges in ambulance demand, placing a tremendous burden on pre-hospital medical staff. They found themselves continuously transferring critically ill patients to healthcare facilities, working with limited resources, and facing high demands, which strained their resilience.

3.2.1 Sub-theme I: excessive workload

The prevalence of infections resulted in a significant rise in the number of ambulance dispatches. Each day, a large number of individuals with fever and respiratory symptoms required ambulance services. Ambulances were constantly engaged in transporting critical patients. Additionally, pre-hospital medical staff had to work overtime to compensate for staffing shortages. In addition to their pre-hospital care responsibilities, they also provided telephone counseling to non-critically infected patients who were quarantined at home. Two participants expressed their experiences:

> *"We were overwhelmed by the daily influx of patients requiring transportation. Keeping up with the demand was a challenge." (P2).*

> *"We had to work long hours and provide counseling over the phone. It was physically and mentally exhausting." (P13).*

TABLE 2 Sociodemographic characteristics of the participants ($N = 15$).

Participants		Educational background	Age (years)	Gender	Marital status	Pandemic work duration (month)	History of COVID-19 positive test	COVID-19 symptom history	EMT work experience (years)	Interview duration (min)
P1	EMT	Bachelor's degree in EMS	36	Male	Married	24	No	Yes	13	40
P2	EMT	Associate's degree in EMS	40	Male	Married	20	No	Yes	22	60
P3	EMT	Master's degree in nursing	39	Male	Married	16	No	Yes	13	45
P4	EMT	Bachelor's degree in EMS	33	Male	Single	12	No	Yes	11	50
P5	EMT	Master's degree in nursing	32	Male	Married	12	No	Yes	10	55
P6	EMT	Bachelor's degree in EMS	37	Male	Married	12	No	Yes	14	47
P7	EMT	Bachelor's degree in EMS	34	Male	Married	14	Yes	Yes	13	53
P8	EMT	Associate's degree in EMS	42	Male	Married	15	No	Yes	18	60
P9	EMT	Bachelor's degree in EMS	52	Male	Married	18	No	Yes	25	60
P10	EMT	Master's degree in nursing	47	Male	Married	15	No	Yes	23	60
P11	EMT	Bachelor's degree in EMS	40	Male	Married	13	Yes	Yes	22	53
P12	EMT	Bachelor's degree in EMS	45	Male	Married	12	No	Yes	5	55
P13	EMT	Associate's degree in EMS	43	Male	Married	17	Yes	Yes	8	51
P14	EMT	Associate's degree in EMS	39	Male	Married	12	No	Yes	6	42
P15	EMT	Associate's degree in EMS	28	Male	Single	19	No	Yes	4	40
P16	EMT	Associate's degree in EMS	38	Male	Married	18	No	Yes	8	39
P17	EMT	Bachelor's degree in EMS	52	Male	Married	12	No	Yes	28	56

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TABLE 3 Themes, subthemes, and codes.

Themes	Sub-themes	Codes
Workload and Resilience	Excessive workload	Increased ambulance dispatch, overwhelming emergency calls, educational needs, never-ending telephone counseling, staff shortage
	Sacrifice	Taking gloves off, removing gowns, wearing a simple surgical mask rather than an N95 respirator, removing goggles
	Fragile resilience	Infection with COVID-19, reduction in workforce, the dilemma between whether to continue or quit the work.
Damages	Mental distress	Fear of becoming infected, concern about the virus spreading to family members, relatives, or strangers, and worry about near death
	Social stress	Being far from family members, relatives, and friends, being isolated at work, being isolated at home
	Physical harm	Difficulty in breathing, poor lung CT scan, death of staff or family members
A lack of control'	Ambiguity	Being ambiguous about the disease, unclear about prevention methods, vague about therapy, and vague about complications
	Difficult pre-hospital management	Failure of all existing medication therapy, the ineffectiveness of alternative treatments, and the ineffectiveness of vaccinations
	Becoming more lethal	New variations with a higher mortality rate and new characteristics with more serious complications
Under-preparedness	Delayed action	Delayed public announcement, delayed medical staff announcement, delayed prompt action
	Early PPE Shortage	having insufficient PPE and expensive prevention tools like hand wash agents
Post-traumatic growth	Professional image	Patients' prayers for EMTs, gratitude to EMTs in media or by high-ranking community authorities, people's support
	Professional advancement	Raised salary, some solved professional issues, sense of empowerment in coping strategy, surge management, and overcoming crisis

Staff shortages occurred due to infection-related contamination. Some staff members were either hospitalized or placed in home quarantine, leaving the remaining workforce to face an overwhelming workload. As a result, pre-hospital medical staff had to extend their working hours to compensate for the staffing gap. One participant shared:

> *"As the Coronavirus gradually reduced our workforce by infecting our colleagues, pre-hospital medical staff had no choice but to work extra hours to cover the staffing shortfall." (P13).*

3.2.2 Sub-theme 2: sacrifice

Due to prevailing negative attitudes toward COVID-19 patients and their relatives within certain communities, the infection became a taboo topic. People would flee or avoid areas where COVID-19 patients were present or had close relatives. It was disconcerting for pre-hospital medical staff to be seen wearing PPE such as gloves, face shields, gowns, goggles, and N95 masks in these neighborhoods, as it signaled the presence of a COVID-19-infected individual. Some patients and their family members hesitated to call emergency services (e.g., dialing 115) due to the associated taboos. Consequently, pre-hospital medical staff often had to remove certain parts of their PPE to navigate these taboos. Two participants expressed:

> *"If a family was infected with COVID-19, other neighbors would want to leave the apartment or block to ensure their safety or they would view the infected family negatively." (P1).*

> *"To avoid the stigma, we often had to remove most of our PPE while in the patients' neighborhood and transport them wearing masks and gloves only!" (P8).*

3.2.3 Sub-theme 3: fragile resilience

Pre-hospital medical staff faced numerous challenges in their work, including staff shortages, consecutive long shifts, inadequate safety measures, stressful situations, and high mortality rates. While they managed to overcome these obstacles, the hardships and difficulties they encountered had the potential to weaken their resilience and determination at any given time, causing them to consider giving up the fight against the pandemic. In some cases, family members of individuals with underlying chronic illnesses would pressure them to leave the profession in order to prioritize their own safety. However, despite the difficulties, these dedicated professionals persisted in providing pre-hospital services. Two participants expressed their perspectives:

> *"We were torn between prioritizing our own safety and staying on duty. However, our unwavering commitment compelled us to continue offering our services in the face of any adversity." (P9).*

> *"The stressful circumstances, inadequate equipment and staff, and lack of support were enough to make us contemplate leaving the job." (P5).*

3.3 Theme 2: damage

Pre-hospital medical staff experienced significant physical, psychological, and social impacts as a result of COVID-19. Among them, three individuals tested positive for COVID-19 and suffered from severe psychological issues and physical injuries, while others

exhibited symptoms such as dyspnea, fatigue, and myalgia. Sadly, some pre-hospital medical staff succumbed to the disease after experiencing severe conditions. The second theme encompassed psychiatric distress, social stress, and physical harm.

3.3.1 Sub-theme 1: psychiatric distress

The pre-hospital medical staff not only grappled with concerns about their own vulnerability to infection but also harbored anxiety about potentially transmitting the disease to their loved ones. The high mortality rates further exacerbated their distress.

> *"Several of our colleagues had family members who were hospitalized and, tragically, some even passed away! I was primarily worried about the possibility of spreading the infection to my wife and children." (P7).*

> *"We witnessed a significant number of patients we transported by ambulance succumbing to the disease in hospitals later on! Such news deeply impacted our emotional well-being!" (P8).*

3.3.2 Sub-theme 2: social stress

In order to prevent the transmission of infection to their immediate family members, pre-hospital medical staff resorted to self-isolating either within a designated room in their homes or in public spaces such as their workplaces. Additionally, due to their extensive interaction with individuals afflicted by COVID-19, these personnel were often stigmatized as potential carriers of the virus, resulting in people actively avoiding their presence. Consequently, pre-hospital medical staff found themselves distanced from both their loved ones and the general public, a measure aimed at maintaining social distance but one that also introduced significant social stress into their lives.

Participant 11 expressed concerns about the proximity to family members within their household, stating, *"The thought of being in close proximity to my family members in the house worries me. As a precautionary measure, I isolate myself in a separate room at all times. Additionally, after completing my shifts, I ensure to change my protective suit in the parking lot."*

Participant 2 highlighted the experience of being avoided by people in their neighborhood due to the perception that they were potential carriers of the disease. He shared, *"I observed that individuals within our neighborhood who were familiar with my profession actively avoided me, as they held the belief that I posed a risk of transmitting the disease."*

3.3.3 Sub-theme 3: physical harm

3.3.3.1 Physical impact

Pre-hospital medical staff faced significant physical challenges arising from their round-the-clock exposure to infected patients, extended working hours, sleep deprivation, and inadequate nutrition. Tragically, some of these dedicated professionals succumbed to organ or multi-organ failure after contracting COVID-19. Common physical symptoms experienced by pre-hospital medical staff included fever, shortness of breath, excessive sweating, bruising, body pain, and persistent coughing. Moreover, the toll of the virus extended beyond the staff themselves, with numerous family members also falling ill and, in certain cases, even losing their lives.

Participant 13 vividly captured the sense of vulnerability within the profession, sharing, *"At any given moment, all of us were susceptible to disease and death. Several of our colleagues or their family members have already been infected or, tragically, passed away."*

Participant 11 conveyed the lasting impact on their respiratory system, revealing, *"Even five months after contracting the disease, I continue to experience coughing. My respiratory system has suffered significant damage."*

3.4 Theme 3: a lack of control

Despite the widespread vaccination efforts (Di Mauro et al., 2022), the unpredictable nature of COVID-19 persisted due to the emergence of new virus mutations and the development of sub-variants. This theme encompasses the notions of "ambiguity," "ineffective treatment," and "increased lethality."

3.4.1 Sub-theme 1: ambiguity

The lack of comprehensive understanding regarding COVID-19 has contributed to its global spread. The novel virus remains enigmatic, with limited specific information available. Participant 7 emphasized the vast unknowns surrounding the virus, stating, *"Every aspect of the virus, from its origins to its control, remains a mystery. The virus exhibits periodicity, and its mutations further complicate matters."* Participant 5 echoed this sentiment, expressing uncertainty about the future of the ongoing situation.

3.4.2 Sub-theme 2: difficult pre-hospital management

Managing critical cases in the pre-hospital setting proved arduous. Despite employing various medical treatment techniques, the patients' conditions remained unmanageable, necessitating their intubation and mechanical ventilation. Participant 5 highlighted the ineffectiveness of medications administered to severely ill individuals, sharing, "*None of the drugs administered to these critically ill patients proved effective. I also worked in a hospital concurrently and realized that only divine intervention could treat such severe cases."* Participant 7 further reflected on the gravity of the situation, expressing concern about the potential shortage of oxygen and ventilators for critically ill patients. *"The situation was so bad that we were afraid that we would not further able to provide oxygen and ventilators for the critical patients."*

3.4.3 Sub-theme 3: becoming more lethal

3.4.3.1 Escalating lethality

In recent waves, notably the Delta variant, COVID-19 demonstrated an increased lethality compared to previous strains. Surprisingly, a significant number of young individuals fell critically ill despite their anticipated resilience. Participant 15 expressed the helplessness experienced in the face of the virus, stating, *"There seems to be no solution to this virus. I ponder when this disease will finally abate."* Participant 12 shared the alarming nature of their calls during the Delta wave, with critically ill patients teetering on the brink of death, saying, *"All of our calls in the Delta wave were from critically ill*

patients, and in some dispatches, critically ill patients were on the verge of death." (P 12).

3.5 Theme 4: under preparedness

The theme of under preparedness highlights the community's initial lack of readiness to effectively mitigate the disease's spread when the outbreak began. Consequently, the infection rapidly disseminated throughout the country. This theme encompasses the sub-themes of "delayed action" and "PPE shortage."

3.5.1 Sub-theme 1: delayed action

In response to the emergence of the pandemic in China, flights between Iran and countries experiencing conflicts continued, providing an entry point for the virus. There was a delay in informing the public about the new infection, contributing to the subsequent outbreak within the country. The lack of anticipation regarding a pandemic may have contributed to this delay. Additionally, the experiences of pre-hospital medical staff revealed that, despite periodic quarantine requirements during various waves, compliance with quarantine rules was hindered by the country's challenging economic circumstances, exacerbated by severe sanctions.

Participant 2 recalled the initial perception of the situation, stating, *"Initially, the condition was not regarded as serious. Officials initially claimed that the infection was unlikely to spread from China to other countries."* Participant 4 highlighted the economic realities faced by individuals, explaining that the need to work, even during quarantine periods, stemmed from the financial obligations associated with their shops and the need to pay monthly rent. *"If people close their shops, how can they pay the monthly rent of the shop? They have to work under any conditions, even during quarantine time." (P4).*

3.5.2 Sub-theme 2: early PPE shortage

In the early stages of the pandemic, health facilities faced a shortage of PPE due to insufficient planning. Additionally, the high prices of PPE and the country's economic challenges further exacerbated the situation, making it difficult for people to purchase adequate protective gear.

Participant 3 shared the scarcity of PPE during the initial waves, stating, *"There was an insufficient supply of PPE in the early stages. We had to personally purchase them."* Participant 11 elaborated on the restrictions imposed on PPE usage, explaining that staff members were provided with limited quantities of PPE and were not permitted to exceed their allotted quota. *"PPE was supplied to the staff according to quotas, and we were not permitted to utilize more than our limit." (P11).*

3.6 Theme 5: post-traumatic growth

Despite the challenging circumstances faced during the pandemic, first responders experienced positive outcomes and personal growth. They received recognition, dignity, and respect from society, similar to other healthcare workers. This theme encompasses the sub-themes of "professional image" and "professional advancement."

3.6.1 Sub-theme 1: professional image

The commitment and contributions of pre-hospital medical staff in saving lives were witnessed by the public. Their sacrifices were readily apparent, and during the outbreak, people endeavored to support healthcare workers in any way possible. This support manifested through emotional displays, provision of PPE, and distribution of food packages. Numerous individuals, as well as authorities and the media, expressed gratitude and admiration for the sacrifices made by healthcare providers, including pre-hospital medical staff.

Participant 15 reflected on the unprecedented emotional treatment received, stating, *"We observed that people generally appreciated and expressed more emotions towards us, which was remarkable."* Participant 9 highlighted the praise and gratitude conveyed by officials and the media toward healthcare workers. He said: *"During the pandemic, officials in the media praised and thanked the health care workers." (P9).*

3.6.2 Sub-theme 2: professional advancement

Pre-hospital medical staff, alongside other healthcare professionals, played a crucial role in responding to the COVID-19 pandemic, extending their capabilities beyond normal limits. The experience of managing the pandemic empowered pre-hospital medical staff in terms of coping strategies, managing increased demands, and patient care.

Participant 2 expressed satisfaction and delight in witnessing positive reactions from authorities, stating, *"Although we are currently engaged in a genuine war, the positive responses from the authorities uplift us."* Participant 3 recognized the pandemic's challenges but also acknowledged the valuable lessons learned, stating, *"Despite the numerous challenges, the pandemic has been a source of growth. It has enhanced our ability to provide pre-hospital services, and I feel a boost in my self-esteem."*

4 Discussion

In this study, we explored the experiences of Iranian pre-hospital medical staff during the COVID-19 pandemic, identifying five key themes: workload and resilience, damage, lack of control, under preparedness, and post-traumatic growth. The inequality between call volumes and responses affected staff resilience, leading to a heavy burden and damage. The initial lack of control and unpreparedness worsened the situation. However, first responders' sacrifices in managing the increased demand for emergency services garnered community respect and contributed to professional growth.

The first theme highlights that when the workload significantly exceeded capacity and staff numbers declined due to COVID-19 infections, the resilience of the staff was compromised. These findings align with a previous studies indicating a surge in demand for ambulance services during the COVID-19 pandemic (Kinross et al., 2020), with increased calls related to COVID-19 cases and a decrease in other emergencies like road accidents (Lerner et al., 2020), which have had a profound impact on their resilience (Lai et al., 2020; Sun et al., 2020). The pre-hospital system in Iran has been heavily burdened by the outbreak, with pre-hospital medical staff playing a crucial role in patient management, including screening, primary care, and hospital transfers (Hadian et al., 2022).

To mitigate the negative impact of increased workload and fragile resilience, studies suggest strategies such as resilience, determination, humor, competence, and emotional tolerance (Piotrowski et al., 2021). In Iran, the government requested overtime and extended shifts from existing staff to address increased workload. They also recruited recent nursing graduates and medical personnel to fill workforce gaps in pre-hospital emergency care (Hadian et al., 2022). The authors suggest teaching adaptive strategies to enhance the resilience of pre-hospital staff. Moreover, implementing effective triage systems can address call volume inequalities, while workload analysis optimizes resource allocation (Marks, 2022).

A portion of our findings emphasized the adverse effects of COVID-19-related stigma on the staff, corroborated by other studies (Turner-Musa et al., 2020; Bhanot et al., 2021). To address COVID-19-related stigma, our research suggests strategies such as public awareness campaigns, media engagement, community dialogs, empathy education, and legal protections against discrimination. These measures could promote public education, compassionate treatment, and a supportive society (Valeri et al., 2021).

The "damage" theme explores challenges faced by pre-hospital medical staff, encompassing physical injury, psychological discomfort, and social stress. Positive-test participants experienced these challenges more frequently. A previous study (Higginson et al., 2020) highlighted the physical health risks faced by pre-hospital medical staff during the early days of the COVID-19 pandemic, attributed to poor recognition of the disease and inadequate PPE. From author's opinion, protecting their safety requires prioritizing the availability and appropriate use of adequate PPE, providing regular infection control training, and implementing comprehensive occupational health and safety protocols (Marques et al., 2020).

Our study revealed that pre-hospital staff suffered from stress, in line with our findings, Piotrowski et al. (2021) highlighted the heightened stress, exhaustion, and worry experienced by pre-hospital medical staff (Piotrowski et al., 2021), emphasizing the need for tailored mental health support programs. According to researchers, regular check-ins, access to counseling services, and resilience-building techniques can be crucial steps for mitigating psychological challenges.

In addition to mental stress and physical harm, pre-hospital staff also experienced social stress as another significant factor of concern, which confirmed by other studies (Alahdal et al., 2020; Vindrola-Padros et al., 2020; Alqahtani et al., 2021). According to researchers, prioritizing initiatives like virtual communication platforms is crucial to address the social and emotional needs of pre-hospital staff.

Our third theme, "a lack of control," highlights the challenges in managing the COVID-19 pandemic due to the unknown nature of the virus and absence of effective treatments. The global healthcare systems, including Iran's, have been heavily impacted by the COVID-19 pandemic. Effectively managing this crisis necessitates the adoption of novel strategies worldwide (Zargham et al., 2021). Chen et al. (2021) also emphasized these challenges and the impact of virus mutations (Chen et al., 2021). The emergence of new variants, like the Delta strain, poses significant threats with higher infectivity and viral load (Yu et al., 2021). Based on researcher perspectives, it is crucial for healthcare professionals to stay updated on research and guidelines to adapt infection control and treatment strategies accordingly, as per researcher perspectives (Majid et al., 2011).

The feeling of helplessness and loss experienced by caregivers due to a lack of control over the pandemic and infection control is another significant aspect to consider (Iheduru-Anderson, 2021). Comprehensive training, support, and regular updates on guidelines are crucial in addressing the challenges faced by healthcare professionals in managing the pandemic and ensuring they have the necessary knowledge, skills, and resources (Frenk et al., 2022).

As our findings reflected, the lack of preparedness in managing the ongoing crisis has multifactorial causes. One contributing factor is the lack of collaboration between authorities, scientific institutions, and the media (Ruiu, 2020). Encouraging transparency, trust, and collaboration can enhances preparedness and response capabilities while addressing barriers such as conflicting news, delays in official announcements, paternalistic attitudes, and political ambiguity that hinder population awareness and preparedness (Ruiu, 2020). Therefore, healthcare professionals and authorities should prioritize clear and consistent communication to the public, providing up-to-date information, guidance, and instructions. Open and transparent communication channels can help build trust, address misconceptions, and foster public compliance with preventive measures (Lee and Kwak, 2012).

Our findings highlighted the positive impact of the COVID-19 pandemic on pre-hospital medical staff, including increased visibility and recognition within society. Notably, they have received positive feedback, social respect, and increased pay. Other researcher reported that the acknowledgment by the general population, the media, and government authorities further validates the professionalism and dedication of these front-line responders (Liu et al., 2020; Sun et al., 2020).

4.1 Limitation

Our study focused on pre-hospital services provided by pre-hospital medical staff in Tehran, the capital of Iran. It is possible that the conditions of pre-hospital care in other cities with limited facilities may be more challenging. One limitation of our study is the potential influence of the researcher's preconceived notions on the results. To mitigate this effect, the researcher took precautions to set aside their prior knowledge and biases at the beginning of the study, thus minimizing their influence on the findings. Furthermore, it is worth considering the economic, cultural, and social differences between Iran and other countries.

5 Conclusion

The surge in pre-hospital treatment requests during the COVID-19 pandemic has significantly impacted the workload and well-being of medical staff. This imbalance has led to mental, social, and physical challenges. Despite the hardships, their sacrifices have improved their professional image and garnered increased respect. To support pre-hospital staff, resources and support should be provided, including adequate staffing, sufficient PPE, and well-being programs. Fostering a culture of accountability and providing necessary training further enhances their performance. Individuals previously infected with COVID-19 experienced distress and transmission concerns, warranting further studies for comparison.

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.

Author contributions

MJ-O, STM, and AE conceived the study design. HS, MJ-O collected the data, conducted the data analysis, and wrote the manuscript. STM conducted the data analysis. MJ-O, STM, AE, MD, and HS have made a considerable contribution to the study design, data analysis, interpretation of results, and writing of the manuscript. All authors contributed to the article and approved the submitted version.

Ethics statement

The studies involving humans were approved by the Baqiyatallah University of Medical Sciences (BUMS) (ID: IR.BMSU.REC.1399.133). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

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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/fpsyg.2023.1230892/full#supplementary-material

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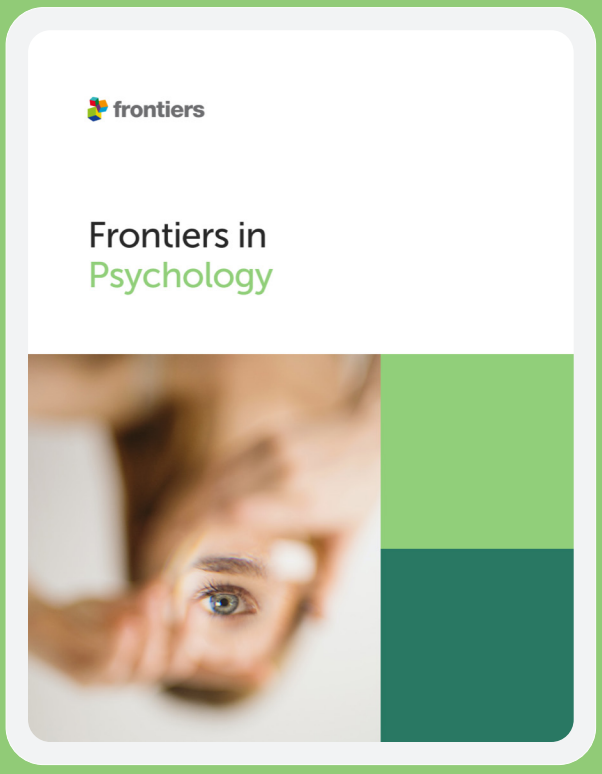

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